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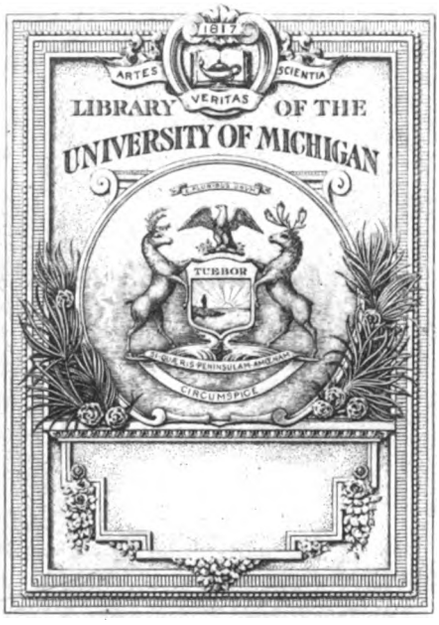
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ELECTRICAL ENGINEERING

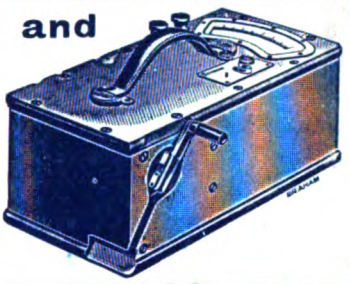
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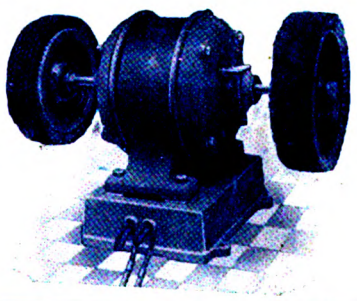
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The Engineering Journal of the Electrical Industry

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

BINDING "ELECTRICAL ENGINEERING." — Vol. V. of "Electrical Engineering" (Jan.—Dec. 1909) closed with our last issue. An index for the volume is now ready, and copies may be ordered from any newsagent or bookseller at the price of 1d. each (or post free, 1½d.). Binding Cases, including index, are also ready, price 2s. each, post free 2s. 4d. (Abroad 2s. 6d.) Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to us, carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad.

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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

SUMMARY

Our monthly supplement on "Electrical Engineering in Mines" is included in this issue, and opens with a practical illustrated article by Mr. J. P. Simpson on cables in shafts and main haulage ways, in which the author favours the use of armoured rather than lead-covered cables, and describes a system of supporting cables in shafts. An illustrated description of the electrical equipment of an ironstone mine, including some specially designed haulage controllers, follows, and a further illustrated article describes a three-phase winding plant in South Wales. An electric pumping plant in a New Zealand mine is also described, and other articles deal with the general question of electrical working in mines, a new electric safety lamp, and some electric mining plant seen at a visit to a well-known works. A summary is also given of electric mining patents published in December.

The electrodes of the Foster multiple-carbon flame arc lamp consist of from two to four cored carbons moulded together, and the arc burns from one pair of cores at a time, changing carbons as they are burned down. Striking and feeding is effected by a brake mechanism without any clockwork. Neither electrode is swung for striking, as owing to the wide angle at which the carbons are placed, a simple lift of the brake mechanism suffices. With a four-carbon electrode, 24 in. long, from 40 to 50 burning hours are obtained. (Page 3.)

The fourth and final report of the Royal Commission on Canals deals with the question of electric haulage on canals, chiefly from the point of view of organisation. No definite expression of opinion is given upon the subject, although the opinions of Continental and American engineers in favour are recorded. The appointment of an Inland Waterways Board is recommended, and among the duties of this body is the decision under what conditions electric haulage may be introduced. (Page 4.)

Mr. Buxton, the Postmaster-General, has stated that during the last four years only about 3,250 telephones had been purchased abroad by the Post Office. Since September, 1909, he had not given a single order to any foreign firm for telephone work. (Page 4.)

In August, 1908, the Siemens & Halske Akt.-Ges. applied for a patent to cover a process for manufacturing a ductile alloy of tungsten and nickel from which filaments could be drawn and the nickel afterwards removed by heating. Opposition was entered to the grant of this patent by the British Thomson-Houston Co., who alleged that a patent granted in 1907 to W.

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C. Arsem and assigned to them, was a master patent covering all processes of forming filaments by first mixing tungsten with a softer metal to form a ductile alloy from which the foreign metal can be afterwards extracted. The Acting Comptroller-General decided in favour of the British Thomson-Houston Co., but allowed the grant of the patent with certain amendments to the specification, including a reference to the Arsem patent. The Siemens & Halske A.-G. have appealed against this decision, however. (Page 5.)

REVIEWS appear of the Proceedings of the 32nd Convention of the National Electric Light Association, and several annual pocket-books and works of reference. (Page 6.)

WE have received a letter from Mr. C. Vicarino relating to the train-lighting system recently introduced into this country by the Tudor Accumulator Co. (Page 6.)

THE coroner's inquiry into the cause of the Clapham fire resulted in a verdict that it was due to the breaking of an electric lamp, which set fire to cotton wool and celluloid combs in the window. The verdict contained a warning against the dangers of such methods of window dressing. Evidence was given by Mr. S. G. C. Russell as to experiments which he had carried out, the result of which was to set fire to cotton wool and celluloid when a Tantalum lamp was broken and the pieces of filament allowed to fall. (Page 7.)

A NEW suction cleaner comprises a small centrifual blower which draws the dust up through a fan-shaped nozzle, and delivers it into a cloth bag. The latter allows the air to escape, but retains the dust. Nozzle, blower and motor are mounted together at the end of a pole. The apparatus takes only 100 watts. (Page 8.)

THE Dublin Corporation have decided to increase their electric lighting charges by 10 per cent. for a period of twelve months, owing to the loss which is at present involved upon the undertaking.—Liverpool Corporation are advised to give a trial to the Norwich system of charging for electricity.—Reductions in the charges for electricity supply are being made in Shoreditch.—The Aberdeen Corporation are taking steps to enforce Mr. Patchell's award concerning the supply of electrical energy to the local tramway company.—Owing to the inability of the Uxbridge and District Electric Supply Co. to work their undertaking profitably, the debenture holders propose taking charge of it. (Page 10.)

THE Belfast Tramways and Electricity Committee require water-tube boilers, superheaters, mechanical stokers, &c.—Stepney Borough Council require a turbo-generator, together with boilers, converting plant and switchgear.—Submarine cable is required by the Australian Postmaster-General. (Page 10.)

WE give details of the electrical bills which have been deposited for the next session of Parliament. An important proposal is the amalgamation of the Baker Street and Waterloo, Charing Cross, Euston and Hampstead, and the Great Northern, Piccadilly and Brompton Railway Companies, under the title of the London Electric Railways Co. The Yorkshire Electric Power Co. seek powers to invest capital in industrial undertakings purchasing electricity from the company, and several municipalities seek electric wiring powers. (Page 13.)

AMONG the specifications published by the Patent Office on Thursday last were two by A. F. Berry for methods of controlling the temperature of hot-plates supplied from auto-transformers. In one arrangement, the low-pressure heating winding is connected to different tappings off the transformer winding, and in the other, the heating winding is divided into parts which can be connected to the transformer separately or in series or parallel. A method of preventing the steel-tape armouring of cables from slipping and exposing the insulation is covered by E. A. Claremont and J. Stratton. C. H. Weber has a specification describing a process for manufacturing metal filaments which consists in first mixing the tungsten powder with pyridine or quinoline. In spite of opposition, a patent has been granted to J. Howden & Co., covering the automatic admittance of live steam into the low-pressure reservoir of an exhaust steam plant when the supply of exhaust steam fails. Opposition has been entered to a patent by A. Sang for a process for depositing metal on wires, &c., by heating the wire electrically in a powder of the metal or an oxide. A patent by J. G. Merryweather for a high-speed pump expires next Thursday, after the full life of fourteen years. (Page 16.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JANUARY 6TH.

Royal Institution.

3 p.m. Juvenile Lecture V., "Electric Oscillations," by W. Duddell, F.R.S.

Röntgen Society.

8.15 p.m. At 20 Hanover Square, London. Paper by Dr. W. S, Lazarus-Barlow.

FRIDAY, JANUARY 7TH.

Institution of Mechanical Engineers.

8 p.m. At Storey's Gate, St. James's Park, London. "An Account of a Visit to the Power Plant of the Ontario Power Co., at Niagara Falls," by C. W. Jordan.

Electro Harmonic Society.

8 p.m. Smoking Concert at Holborn Restaurant, London.

SATURDAY, JANUARY 8TH.

Royal Institution.

3 p.m. Juvenile Lecture VI., "Electric Lighting," by W. Duddell, F.R.S.

TUESDAY, JANUARY 11TH.

National Electrical Manufacturers' Association.

2.30 p.m. Committee Meeting at Balfour House, Finsbury Pavement, London.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "The Testing of Rubber for Electrical Work," by Prof. A. Schwartz.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. Meeting at 207 Bath Street, Glasgow.

Illuminating Engineering Society.

8 p.m. At the Royal Society of Arts. Discussion on "Glare: Its Causes and Effects," to be opened by Dr. J. H. Parsons.

WEDNESDAY, JANUARY 12TH.

Association of Engineers-in-Charge.

8 p.m. At St. Bride's Institute, Bride Lane, Fleet Street, London. "Heating and Ventilation of Public Buildings," by T. W. Aldwinckle.

THURSDAY, JANUARY 13TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. Second Kelvin Lecture, "Lord Kelvin's Work in Telegraphy and Navigation," by Prof. J. A. Ewing, F.R.S.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science.

Smoke Nuisance Prosecution.—At the Glasgow Police Court, last week, the Craigpark Electric Cable Co. were fined 10s. for allowing black smoke to issue from their chimney for twenty minutes on November 29th. Local inspectors gave evidence to the effect that the boilers used are too small for the work required of them.

Agreement between French and German Firms.—The *Manchester Guardian* reports that a working agreement has been come to between the Felten Guilleaume Lahmeyerwerke A.-G. of Mülheim-on-Rhine, and Messrs. Schneider & Co. of Le Creusot. The arrangement is said to be the outcome of several large orders which have been executed conjointly by the Schneider Co. and the Société Anonyme d'Electricité Lahmeyer, of Paris, the French branch of the German company. These include a rolling-mill plant for the Terri Iron works, and a 1,500-h.p. single-phase locomotive for the Compagnie des Chemins de Fer du Midi. The above companies have also arrangements with Messrs. Escher Wyss & Co., of Zurich, with regard to Zoelly turbines.

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THE FOSTER MULTIPLE CARBON FLAME ARC LAMP

THE "Q" type flame arc lamp, which is manufactured by the Foster Arc Lamp & Engineering Co., Ltd. (Worple Road, Wimbledon, S.W.), is noteworthy chiefly on account of the special electrodes which are used. As can be seen in the sketch in Fig. 1, these comprise four hard carbons with soft impregnated cores, moulded together so as to form one solid elec-

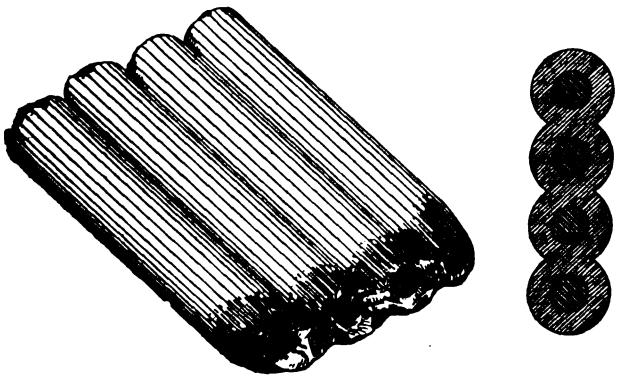


FIG. 1.—SKETCH AND SECTION OF QUADRUPLE CARBON. (Full size.)

trode. The arc burns from one pair of cores at a time only, and changes over from one pair to another as the carbons are consumed. A steady, silent burning without extinction of the arc during operation is claimed for this arrangement.

The two electrodes, which converge at an angle somewhat larger than is usual (nearly 25°), feed down by gravity, and are controlled by an improved design of brake mechanism without any clockwork. Contrary to the usual practice, both electrodes run in fixed guides, there being no swinging movement for striking and adjustment. The arc is struck by an upward movement of the electrodes in the directions of their respective axes, and the necessary separation is obtained without a large movement on account of the wide angle at which they converge. A very delicate feed and adjustment, without any possibility of overfeeding, is said to be secured by this means. A general view of the interior of the lamp is given in Fig. 2, and Fig. 3 illustrates the exterior and interior of the case, showing the ventilating arrangements.

With a four-carbon electrode, the burning hours are from 40 to 50 on one trim, according to the current taken, but 2- or 3-carbon electrodes can be used if desired. As the combined electrode offers a large section to the current, no wire core or other means of increasing the conductivity is required, and for this reason the cost of electrodes is said to be only 0·18d. per hour, or approximately 40 per cent. less than when ordinary metal-core carbons are used. The lamp is supplied for burning at 8, 10, or 12 amperes at a pressure of from 35 to 50 volts per lamp, and for both A.-C. and D.-C. circuits. There is ample space below the mechanism chamber and between the electrodes for the substitutional resistance in the case of series running, and the cut-out can also be fixed inside the lamp. A special arrangement of the globe collar at the base of the lamp ensures a good circulation of air in the globe to prevent a deposit of the fumes on the interior, which is of especial importance in long burning lamps. As the electrodes move only in the directions of their axes, they are made to fit the openings in the economiser closely, and thus prevent the fumes from reaching the mechanism. The clay economiser is supported by a copper ring fitted into a cast-iron base, to which is attached a blow-out magnet, as shown in Figs. 2 and 3.

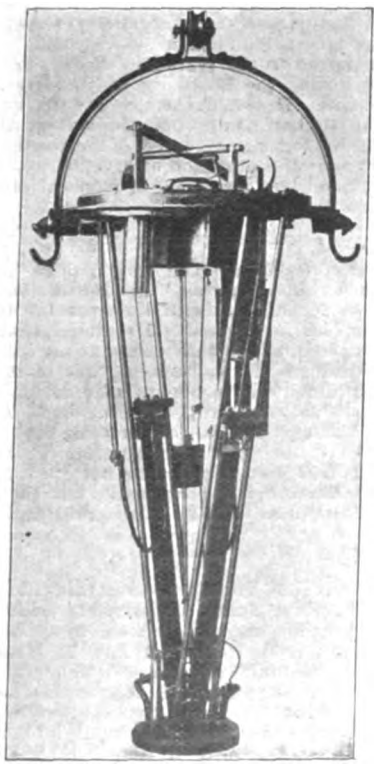


FIG. 2.—GENERAL VIEW OF MECHANISM.

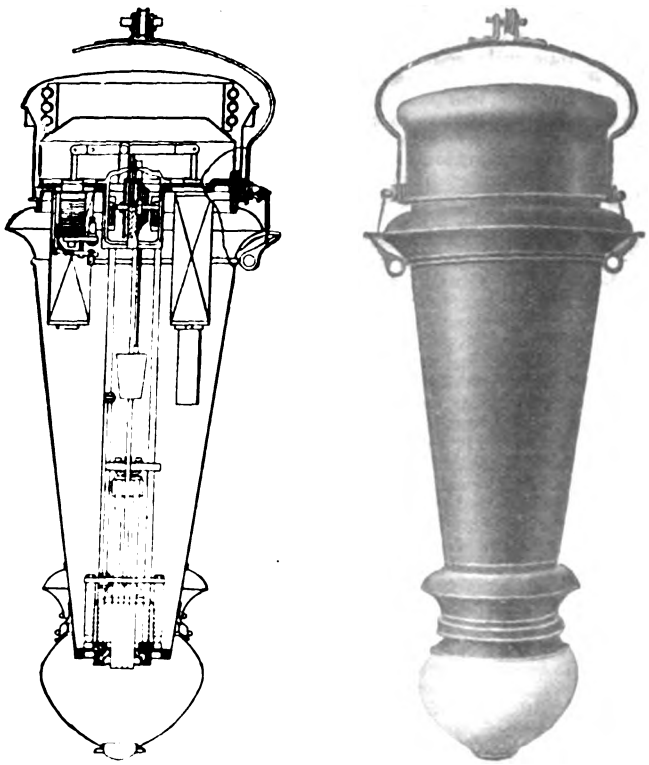


FIG. 3. SECTION AND EXTERIOR VIEW.

The brake-mechanism comprises a drum with three grooves and a scroll, all mounted on a single spindle, to which is fixed a clock spring. The chain which passes round the scroll is attached to a counter-weight sliding on a central rod, and is so arranged that it hangs from a smaller radius as the electrodes burn

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away and descend. In this way the force tending to draw the carbons up is always the same whatever their length. The chains supporting the carbons are passed round two of the grooves in the drum, while the third forms the brake wheel. A steel brake-chain passes over this last, and is attached to a rocker operated by the rocking lever. This latter is controlled by the shunt and series solenoids in the usual way. Striking the arc is effected by the series coil causing the brake-chain to grip the wheel and turn it so as to lift the electrodes, and feeding is accomplished by the wheel being released so as to allow the electrodes to drop.

The whole of the mechanism is placed in the top of the lamp on a cast-iron frame with a weather-proof cover. A lamp for a quadruple section electrode weighs 44 lb. complete, and the overall length of the lamp is 3 ft. 4 in. The length of the electrodes is 24 in., and the diameter per carbon 9 mm. in the case of the 30-hour burning lamp. The lamps are supplied for three periods of burning, namely, 15 to 16, 25 to 30, and 40 to 50 hours.

ELECTRIC TRACTION ON CANALS

THE Royal Commission on Canals and Inland Navigations of the United Kingdom have just issued their fourth and final report. The Commission was appointed in August, 1906, and was presided over by the Right Hon. Lord Shuttleworth.

In our issue for February 28th, 1907 (Vol. I., p. 405), the evidence of Prof. E. W. Marchant, of Liverpool University, in relation to the use of electricity for haulage purposes on canals was given at length, and it is in connection with this aspect of the question that the following extracts from the report are given:—

The report recommends the amalgamation and bringing into working order of certain waterways which, taken together, would form four main routes connecting the Midlands or Birmingham district with the estuaries of the Thames, Mersey, Severn, and Humber, and deals at length with Continental views and practice as to traction, organisation of traffic and other matters connected with canals. It points out that recent experiments have been made in France and elsewhere by electric tractors running on rails laid on the tow-path. A system of this kind has been established on the canals d'Aire, de la Deûle, and the diversion of the Scarpe for a distance of 36 miles. By a decree of July, 1907, a concession was given to the Northern Electric Co. to establish electric traction on a crowded part of the St. Quentin Canal for a distance of 55 miles. This concession is for 40 years, and reserves to the State full control and the right to purchase. It is also proposed to use electric haulage on the new Canal Du Nord, now in course of construction, and the exclusive right of traction is conceded to the Chamber of Commerce of Douai for a term of 50 years as part of the means of raising revenue to meet the debt charges on the loan raised by them as a contribution towards the cost of the canal. Reference is also made to the use of electricity upon the Teltow Canal, where it is made obligatory, other forms of traction not being permitted.

The report adds that discussions at the recent International and Inland Navigation Congresses of European and American Engineers, show that the tendency is to accept electric haulage as the best and most economical form of traction on canals on which the traffic is, or may become, sufficient to repay the cost of installation. The following advantages of haulage by electric tractors instead of by steam tugs are set forth:—

(1) Assuming that the electric lines are laid on each bank, there will be greater regularity and uniformity of speed in the service than where tugs are used, and there will be less delay in despatching cargoes at short notice and at regular intervals.

(2) The banks and bottom of a canal are not so much injured by electric towing as they are by tug-towing. In the latter case the peculiar disturbance to the bottom, with consequential injury to the side-banks, caused by the motion of the screw, is added to the wave from the moving boats common to each mode of transport.

(3) In the case of electric towing there is a considerable economy of space and water in locks and lifts, because tugs and steam-boats, which by reason of the machinery have a smaller cargo-carrying capacity than barges of like dimensions, need not be taken through.

(4) The electric power, when once installed all along a line of waterway, can be utilised, not only for traction, but also for operating locks and other works, and lighting the waterway at night, and can even, perhaps, be utilised for factories establishing themselves along the waterway.

It has been contended that as the cost of installing electric traction is considerable, its use should be compulsory, and other forms of traction should be excluded. In experiments with electric traction in France where horse traction has been allowed to continue on the same sections, it has been found (1) that it was necessary to undertake extensive works, so as to give room for the rails and still allow room for horse haulage; (2) that a small proportion of slowly-moving boats was sufficient to prevent electric traction from giving all the increased speed of which it is capable. Continental experts are thus being led to these two conclusions: first, that other forms of traction, mechanical or animal, should be excluded; and secondly, that the exclusive right to supply power should be in the hands, either of the owner of the waterway, or in those of the concessionaires. To a certain extent these conditions would assimilate the system of canals to that of railways.

Special attention is drawn to one of the papers read before the Inland Navigation Congress held at St. Petersburg in 1908. This was a report of the proceedings of a sub-committee of the German-Austro-Hungarian Society of Inland Navigation in the preceding year on the "Towing monopoly and mechanical ship-traction on Canals." This Committee consisted of representatives of the Government of Prussia, Saxony, Austria-Hungary, and various expert representatives of inland navigation, and their report is accepted by the Royal Commission as embodying the best informed modern opinion. The Committee were unanimously of opinion that "electric towage from the bank is the most suitable means of economical exploitation of the canals." M. Kuhn, City Engineer of Vienna, in a report to this Committee, considered that electric haulage could only be advantageous if (*a*) the whole towing service is handed over to the owners of the electric towing installation; (*b*) if the goods transported are of such an amount as to make electric towing cost less than towing by tugs.

The Commission, after referring to the conclusion of Professor Marchant that even if the electrical system is not more economical than haulage by steam tugs, it is decidedly to be preferred on account of the auxiliary advantages which there are in using it, state that the subject is one of more than mere engineering importance, because it affects the question of the whole organisation of traffic upon main line waterways.

In conclusion, the Commission recommend the appointment, in connection with English and Welsh waterways, of a Central Waterway Board, consisting of three or five Commissioners, who should be paid, and give their whole time to the work. The four main routes of canals indicated above should, it is recommended, be transferred to the Waterway Board, as a first step, by the Act constituting the Board, or in an early scheme proposed by the Board. It would then be for the Board to consider whether if electric haulage is adopted on these or any other canals, and the tonnage conveyed is increased, the increase of traffic will pay for the provision of traction by, or on behalf of, the authority, and how low a rate of payment can be charged for this service without loss.

Manufacture of Telephones.—The daily papers report that in a speech made by Mr. Buxton, the Postmaster-General, at Islington, last week, he dealt with the question of purchasing telephone instruments in Sweden. He stated that during the four years he had been at the Post Office, about 3,250 telephones were purchased abroad. This, however, was in the early days of his administration, when one particular design of telephone instrument was in use, and only one firm made it, and that a Swedish firm. During the past year or two, however, this firm had started manufacturing the instruments in England, and since September, 1909, not only had he not given a single order to any foreign firm for telephone work, but the firm he had mentioned had supplied 13,000 telephones made in British workshops.

Magnetic Wheels for Tramcars.—According to the *Electric Railway Journal* (New York), experiments with a method of increasing traction by magnetic wheels have been conducted for some time by Mr. O. Heinze, of Lowell, Mass. The wheel contains four magnet coils, outside of which are four segments comprising part of the tread of the wheel, and a ring of 12 per cent. manganese steel is clamped between them and the wheel proper to send the magnetic circuit into the rail. The energising of the magnets is so timed that each succeeding section of the wheel is attracted to the rail just in advance of making contact with it, so that the device besides giving increased adhesion also assists acceleration. The current is cut off from each given segment as soon as it is no longer in contact with the rail. Tests have been made on a truck equipped with two 35-h.p. 550-volt standard railway motors, and weighing 13,000 lb. With the traction due to weight alone the motors developed a drawbar pull of 2,500 lb. With the wheels magnetised, the tractive effort was increased to 8,500 lb., or more than 300 per cent. The inventor does not claim to increase the traction by such a liberal percentage on an ordinary car, but states that a car equipped with his device should be able to mount grades that are otherwise impossible without a rack.

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ELECTRICAL ENGINEERING
IN
MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "The Editor, Electrical Engineering, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

CABLES IN SHAFTS AND MAIN HAULAGE WAYS

By J. P. Simpson, M.I.M.E.E., Electrical Engineer to South Hetton Coal Co., Ltd., Murton Colliery

[*Editor's Note.*—The fact that the opinions expressed by the writer of this article differ in some respects from those published by Mr. H. J. Fisher in a former supplement make them none the less interesting. In both cases they are based on the author's actual experience.]

THERE is no part of an installation that requires more consideration than the cables in the shaft and main haulage ways, because they are subject to many variations in temperature, which cause them to expand and contract, and thus to be continuously moving. They are also subject to shocks and strains, due to material falling down the shaft, and falls of stone. In many shafts water is continually dropping, and for these reasons as dry a place as possible, and out of the way of guides and winding ropes, should be selected. Lead-covered cables should never be used in shafts, as the weight of the lead produces creep, which in time would cause faults to develop. The best and most substantial cables to instal in a shaft are double-wire armoured, the armouring of which should be wound spirally and in opposite directions, or cables armoured with steel tape, wound so that the armour is locked or wedged; but whichever class is used, they should be braided and compounded over the armour. Unarmoured cable should never be installed in shafts, owing to its being mechanically weak and not able to withstand a knock should anything fall down the shaft and strike the cable.

The writer has found that the best class of cable for shaft work is that in which the conductors are insulated with bitumen compounds, and the space between the insulated cores filled in with jute mixed with a plastic compound, so as to keep any moisture from creeping in. Two layers of cotton tape soaked in compound are wound over the jute, and, on top of this, marline is wound on spirally so as to give a round surface for the armouring; two layers of marline are wound in opposite directions over the armouring, and the whole is compounded together. Cables of this description have been installed in very wet shafts, and have been at work over two years at a pressure of 2,000 volts, and have never given the slightest trouble.

Shaft cable should always be installed in one length, where possible, as joint boxes are not reliable, and as cables are now made in such long lengths joint boxes can be dispensed with. The writer has installed cables in shafts which required a length of 500 yards to go from the power-station at bank to the distribution house underground. These cables were put down in one length, and were double-wire armoured, three-core, 37/14 cables.

A cable of this description must be substantially fixed, as it is not capable of supporting its own weight. The first cost of fixing shaft cables may be a large item, but it is worth the extra cost, because, unless they are well supported, they are sure to give trouble, and perhaps mean renewing the whole length of cable. The best method of fixing these cables is to support them at intervals of about 20 yards by hard wood clamps steeped in tar, and, where there is sufficient room in the shaft to run steel rope guides to carry the cables, no better method can be adopted. Fig. 1 is a rough sketch of the arrangement.

Two steel "I" girders are placed side by side with holes cut to allow the steel ropes and cables to pass through with a good clearance. These girders are then built into the shaft. Steel ropes are run down the shaft to the required depth, and fixed at the top side of the girders by forged clamps (Fig. 2), 12 in. deep, which bolt together and thus have a good hold of the steel rope. At intervals of about 20 yards forged clamps of similar shape, but 6 in. deep, are fixed to the steel ropes so as to support the wood clamps, which are gripped to the cables by six bolts; an iron strop is also put across these clamps in case they split and thus lose their hold. The clamps are hard wood bored out slightly less than the cables, so as to let them grip firmly, and are tapered away so as to allow water to run off. A tapered hole is also cut at the top to a depth of about 1 in., and leaving a clearance of ½ in. round the cable. When the cables are fixed into position, this hole is filled up with bitumen, which is allowed to run over the tapered top, the idea being to run any water off that may have got on to the cable, thus preventing it running down the entire length of cable.

Shaft cables are best if installed in cold weather, because one can be sure that the bolts are tight, having been tightened when everything is in a contracted state. If they are installed in summer weather it is, therefore, necessary to have all the bolts tightened up again when the cold weather comes. Wood casing should never be used in shafts, especially where there is water, as the wet casing will keep the cable in a wet condition, which in time will ruin the insulation; besides, wood casing prevents the cable from being examined as it should be. Whatever class of cable is used, it certainly should be an armoured one.

Where the cable comes out of the shaft into the seam it should be protected, in case anything falls down the shaft on to the cable; all that is necessary is to fix strong timber over the bend in a sloping position, so as to allow water or anything that may fall to run off. Fig. 1 also shows this arrangement.

The cables in the main haulage way are liable to risks not encountered by any other part of the installation. In some cases they extend for some distance inbye, and are, therefore, subject to any fall of roof, or, if they are run under the floor, they are subject

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to strain due to the floor heaving or lowering. Lead-covered cable should never be used for underground work, owing to the bad water that has to be contended with in some instances, also, if lead-covered cables are open, rats and mice, which are numerous in many pits, eat away the lead covering, and in time will cause a breakdown. The only cables suitable for this class of work are (1) vulcanised india-rubber and braided; (2) vulcanised india-rubber, protected by galvanised wire or steel tape; (3) bitumen cables protected by steel armouring. The system in use will, to a certain extent, decide the class of cable to be employed, but the writer is of opinion that nothing but armoured cables should be used in a mine, especially in the main haulage ways. If armoured cables were used throughout in the mine, and the armouring made electrically continous throughout, and efficiently earthed, there would be no danger of shock should a fall of stone occur and damage the cable. To give an instance of this, suppose the stone struck a three-core or concentric armoured cable and pressed the armouring into the cores so as to cause a short circuit from one core to another, it would only trip the switch or circuit-breaker, and thus render the cable dead. Again, if separate cables are used, and the armouring is electrically continuous and well earthed, there will be no danger in touching the armour. But if unarmoured cables are employed, and a fall occurs and damages the cable, or a fault develops through any other cause, there would be a danger of anyone receiving a shock should he touch the place where the cable is damaged. Unfortunately, there are some colliery electricians who do not know the meaning of the words "Electrically continuous throughout, and earthed." The shaft cable should have its armouring connected to earth at bank, while at the opposite end the armouring should also be connected to earth (thus making sure that one good earth connection will still remain if the other breaks down), and the armouring of every sub-feeder which is fed from it should be connected to the shaft cable armouring. The cables leading into motor panels, or motors, should have the armouring connected to the framework. The earthing should consist of a proper earthplate, sunk in as damp a place as possible. A good earthplate can be made with a sheet of iron about 3 ft. square by ½ in. thick, with holes drilled to fix copper strip 1½ in. by ⅛ in., which should be laid edgewise, and fixed spirally on the iron. Wet coke should then be placed between the copper spirals, and a thickness of 18 in. placed under the plate for it to rest on. The earth connection should then be connected to both ends of the copper strip, and about 2 ft. of wet coke laid on top and round the plate. The coke should be beaten up very small; coke breeze is best if it can be obtained. It is not advisable to use water mains alone for earth connections, as they may be disconnected at any time, and thus cut the earth connection. The writer once saw an instance of this. The water main was used for a main earth connection, and a branch pipe that conveyed water some distance inbye was used as the earth connection for a motor some distance from the shaft; this pipe had to be disconnected for some extensions between the shaft and the motor, and the plumber broke a joint by cutting through a ferrule. As he broke this ferrule from the pipe, his chisel made connection between the two pipes, and caused a flash. There had been a slight earth on the motor at the inbye side, but, fortunately, he only received a slight shock.

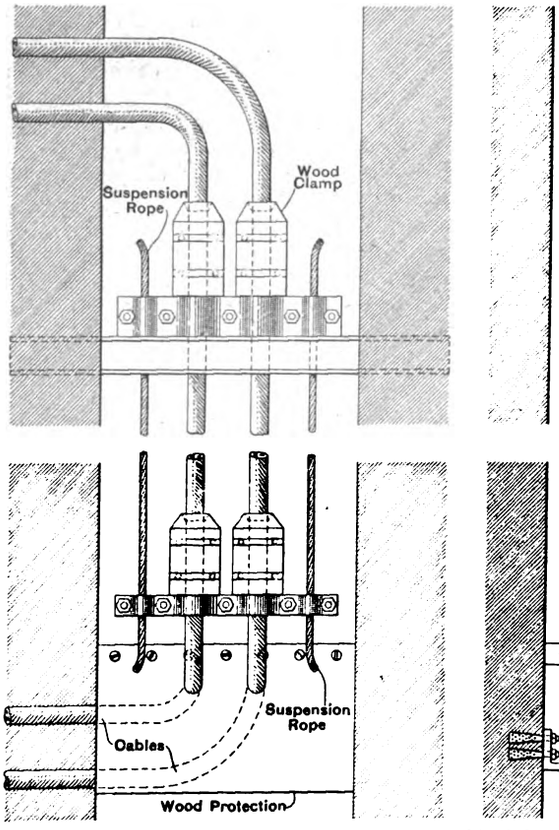


Fig. 1.—Sketch showing arrangement of Shaft Cables.

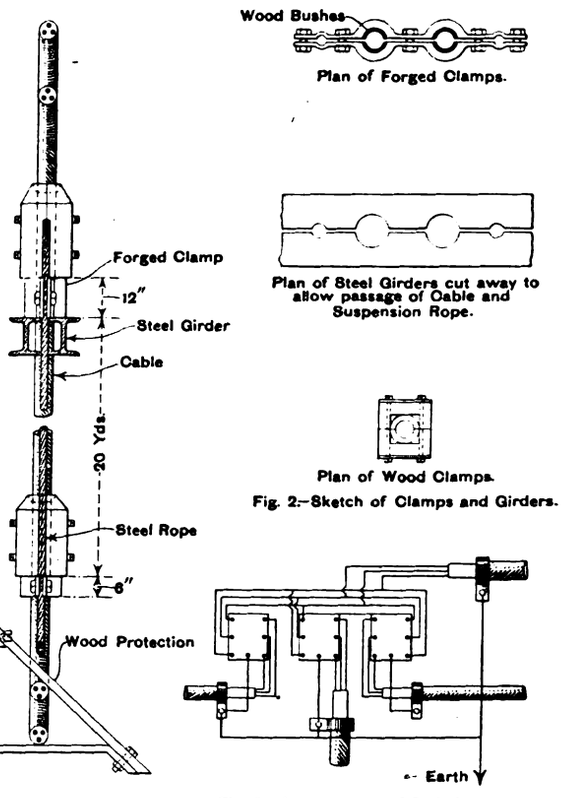


Fig. 2.—Sketch of Clamps and Girders.

Fig. 3.—Arrangement of Switches on a 3-Phase System.

In cases where junction-boxes are used, great care should be taken to make the armouring electrically continuous by stout copper bonding the armouring to the box, or by connecting the armouring at each end of the box.

It is the writer's opinion that it is not the best method to use junction-boxes underground, especially at a feeding centre; he recommends the use of switches instead. To give an instance, the writer once saw an installation where there were three haulages in one seam, and the feeder from the distribution-house (which was in another seam) connected into a four-way joint-box, from which the three haulages were fed. Now,

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suppose any one of these haulage cables broke down, it meant that the current would have to be switched off the feeder from the distribution-house, thus shutting down that seam until the fault was repaired, or the faulty cable disconnected from the box. If switches had been used at this feeding-point the faulty cable alone could be switched off, and, therefore, not interfere with the other two haulages. Fig. 3 shows the arrangement for a three-phase system with armoured cables. Of course, these switches would have to be kept locked up so that no unauthorised person could interfere with them.

The fixing of cables in main haulage ways is an important point; they should never be fixed with metallic fastenings, unless it is in the motor-house, or through an arch or curve which is brick built. Where the cables have to be suspended from the props, or baulks, it must be done with rope or leather slings, so that if a fall occurred, or the baulks broke, the cable would be borne to the ground by the sling breaking, which would minimise the danger.

Where concentric cables are used, the outer conductor should always be kept at earth's potential, thus allowing it to be handled without risk of shock. For high-tension work, the writer thinks that there is nothing to beat vulcanised bitumen cables, especially in wet places. He has had three-core cables, double-wire armoured, working in such places for over two years, and their insulation resistance is as good to-day as it was the day they were laid down. In places where the floor does not move, the cables can be laid underground in good troughs, or even on the solid system; the writer has laid cables in this manner with good results, but prefers them in view for pit work.

Perhaps a word of advice on "feeder protection" would not be out of place in this article. I refer to the "Merz-Price" system of feeder protection. If I may say so, it is a long-felt want supplied, and is just the thing required in mines. The idea is, should any out of balance occur in any phase (due to earths or shorts), or, in other words, should one phase be supplying more current than the other, the relay operates, which closes an independent circuit supplied by a direct current from a battery in series with the trip coil of the switch, and the switch operates. These relays will act before a feeder has time to arc at all, so that there is no danger of a spark from the cable causing any trouble.

ELECTRIC POWER AT THE LOFTUS IRONSTONE MINES

AN electrical installation with a number of interesting features has been put down in the Loftus ironstone mines of Messrs. Pease and Partners, by Messrs. Ernest Scott & Mountain (Gateshead-on-Tyne). These mines are situated about four miles from Saltburn on the Yorkshire coast, at some distance from the Durham coalfield, so that the saving in fuel effected by the adoption of electrical driving is of some importance. The mine consists of two drifts running into the face of the hillside on the east of the deep valley dividing Loftus from Carlin How. With the north drift nothing in the way of electrification has yet been attempted, as the ironstone is easily brought to the in-bye end of the main haulage plane, from which sets of ten tubs at a time are pulled out to the surface by a steam-driven hauling engine. The other (south) drift, tending in a south-easterly direction, is also operated by means of a steam hauling engine at the surface, and serves to bring stone from three different districts, namely, Whitecliffe Mine, lying underneath part of the township of Loftus; Loftus Mine proper, further to the north; and Grinkle Mine, some two miles distant. In arranging the electrical underground haulage, the lead of the ropes was kept as straight as possible, and it was arranged that either engine could relieve the other in the case of a breakdown. The in-bye haulage roads meet at the bottom of the drift from the surface, and at this point the ropes from the two haulage gears cross.

Owing to the intermittent nature of the load on these haulages, it was decided to obtain the electric current from the Cleveland and Durham Electric Power Co., through a sub-station at the mine. For the endless-rope haulage at Whitecliffe, for the centrifugal pumps, drainage pumps, and the electric drills at the face, also for the electric lighting at the surface and underground, and motors of various sizes on the surface, current is provided from the power station at the mine, which is equipped with three four-cylinder vertical gas engines by the Campbell Gas Engine Co. (Halifax), each coupled direct to a 230 kw. 550 volt continuous-current generator. Gas is furnished by three Campbell suction-type producers. One of the haulage gears was originally worked by a horizontal steam engine, which was displaced by a continuous-current motor of 250 h.p., running at a normal speed of 375 r.p.m., regulated by means of a metallic controller of the tramway type with iron grid resistances, and supplied from the power station. This motor ran for about two years, and the only difficulty was due to the unavoidably intermittent nature of the load, which occasionally led to irregular working in the power station. In view of this, and the steady increase in constant running machines underground and on the surface, which provided sufficient load for the power station, it was decided to replace the motor by one of the three-phase type, to take its supply from the power company's mains. The present motor is of 250 to 300 h.p., running at a speed of 343 r.p.m., and wound for a voltage of 2,750, at 40 cycles per second.

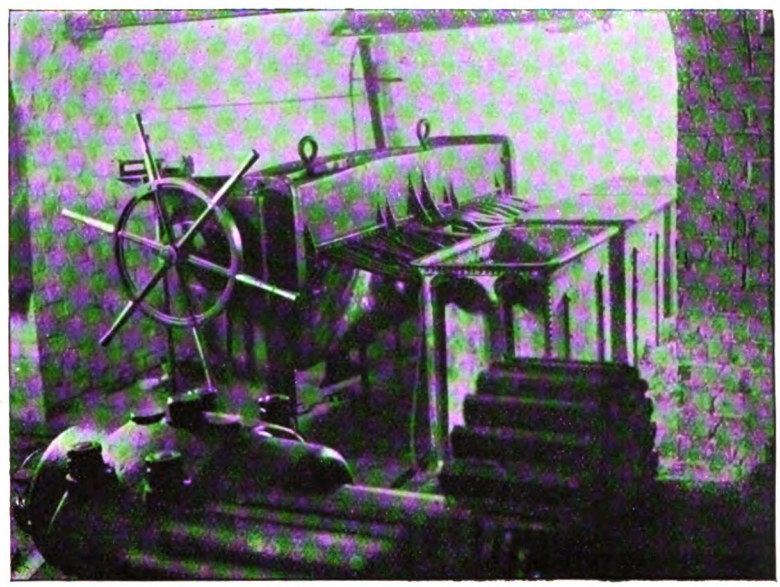


FIG. 1.—HAULAGE CONTROLLER IN POSITION.

Behind the motor, in a specially constructed archway, is fixed a metallic controller, which is a very massive instrument specially designed and supplied by Engineering Instruments, Ltd. (Darlington), for this work, and containing several unique features. The controller is divided into three sections, *i.e.*, one for each phase, each with 15 stops. Each stop in the controller consists of a quick-break switch with positive action, and, in addition, a spring break so arranged that in the event of the spring failing the switch will still be effective. Each stop is connected to an elaborate series of resistances carried in three galvanised iron tanks beside the controller. These tanks are filled with oil, and fitted with heavy copper circulating pipes, through which cooling water is forced by means of a centrifugal pump driven from the shaft of the motor. The controller body is mounted upon heavy cast-iron end supports, and raised clear of the ground, and is so arranged that the oil-filled tanks in which the switches operate can be readily lowered to provide for inspection and renewals. The controller is worked by means of a substantial handwheel fixed at the end of a long steel rod carrying it up to the operating platform. Beneath the pedestal carrying this handwheel is also fixed the oil-filled high-tension reversing switch, the handle of which is interlocked with the main wheel, so that the connections cannot be reversed until the wheel is in the "off" position. Still further back in the archway behind the motor will be found the water-filled resistance tanks to supplement the metallic resistances already described. These water tanks are very large, constructed of elm planks 1½ in. thick, and each holding

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approximately 190 gallons. Their duty is to absorb a very large proportion of the energy at starting, so as to give a very gradual acceleration when picking up a set of tubs. These liquid tanks are coupled to the first three stops of the controller only, and are then relieved of further work, any regulation beyond this point being carried out by the water-cooled metallic resistances alone. A steady speed of from one to two

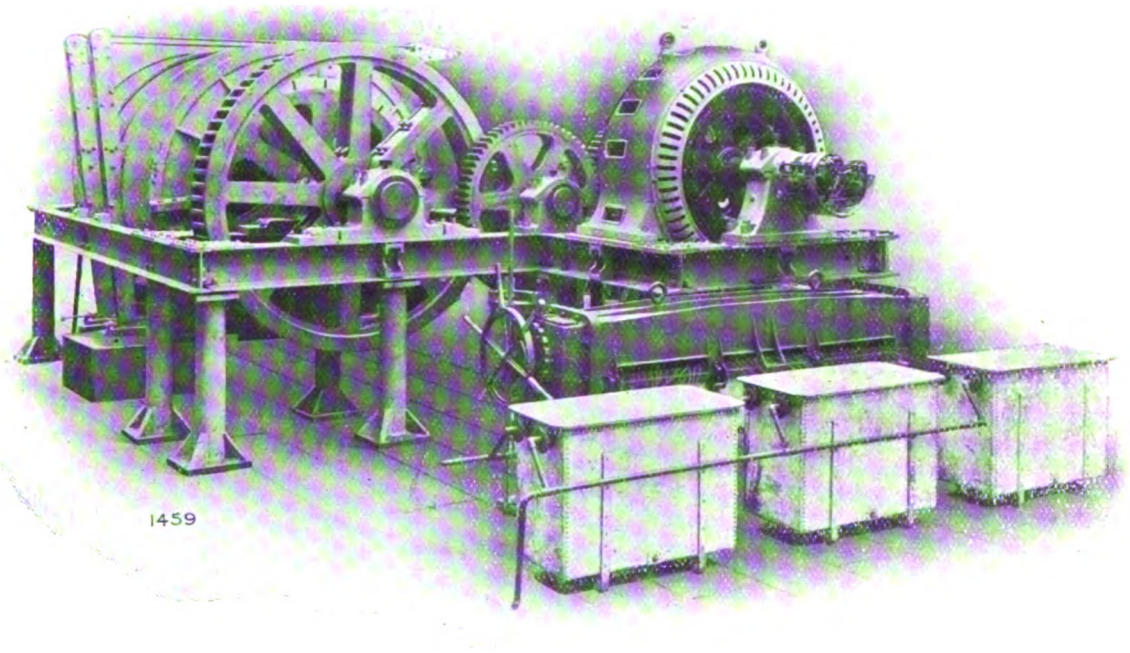


FIG. 2.—350-H.P. HAULAGE GEAR BEFORE ERECTION.

miles per hour can be maintained with the water tanks in circuit for purposes of adjusting the length of the rope, or for allowing the slack between tubs to be taken up gently. The work done by this haulage is to bring sets of from 30 to 50 tubs at a time over the somewhat uneven road from Loftus or Grinkle; in the latter case the run is 2,500 yards in length, and occupies from start to finish approximately 10½ minutes, from which it will be seen that the average speed is 8¼ miles per hour.

The other haulage gear is driven by a 300-h.p. motor, and is entirely new. The controlling arrangements are similar to those already described. A view of the controller in position is shown in Fig. 1, while the whole gear assembled prior to erection is seen in Fig. 2. There are two drums, each 6 ft. diameter on the barrel, and 2 ft. 8 in. wide, the shield boards being 8 ft. 6 in. diameter overall. Each of the two drums is fitted with "Hall" type of friction clutch, consisting of a very heavy cast-iron centre keyed to the main shaft and revolving with it. Outside this centre is an all-round brake strap 6 in. wide, fitted with elm blocks and operated by means of rods and levers inside the haulage drum, and connected to a sliding sleeve between the drums. The position of this sleeve is regulated by means of a hand-wheel with double-threaded screw, and is so arranged that either drum may be put into motion or stopped at will. The motor is capable of giving up to 450 h.p., and runs at 325 r.p.m., the voltage being 2,750. Owing to the frequent starting and stopping which is required, the motor is fitted with a wound rotor with very massive slip rings outside the end bearing protected by a sheet metal cover.

The continuous-current equipment at the surface comprises motors for operating the picking belt, tippler, and small motor generator for providing the lighting current for arc and incandescent lamps.

The continuous-current distribution board at Whitecliffe consists of a heavy cast-iron casing mounted on brick pillars and carrying double-pole switches mounted on slate base. The circuits in the board are five in number, and provide for the centrifugal pump room adjoining, the endless-rope haulage some 200 yards further in-bye, the drainage pumps placed at various points nearer the face, and the electric drills, which are in turn run from separate circuits leading out of a special distribution room at the side of the travelling road.

The centrifugal pumps are two in number. Each pump is constructed to deliver 600 gallons per minute against a head of 300 ft. and is driven by an 85-h.p. motor. These pumps deliver the water to the surface, and are run alternately, as the mine is fortunate in having large standage accommodation, which enables the pumps to be worked economically under the present strict regulations as to hours.

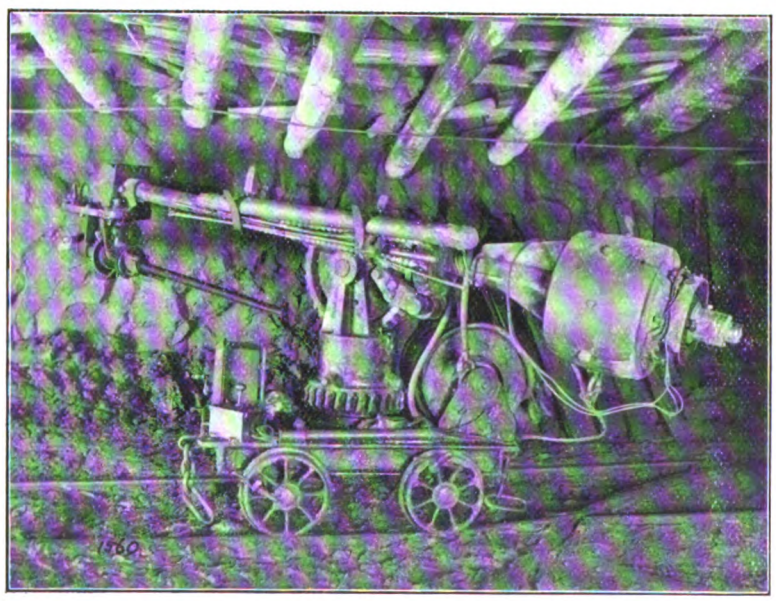


FIG. 3.—5-H.P. D.-C. MOTOR DRIVING ROCK DRILL.

Each pump set is provided with a switch column consisting of double-pole switch with circuit breaker and ammeter, the whole being ironclad and fireproof. The motors are started by means of "Esco" liquid switches.

Leaving the pump room, we proceed further in-bye to the endless-rope haulage, which operates two loads leading in-bye

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to the face, and brings the tubs out to the assembling points, where they are picked up by the main rope haulage already mentioned.

This gear is driven by a 100-h.p. induction motor running at 525 r.p.m., and controlled by a liquid switch.

The next features of interest in the mine are the drainage pumps, which are of the ram type, and deliver their water to the sump, which supplies the two centrifugals already referred to. These pumps are of the portable type with direct-geared motors. There are two sizes in use, one suitable for 50 gallons per minute, and the other for 90. The switchgear for the motors is also mounted on the pump framework, so that the whole set is readily removed as circumstances require.

At the face of the mine useful work is done by a large number of electric drills, one of which is shown in Fig. 3. These drills are of exceptionally massive design, on account of the hard nature of the ironstone in which they have to work. Each drill is capable of boring 30 holes, 1½ in. diameter, and 3 ft. to 4 ft. long, in an hour, and does this work regularly while in ordinary use. It will be seen from the illustration that each drill carries its own supply of trailing cable on a special drum fitted with sliding contacts, the starting switch and regulator being also fitted on the drill carriage.

The whole of the installation has been carried out under the general direction of the manager of the mine, Mr. W. Moore; the under-manager, Mr. F. Seymour; and the active superintendence of Mr. T. Scott and Mr. W. Robson, the mechanical and electrical engineers.

A THREE-PHASE WINDING PLANT

A GOOD example of an electric winding plant of moderate size, in which the magnitude of the peaks of the load in relation to the capacity of the generating plant available is not sufficient to justify the capital cost of a flywheel equaliser system, is presented by an electrically-operated winder installed by the British Westinghouse Co. at the Tredegar Iron and Coal Co.'s Maclaren Pit, Abertysswg. The plant was operating at the commencement of sinking, and received power from an electric power station about 3,000 yards away at Ty Trist, the transmission line being led over the hills and terminating in high-tension lowering transformers. The winder was designed to raise rock, &c., during the process of sinking the shaft. Only one drum was used during sinking operations, the maximum unbalanced load being: rope, 22 cwt.; cage and chains, 26 cwt.; burden, 40 cwt.; total, 88 cwt. The maximum speed of hoisting was 600 feet per minute. On the completion of sinking the

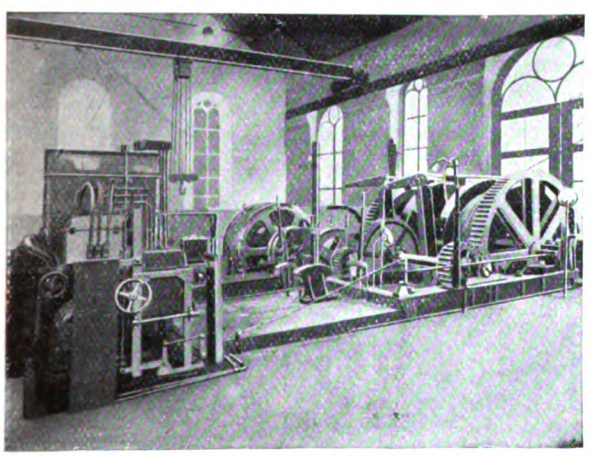


FIG. 1.—THREE-PHASE WESTINGHOUSE WINDING PLANT AT TREDEGAR COLLIERY.

winder was to be used for winding 500 tons of coal per day of nine hours, from a depth of 380 yards to a level of 300 yards from the bank—that is, 80 yards—for which purpose it is now employed. Two drums are used, and the cages, &c., are balanced.

The total load is 1 ton 14 cwt. 3 qrs., made up of 1½ ton of coal, and the 80 yards of rope of the cycle of operation occupies 45 sec., of which 30 sec. is actual winding. A view of the equipment is given in Fig. 1.

The drums are 6 ft. in diameter over the treads, and 2 ft. in width between the cheeks, one cheek of each drum being formed by a spur wheel and the other by the brake wheel. The drums are keyed to separate shafts, and can be operated either singly or together, in a similar manner to a main-and-tail haulage. The motor has a normal capacity of 250 h.p. at 380 r.p.m., and is of the Westinghouse standard three-phase induction type. Its working pressure is 500 volts at 40 cycles.

The control gear employs a liquid resistance consisting of two tanks mounted one above the other, a small motor and circulating pump, an oil-immersed main reversing switch, and also a main emergency switch. The upper tank contains three stationary electrodes and a movable sluice-gate, the electrodes being connected to the slip-rings of the main motor. The lower tank holds a supply of resistance liquid, and is fitted with cooling coils, through which cooling water is circulated. The resistance liquid is pumped into the upper tank by means of the small motor-driven circulating pump, and returns to the lower tank over the sluice-gate, which is in its lowest position when the driver's operating lever is at "off." The movement of this operating lever first throws the reversing switch in the primary circuit of the main motor in one direction or the other (according to the required direction of rotation), and then raises the sluice-gate. The latter operation causes the level of the liquid in the upper tank to rise, and consequently decreases the resistance between the slip rings.

The sluice-gate may be stopped in any position, or it may be immediately thrown to its highest position, this depending on how the driver manipulates the operating lever. As, however, the liquid cannot follow the raised sluice-gate faster than the pump can pump the liquid into the upper tank, a certain maximum acceleration of the motor (which is due to the rate

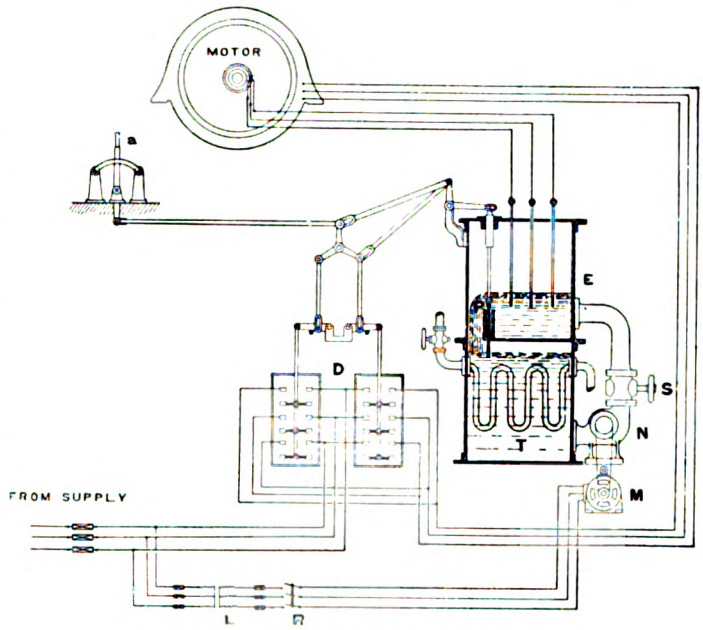


FIG. 2.—DIAGRAM OF CONNECTIONS.

of decrease of resistance in its rotor circuit) cannot be exceeded, although any less acceleration may be obtained. This maximum acceleration is adjustable by means of a stop valve in the delivery pipe of the pump.

The primary reversing-switch and sluice-gate are operated directly from the driver's lever, as shown in Fig. 2, where *a* is the driver's lever, *D* the main reversing switch, *E* the liquid-resistance tank, *P* the sluice-gate, *T* = the resistance-liquid reservoir with cooling coil, *N* the circulating pump driven by the motor *M*, and *S* the regulating valve.

The Harris Safety Shot Firing Apparatus.—A brief description of this apparatus, which has been designed to provide for the insertion of electric detonators in bore holes, was given on page xviii. of the last Mining Supplement, ELECTRICAL ENGINEERING, December 2nd, 1909. Mr. R. D. Harris has drawn our attention to the fact that our description was somewhat misleading. The copper rod is inserted into the last cartridge of the explosive *before* it is placed in the bore hole, and after the rod is inserted the hole must be well rammed with clay to prevent the flame from escaping. Finally, the detonator is placed in the end of the metal tube, with the firing wires *outside*, and the whole is inserted in the channel left by the copper rod. The detonator is then inserted into the hole made by the rod in the last cartridge by means of a fine rod in the tube. After withdrawing the tube, the hole is plugged, and the shot is ready for firing. Mr. Harris informs us that this apparatus is being used with complete success at the Dulais Colliery, Onllwyn, Glamorganshire, and that, between November 22nd and December 4th last, over 700 shots were fired with it, three misfires being dealt with without any danger or difficulty.

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THE MINERS' ASSOCIATION AND ELECTRICAL WORKING

THE November issue of the *Monthly Circular* of the Northumberland Miners' Mutual Confident Association contains a section written by Mr. Thomas Burt, M.P., who has on previous occasions offered suggestions for minimising the dangers arising out of the use of electrical appliances in mines by stricter supervision, better inspection, and the appointment of properly trained men. He includes the following extract from correspondence from a colliery expert in practice in the northern counties. In criticising the manner in which some colliery installations have been carried out, his correspondent writes:—

"I feel strongly on the question of having certificates given to the mechanical engineers of collieries who are in charge of the electrical plant, and who are more or less responsible to the colliery manager and to the owners. Unfortunately, however, the colliery manager is the man responsible to law, and as a rule it is he who takes up the purchase of the installation with the contractors, and many contracts have been let at ridiculous prices to electrical companies, who were anxious to get in touch with mining work, but who had no experience of the operation of colliery electrical machinery, and who, to save making a bad bargain, put in the cheapest kind of machinery and plant to do the work. The colliery manager and the colliery engineer, in many cases, had little or no knowledge of electricity, and consequently were quite unable to supervise the work, and even now, although many colliery engineers have a good knowledge of electricity, there are very many collieries indeed where the electrician has only a very inadequate knowledge of electricity, and is certainly not competent to design or superintend the installation of electrical plant of any consequence. In some cases, consulting engineers have been employed, but again, the man appointed has usually been an electrical expert pure and simple, and he has had to gain his mining experience at the expense of the owners, and sometimes at the expense of the workmen. With regard to inspectors, I would like to point out that it is useless to appoint electrical inspectors who are purely electrical engineers. He may have every qualification as an electrical engineer, but unless he has had a very considerable experience in actual colliery work, he cannot carry out the duties efficiently.

"The only other point which I should like to mention is the suggestion that I made to you *re* the Miners' Association appointing their own electrical expert. The point raised is this: So far, the owners of collieries have installed, through their colliery managers, electrical plant, of which the latter has very little, if any, knowledge, and so far as the men themselves are concerned, their interests were not sufficiently considered; but in going through the whole of the accidents that have occurred due to 'Electricity in Mines' it is the men who have been the sufferers, and they have suffered in the majority of cases simply because the installation had not been fitted as it ought to have been by the electrical contractors.

"The suggestion I have to make is this: That the miners themselves appoint their engineer to attend inquests, and make a report on every fatal accident, and to make suggestions for their prevention, and such a record would not only be valuable to the miners themselves, but would be of material assistance to the owners when installing electrical plant, and would thus do very much to remove the present feeling against the use of 'Electricity in Mines,' which can do much to improve the conditions of the men underground if properly installed and used."

ELECTRIC PUMPING EQUIPMENT AT THE NEW ZEALAND CROWN MINES

AN important electrical pumping equipment will shortly be completed at the Crown Mines at Karangahake, New Zealand. This pumping plant was necessary in order to extend the workings below the No. 5 level in the mine. Six hundred gallons of water per minute have to be raised a vertical height of 380 ft., and as further sinking is carried out this quantity will increase, until it is estimated that 1,135 gallons of water will have to be pumped a total height of 750 ft. This will be done in two stages by means of electrically-driven ram pumps.

The generating station is situated about 6,000 ft. from the mine, where a water supply is available from the Ohinemuri River. The power station equipment consists of a 720 b.h.p. water turbine direct coupled to a 550 kw. generator and a 500 b.h.p. steam engine direct coupled to the opposite end of the same generator, and the coupling between each is arranged so that the generator may be driven by one, the other, or both of the prime movers. The whole of the work will be done by the water turbine for the greater part of the year, and when the supply of water falls off the turbine will be assisted by the engine, and for a short period in the year it will be necessary for the bulk of the load to be taken by the engine. The turbine was supplied by Messrs. Escher, Wyss & Co., of Zurich, Switzerland, and is of the radial flow type, designed to run at 300 r.p.m. It is supplied with water under a net head of 80 ft., and the water is conducted to the turbine by a pipe line 6 ft. in diameter, the draught tubes extending from the turbine to the tail race 21 ft. below. The generator was manufactured by the Electric Construction Company, of Wolverhampton, and is of the three-phase revolving field type, generating at 2,200 volts and 25 cycles per second. The engine is of the high-speed, vertical, three-crank, triple-expansion pattern, manufactured by Messrs. Belliss & Morcom, of Birmingham. It is supplied with steam at 150 lbs. pressure, and exhausts to a rectangular tubular surface condenser supplied by the Worthington Pump Company. The steam is supplied by two Babcock & Wilcox watertube boilers, each capable of normally raising 6,000 lbs. of steam per hour superheated 50 degrees. Feed water heaters and purifiers are provided, and the generating station generally is equipped with the most modern appliances and accessories for both the hydraulic and steam side.

Current is transmitted from the generating station to the mine by means of bare overhead stranded copper conductors upon poles planted at suitable intervals through the Ohinemuri Gorge and the Waitawhita Gorge. From the terminal pole at the mine end a three-core cable is taken to a distributing board placed in a convenient position at the mine mouth, and from this board circuits are provided for the two pump motors, and a transformer is supplied for lighting and general supply.

The two double-acting duplex ram pumps are driven through double-reduction cast-steel spur gears by 250 b.h.p. induction motors, each pump and motor being mounted upon a frame provided with runners. The main incline shaft is provided with rails upon which the pumps are placed, so that they are in position to follow up the workings or be hauled out in emergency. The pumps were supplied by the Worthington Pump Company, of Newark, and the motors by the Electric Construction Company, of Wolverhampton.

The mine cables throughout are of the three-core type, paper-insulated, lead-covered served with jute, armoured with steel wires, and taped outside the armouring. There are no exposed terminal contacts or conductors of any kind inside the mine, no fuses are used, and all contacts are made and broken in oil contained in cast-iron cases properly sealed. The cables, both bare and insulated, were supplied by Messrs. Johnson & Phillips, and the switchboards, instruments, and all electrical equipment by the Electric Construction Company.

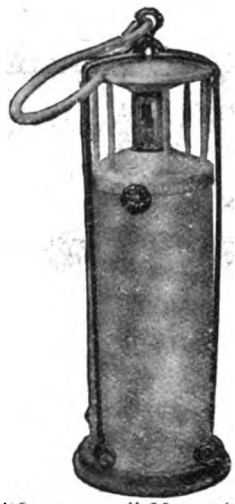
The whole of the apparatus was submitted to rigorous testing, as near as possible under actual working conditions, before being despatched, the boilers, engine, generator, motors, and switchgear being assembled at the works of Messrs. Belliss & Morcom for the purpose. The installation was arranged by Mr. H. F. Parshall, of Salisbury House, London Wall, who was also responsible for the testing of materials and apparatus, and the supervision of the design and manufacture of the equipment. The erection of the complete equipment was carried out by the New Zealand Crown Mines Company, under the direction of Mr. F. R. W. Daw, the company's mine manager, who also furnished the data upon which the installation was designed.

Electrical Mining Equipments.—A pamphlet of considerable interest to mining electrical engineers has just been issued by Messrs. Crompton & Co. (Salisbury House, London Wall, E.C.), and contains about 50 illustrations of plant, &c., typical of the methods used in the supply and utilisation of electricity in mines, a subject to which, as shown by the long list of mines where Crompton machinery is in use, the company have given a great deal of attention. Steam- and gas-driven power station plant is exemplified, and further illustrations show electrical driving of auxiliaries. Converting as well as generating plant is represented, and illustrations are given showing the detailed arrangement of power station main switchboards, and enclosed distributing switchboxes for underground use. A main shaft winding system, employing batteries in conjunction with boosters for load equalisation, is explained with diagrams, and illustrations are given of a number of patterns of electrically-driven haulage gears. Special controllers, both of the oil immersed pattern with metallic resistances, and also with liquid resistances, have been designed. Pumping, air compressing, and ventilating plants are dealt with, and an illustration of a special form of enclosed motor ventilated through pipes is given. Various applications of electric power for surface purposes are also illustrated, including electric capstans, machine tools, &c., and in speaking of lighting, the application of the auto-converter (see ELECTRICAL ENGINEERING, July 8th, 1909, page 629), for reducing the pressure of 500 volt circuits to a value convenient for lighting is explained.

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MINERS' ACCUMULATOR SAFETY LAMP

THE accompanying illustration shows the general design of a new unspillable accumulator safety lamp, which is manufactured by Messrs. Longstreth's, Ltd. (190 Queen's Road, Battersea, London, S.W.) This lamp is suitable for use in mines, gas-works, sewers, and other places where the presence of inflammable gases is possible. It weighs under 3½ lb., and gives a light of two candle-power for twelve hours on one charge. The case is of aluminium, and the wire loops attached to the base are brought together over the top of the lamp chamber and clamped. A padlock can be inserted to lock the lamp if necessary. The whole lamp is easily taken apart and put together. An explosion-proof switch with internal contacts is provided. The accumulators are of the well-known "Lithanode" patent unspillable pattern, in which an auxiliary vent chamber with means for returning the acid sprayed or leaking from the main cell, is provided. This chamber prevents any likelihood of acid spraying out of the cell, and renders it possible to invert the cell without any acid escaping.



"LITHANODE" MINERS' SAFETY LAMP.

SOME NEW MINING PLANTS

WE recently had an opportunity of inspecting some mining machinery in course of completion at Messrs. Ernest Scott & Mountain's works. Among the most interesting pieces of plant shown us were some portable haulage gears for small main rope, and main and tail haulage, which have been specially designed for getting the coal from the working face to the main haulages. There is no doubt that when the eight hours Act comes into force, provision will have to be made in most collieries for getting the coal away from the working face quicker than is at present done, and where electricity is installed these portable haulages are by far the handiest thing that can be used. The main rope haulages are made in three sizes: 5 to 10 h.p. with a drum 15 in. dia. by 12 in. wide; 10 to 20 h.p. with a drum 18 in. dia. by 10 in. wide; 20 to 30 h.p. with a drum 21 in. dia. by 12 in. wide. The rope speed is generally about four miles per hour, but this can be arranged to suit purchasers' requirements. Where the gradient is not sufficient to enable the tubs to self-act (2 in. to the yard is generally found sufficient for this purpose), an endless rope drum is substituted for the main drum, or a portable main and tail haulage can be used.

A jaw clutch is provided for throwing the drum out of gear, so that the empty sets can be lowered on the brake with the motor standing. The bed is built up of steel plates, stiffened with angles and bolted together, so that it can be very easily taken apart, and is intended to carry either a three-phase or continuous-current motor which drives through machine-cut gearing, the motor being provided either with a raw-hide pinion, or, if it has to work in a damp situation, a forged-steel pinion. The whole of the gear can, if required, be mounted on trolley wheels. The bearings are gun-metal bushed, and, by withdrawing a few bolts, can be quickly withdrawn.

A portable main and tail haulage shown us was for the Carlton Iron Co., and is driven by a 20-h.p. three-phase slip-ring motor through a Hans Renold chain. One drum is raised slightly above the other so that the haulage ropes clear, and the gear is arranged for a speed of five miles per hour. The general design of this gear is very similar to the portable main rope, and it is designed to meet the requirements for a portable haulage where the gradient is not sufficient to enable the tubs to self-act the whole way.

Two haulage gears for the James Ross & Co.'s shale mines were also on view. The larger of these haulages, which is of 300 h.p., is for dealing with tubs on a gradient of 29 in. to the yard, or an angle of 53°, and is practically a winding engine. Two drums are used, one for the ascending, and one for the descending cages, one of the drums being provided with a jaw clutch, so that the position of the cages in the shafts can be adjusted on the incline. The maximum rope speed is 12 miles per hour, and the complete winding is calculated to take about 60 seconds. The load is 7 tons, which is raised through a total vertical lift of 773 ft. on an incline 960 ft. long. The motor, which runs at 465 r.p.m., is mounted at the side of the winder on separate slide rails, and drives through machine-cut helical gear. An automatic overwinding device is provided, which in case of an overwind cuts off all current to the motor and applies the post brakes by tripping a dead weight. This overwinding device is fitted to the depth indicator. A platform is provided about the level of the drum shaft on which the driver's seat is arranged, and this platform is extended all round the gear so as to give access to all parts, and is provided with stairs. Below the platform the space is partly bricked in and partly enclosed with flat mesh work, so as to enclose the winding engine and prevent access by unauthorised persons.

The smaller 100-h.p. haulage is for dealing with tubs on a gradient of 9 in. to the yard, 320 yards long, rising to 773 ft. vertical. The greatest load is 2 tons, and the maximum speed of rope 600 ft. per minute; time of a wind is about 120 seconds. The same arrangement of platform, overwinding gear, &c., is provided in this case.

Two electrically-driven ram pumps were also in course of construction for the Consett Iron Co. Each pump is designed to deliver 650 gallons per minute against a head of 470 ft., and is driven by a 120 h.p. motor through helical gear. A pump driven by a 40-h.p. motor was also in hand for the Wemyss Coal Co. This contract comprises in addition ironclad switchgear, and starter for controlling the motor, together with a special arrangement of bye-pass and relief valve, which enables the pump to be started, delivering the water back to the sump and the head applied gradually. Another speciality of the firm is a portable pumping set, which is made in a variety of sizes.

ELECTRICAL MINING PATENTS IN DECEMBER

THERE were only two patents published during December which can be said to be connected particularly with the applications of electricity in mines. The first of these is No. 21,693 of 1908, published on Dec. 9th. This was taken out by R. Rutherford, of Ferryhill, Durham, and describes a system of signalling in connection with haulage or winding plant. The apparatus consists of a number of electrically illuminated indicators, which are operated from different points by means of multiple-way switches. These switches are connected in series so that a signal cannot be given unless all are in the same position. The indicators are divided into compartments; thus six illuminated panes may be used, carrying the inscriptions, "Shaft work," "Coal work," "Men Riding," "Stop," "Change decks," and "Ready." The circuits of the lamps in the first four compartments, indicating the nature of the operation being or to be performed, are closed when the various switches are put in the corresponding positions. The remaining two circuits are each controlled by a switch provided with an electromagnetic device to hold it in the closed position until the work has been performed, when a device worked from a moving part of the winding engine closes the circuit of the magnet, opens the switch and extinguishes the lamps, showing that the work has been done. A bell-signalling system is used in conjunction with this visual signalling apparatus.

The other patent, also published on Dec. 9th, is by D. Lewis, of Gwaun-cae-gurwen, Glamorganshire, and describes an electrical apparatus for igniting miners' lamps. This comprises a box with lower and upper compartments. The lower compartment contains accumulators and an induction coil, and the upper compartment is divided into two parts. In one is the switch handle for closing the battery circuit, and the other is a gas-tight compartment for the lamp. A sliding door is so arranged that the switch cannot be closed unless the gas-tight compartment containing the lamp is completely closed.

Dispute re South Wales Colliery Plant.—As mentioned in our issue for December 16th, the Electrical Co., Ltd., are taking an action against Oliver H. Thomas Son & Co., proprietors of the Llynvi Valley Colliery, near Maesteg, for the recovery of £2,707 for electrical plant delivered at the colliery. A counter-claim has been entered by the defendants for £30,100. The proceedings originated before Mr. E. J. Pollock, official referee, at the Swansea Town Hall, but were subsequently transferred to London, and were continued down to the Christmas recess at the Royal Courts of Justice. The facts of the case are as follows:—The Electrical Co. contracted to supply certain electrically-driven pumps for unwatering of the Llynvi Valley Colliery, which the proprietors allege were unsuitable and defective. The terms as regards payment were that 60 per cent. was to be paid on delivery, 30 per cent. on starting, and 10 per cent. in three months later. The amount of the claim, namely, £2,707, was balance of account. The counter-claim is on account of the alleged inability of the defendants to enter certain workings owing to obstruction by the machinery installed, and also for unreasonable delay in supplying one of the centrifugal pumps. Mr. Abel Thomas, K.C., M.P., and Mr. John Sankey, K.C., appeared for the plaintiffs, and Mr. B. F. Williams, K.C., and Mr. Meager appeared for the defendants. Mr. J. Stottner, formerly manager to the Electrical Company, gave evidence to the effect that the plant was working satisfactorily on the occasions upon which he inspected it after erection, and that if it got out of order at any time it was due to the inexperience of the colliery officials in charge of it. Special care was taken with the construction of this plant, owing to the desire of the firm to supply a number of other mines in South Wales with similar plant. The conduct of the case has consisted to a large extent of the reading of the voluminous correspondence which has taken place between the plaintiffs and the defendants, this occupying several days. A further hearing of the case will be continued when the Courts resume their sittings.

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MANUFACTURE OF TUNGSTEN FILAMENTS

The B.T.-H. Co. claim the Master Patent for Filaments drawn from Ductile Tungsten Alloys

ON August 19th, 1908, the Siemens & Halske Akt.-Ges. of Berlin applied for a British patent to cover a process for manufacturing bodies of tungsten, or of alloys of tungsten and nickel. The application is numbered 17,438, of 1908, and the date claimed for the patent, under the International Convention, is September 26th, 1907, which is the date of the application in Germany. The German patent is in the name of the Siemens & Halske Akt.-Ges., and is numbered 312,701. The complete British specification was accepted, and was published on April 22nd, 1909, and an abstract appeared in ELECTRICAL ENGINEERING, April 29th, 1909. On June 7th following, opposition to the grant of the patent was entered by the British Thomson-Houston Co., of Rugby, on the ground of anticipation by the British patent No. 23,335, of 1906. They also affirm that the invention is not sufficiently or fairly described in the complete specification. The Comptroller decided to grant the patent, with certain amendments to the specification, but this decision has been appealed against.

The specification in question, No. 17,438, of 1908, is a translation, by the Patent Agent, from the corresponding German specification, and gives the following particulars of the process:—

According to the present invention, objects of tungsten and nickel are made by intimately mixing the two metals and sintering them together by heating below the melting point of tungsten. There is thus produced a ductile mass which can be further worked by drawing, rolling, or hammering. As compared with directly melting together tungsten and nickel, this process has the advantage that the difficulties of fusion are avoided and that vaporisation of the nickel, generally unavoidable when the tungsten is fused, is obviated. When the nickel amounts to 10 to 12 per cent., the alloy is nearly insensitive towards chemical reagents, possesses surprising elasticity and great hardness, and can be easily hammered, rolled, or drawn. If objects of pure tungsten are to be made, the nickel can be expelled by heating in a vacuum. In the case of lamp filaments, the heating is advantageously effected by passage of a current through the rolled wire. If less than 60 per cent. of tungsten is present, the removal of the nickel by a current in a vacuum is not possible without melting the alloy. If less than 1 per cent. of nickel is present, the ductility of the alloy is not sufficient. Even with 4½ per cent. of nickel the ductility is still very low, and only with some 5 per cent. and more is an alloy obtained which fulfils all the requirements. A most suitable alloy consists of a mixture of about 85–95 per cent. of tungsten and 15–5 per cent. of nickel, more especially 90 per cent. of tungsten and 10 per cent. of nickel.

In order to obtain an intimate combination, the metals are mixed in the form of easily reducible chemical compounds; for example, tungsten powder may be mixed with nickel oxide, or tungstic acid with nickel oxide, or colloidal tungsten compounds with nickel powder. The reduced tungsten, being finely divided, unites with the nickel intimately and sinters with it to a very ductile mass.

A colloidal solution of a tungsten compound forms a most suitable medium to bind together the materials, and a rod is formed from the mixture. This rod may be about 20 to 30 cm. in length and of about 1–2 mm. in diameter. The rod dries very easily, and is then placed in an electrically-heated tube made of carbon reinforced with quartz. A stream of hydrogen is passed through the tube and the temperature gradually increased until the reduction is completed. When this condition has been attained the temperature is cautiously raised until it is about 1,510° C., and after heating at this temperature for some 50 seconds, a ductile rod is obtained.

The three claims attached to this specification are:—

1. The herein described manufacture of objects of an alloy of nickel and tungsten, by uniting the tungsten with the nickel by sintering the metals together at a temperature below the melting point of the tungsten to form a ductile mass, and then fashioning this mass by mechanical working such as rolling or drawing.

2. The modification in which, after the fashioning operation the nickel added to the tungsten is partially or completely expelled by strongly heating in a vacuum, substantially as described.

3. The modification wherein one of the metals to be combined is used in the form of a reducible compound in order to obtain by the reduction an intimate mixture of the constituents and to facilitate the sintering, substantially as described.

The Patent, No. 23,335, of 1906, put forward by the British Thomson-Houston Co., as an anticipation of the above invention, was granted to W. C. Arsem, of Schenectady, U.S.A., and was assigned by him to the British Thomson-Houston Co. The complete specification describes the process as follows:—

This process is applicable in the treatment of refractory metals such as tungsten, thorium, and molybdenum. The powdered refractory metal is mixed with a less refractory metal, and the mixture is heated to such a temperature that the less refractory metal fuses. An alloy is thereby formed, even though the temperature of fusion is very much lower than the melting point of the more refractory component. Alloys so produced are in some instances ductile, and can be rolled and worked into filaments. The more volatile metal may then be driven off by heat or may be otherwise removed. Although the invention is described in the following with regard to molybdenum, it is applicable to tungsten and other metals. Powdered molybdenum is mixed with an equal part of a ductile metal, such as copper, and the mixture is compressed into a solid lump. This lump is then heated to such a temperature that the ductile metal fuses. The alloy formed is then rolled, or drawn through a die, to produce wires of the proper cross section for lamp filaments, and these are heated in a vacuum or in an inert atmosphere to drive out the copper or other foreign metal. The molybdenum is not left porous by the vaporisation of the copper, but seems to solidify into a dense product. To effect the vaporisation of the copper, a current may be passed through the filaments or they may be heated in a furnace. The temperature of this treatment is somewhat above the vaporising point of copper. The ductile metal serves as a means to draw together the fine particles of the molybdenum or other powder, and subsequently passes off as vapour and leaves these particles cemented together into a strong homogeneous malleable product.

There are four claims to this specification:—

1. The process of manufacturing an electric conductor of refractory metal which consists in mixing the metal with less refractory metal, heating the mixture to fuse the less refractory metal and then treating the mixture to remove the less refractory metal and leave a coherent body of refractory metal.

2. The process of manufacturing an electric conductor of refractory metal which consists in forming an alloy of the metal with a metal having a lower vaporising point, shaping the alloy into wires, or the like, and then heating the wires in a vacuum or inert atmosphere to remove the lower vaporising metal and leave a coherent conductor of refractory metal.

3. In the manufacture of electric conductors as hereinbefore claimed the employment of an alloy or compound of refractory metal and copper.

4. Incandescent electric lamp filaments or conductors of refractory metal manufactured substantially as hereinbefore described and claimed.

At the hearing before the Acting Comptroller, Mr. A. Cliff, both parties were represented by their patent agents; Mr. Bloxam appeared for the applicants, and Mr. J. Gray for the opponents. Declarations were filed by Dr. M. S. von Pirani on behalf of the applicants, and by Mr. H. H. Needham and Mr. Gray on behalf of the opponents. Mr. Gray asserted that the B.T.-H. Co.'s patent, No. 23,335 of 1906, was a master patent for "a process of forming electric conductors by incorporating tungsten with a less refractory and more readily vaporisable metal to form a ductile alloy or mixture which is then shaped into conductors and subsequently treated to remove the vaporisable metal and leave a coherent conductor of tungsten." Mr. Bloxam admitted that the process covered by the applicants' claims 1 and 2 differs from the B.T.-H. process only in the selection of nickel, and Mr. Cliff does not consider that this constitutes a sufficient difference to support a patent, as it was admittedly known at the date of the opponents' patent that nickel alloys with tungsten. Mr. Bloxam denied, however, that the B.T.-H. patent was a master patent requiring a specific reference, and in support of this referred to seven earlier patents; but Mr. Gray argued that none of these disclosed a process for producing a coherent body of pure tungsten as set forth in his declaration as to a master patent. On the second ground of opposition, it was argued that the known B.T.-H. process is not sufficiently covered by the existing disclaimers in the specification, and that the alleged invention as distinguished from that covered by the B.T.-H. patent is not fairly indicated by claims 1 and 2.

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After referring to the above arguments, Mr. Cliff, in his written decision, concluded that the insertion of a specific reference to the B.T.-H. Arsem patent is necessary, and that claims 1 and 2 must be deleted, as the process they claim is substantially the same as the B.T.-H. process. He suggested the additional amendment of the specification by deletion of the words "According to . . . is obviated" at the beginning, and an amendment to the remaining claim which would have made it read as follows:—"The manufacture of objects of tungsten or of an alloy of nickel and tungsten by the process described, wherein one or both of the metals to be combined is used in the form of a reducible compound in order to obtain by the reduction an intimate mixture of the constituents and to facilitate the sintering, substantially as described." This decision was dated October 15th, 1909. The applicants were, however, given the option of retaining claims 1 and 2 if they were restricted by the addition of the specific proportions of the materials described in the specification.

A supplementary decision, dated November 26th, 1909, states that this option has been exercised, and that the specification is to be amended as follows:—(1) The insertion of "*containing not less than* 60 *and not more than* 95 *per cent. of tungsten*" before "by uniting" in claim 1. (2) The insertion of "*of the process claimed in claim* 1" after "modification" in claim 2. (3) The insertion of "*or both*" after "one" in claim 3. The deletion of the paragraph referred to in the earlier decision and the insertion of the specific reference to the B.T.-H. Arsem patent are also required.

Notice of appeal to the Law Officer from these decisions of the Acting Comptroller-General was entered on December 17th, 1909, by the Siemens & Halske Akt.-Ges., but as there is a long list of cases to be heard before this one, it may be some months before the result will be known. The hearing will take place in the Law Officer's Room at the Law Courts, and will be private.

REVIEWS OF BOOKS

Proceedings of Thirty-second Convention (1909) of the National Electric Light Association. Three volumes. 9¼ in. by 6¼ in. (New York: The Association.)

THE proceedings of the Convention of the American National Electric Light Association, which was held at Atlantic City last June, have been issued complete in the form of three handsomely bound volumes. The reports of a number of committees appointed by the Association to investigate various subjects are included, and about 50 Papers, which were read, together with the discussions thereon. A useful feature is the provision of a collection of short abstracts of the Papers and reports, arranged alphabetically according to author, which forms a summary of the contents of the whole three volumes. For the sake of convenience, this is repeated in each volume, and is placed at the beginning. The subjects of the Papers are very diverse, and cover practically the whole range of the electric lighting industry, including not only engineering matters relating to supply and utilisation of electric current for illumination, but also details of the no less important business side of such undertakings. Electric supply for power purposes is also dealt with to a certain extent. The first volume contains reports, Papers, and discussion before the Association in general session, while the second volume forms the proceedings of the technical and commercial sections, and the last volume is devoted to the accounting and executive and public policy committees.

"Practical Engineer" Electrical Pocket Book and Diary, 1910. 566 pp. 5½ ins. by 3½ ins. (London and Manchester: Technical Publishing Co.) 1s.

THERE are evidences of a good deal of revision of this pocket book since the last edition, including some bringing up to date of the section on dynamo design, &c., which is again in the hands of Mr. C. C. Hawkins. Additions are to be found also in the following sections:—Storage batteries, motor-starters, the International candle, transformers, wiring systems, and lamps, though the last-mentioned is not as up-to-date as it might be. The obsolete Osmium lamp, for example, is spoken of as not yet in the commercial stage. The range of sizes of some metal filament lamps is also not quite complete.

The Practical Electrician's Pocket Book and Diary for 1910. 349 pp. 5 in. by 4 in. With illustrations (London: S. Rentell & Co., Ltd.) 1s.

IN revising this pocket book for the 1910 issue, Mr. H. T. Crewe, the editor, has found a certain amount of bringing up to date necessary, especially in the sections relating to gas, oil, and petrol engines, rope driving, polyphase machinery, metal filament lamps, time switches, &c., whilst additional matter treats of cheap wiring systems, auto-transformers, instructions to chargemen, and other subjects. In addition to over 300 pages of useful information a diary is included, as well as a collection of estimating forms for wiremen and others.

"Practical Engineer" Pocket Book and Diary, 1910. 670 pp. 5½ in. by 3½ in. (London and Manchester: Technical Publishing Co.) 1s.

A CERTAIN amount of new matter has been introduced into this year's edition of this pocket book, and additional information has been embodied in the revision of the older sections. The principal subjects which it has been found necessary to bring up-to-date are fuel testing, condensers, friction of air and water in pipes, alloys, pyrometry, suction-gas producers, emery grinding, &c. No attempt is made to exceed the limits of the real pocket book of reference, with the result that space has been found for an amount of really useful data, which compares very well with that in similar publications at a much higher price.

Who's Who, 1910. 2162 pp. **Who's Who Yearbook, 1910.** 162 pp. **Englishwoman's Yearbook, 1910.** 382 pp. **Writers' and Artists' Yearbook, 1910.** 127 pp. 7½ in. by 5 in. (London: A. & C. Black.) 10s., 1s., 3s. 6d., 1s.

MESSRS. BLACK'S Who's Who needs no commendation from us. The fact that it now reaches 2162 pages is sufficient evidence that a biographical notice is given to everybody who is anybody. The Who's Who Yearbook consists of the tables which were formerly such a popular feature in Who's Who itself, and they include many original tables not to be found elsewhere. The two books—the small one being a key to the larger one—seem to have made themselves indispensable in every section of life. The Englishwoman's Yearbook deals with all subjects specially appealing to ladies in matters of education, professions, philanthropy, sport, &c. The Writers' and Artists' Yearbook is a directory for writers, artists, and photographers, and should do much to solve the difficulty of knowing where to place articles, &c.

Hazell's Annual, 1910. 608 pp. 7½ in. by 5 in. (London: Hazell, Watson & Viney, Ltd.) 3s. 6d.

THE twenty-fifth edition of this annual contains a number of new features. In the first place, the contents of the volume have been rearranged in order to bring together articles upon closely related subjects. Another new feature is the introduction of signed articles upon some of the larger topics of the day, including one by Sir Oliver Lodge on the new physics. Brief reviews are also given relating to electrical supply, traction, motors, and omnibuses.

CORRESPONDENCE

THE T.A.C. TRAIN LIGHTING SYSTEM.

[TRANSLATION.]

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Being a subscriber to your journal, I have read in the issue of December 9th, 1909, a description under the title "The T.A.C. Train-lighting System" of a so-called new system of train lighting of the Tudor Accumulator Co., Ltd. (119 Victoria Street, S.W.). The system there described is in all its details without exception a rigorous copy (*copie servile*) of a system which I invented, patented, and worked in 1898, and has hitherto been described under my name in all publications dealing with the matter.

I may add that my system is worked in Russia by the Cie. Russe des Accumulateurs Tudor, with a single battery and iron-wire resistances. The English Tudor Company, in bringing out their servile copy of this arrangement, might at least have had the good taste not to describe as new a system which, as I am in a position to prove absolutely, is entirely my property.

I must ask you to be so good as to publish this letter in your next issue in the interests of the truth.

Yours, &c.,

C. VICARINO

(Director *Cie. Generale Electrique, Nancy.*)

Nancy, 29th Dec., 1909.

[We have sent a copy of this letter to the Tudor Accumulator Co., who will reply in our next issue.—ED. E. E.]

Royal Society of Arts—Among the lectures to be given this session are "The Japan-British Exhibition," by Count Hirokichi Mutsu, January 19th, and "An Improved Method of Electroplating," by A. Rosenberg, February 2nd.

Engineering and Machinery Exhibition, Manchester.—We have received some further particulars of the arrangements for the forthcoming Engineering and Machinery Exhibition at Manchester in October next, which is being organised by the proprietors of the *Engineering Review*. Space is to be charged for at rates from 3s. to 4s. per square foot, according to position, and exhibitors desiring electricity for power will be charged net rate fixed by the Manchester Corporation, which will not exceed 1½d. per unit. The voltage for 3 h.p. and over is 400. Electricity for this purpose is 200 volts, and will be charged at net rate, but the management will, if desired, supply exhibitors with 16-c.p. lamps at 10s. 6d. per lamp (including cost of electricity) for the period of the exhibition.

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THE CLAPHAM FIRE

CAUSED THROUGH BREAKAGE OF A LAMP

THE inquest upon the victims of the disastrous fire on December 20th, at the premises of Messrs. Arding & Hobbs, drapers, and general furnishers, Lavender Hill, London, was continued by the Coroner for the South-Western District (Mr. J. Troutbeck), on Thursday last, and was concluded on Tuesday. The number of persons who lost their lives has now been fixed at eight, including two bodies which are unrecognisable, and one which has not been discovered. The premises are at the junction of Lavender Hill and St. John's Road, and the fire involved the total destruction of a long row of shops in both thoroughfares, and also considerable damage to adjacent property.

The fact that the fire was said to have been caused by the electrical installation in one of the windows lent additional public interest to the inquest, which occupied three long sittings. The fire originated in a shop window, which was, until early in December, lighted by gas, but in connection with a scheme of decoration for Christmas, two gas pendants were removed and electric lighting installed instead. The work of carrying out this installation was entrusted to Messrs. Holmes & Cooper, 160 The Grove, Wandsworth, who had been employed by Messrs. Arding & Hobbs for some years. Verbal instructions were given to do the work in the best possible manner, no limitation as to price being made. The scheme of decoration and lighting decided upon for this particular window was to have two shelves joined together by a sloping board surmounted by a vertical board, nine inches high, the total height at the back of the window being 2 ft. 6 in. All these shelves and boards were covered with cotton-wool (as shown in the sketch, Fig. 1), and upon this

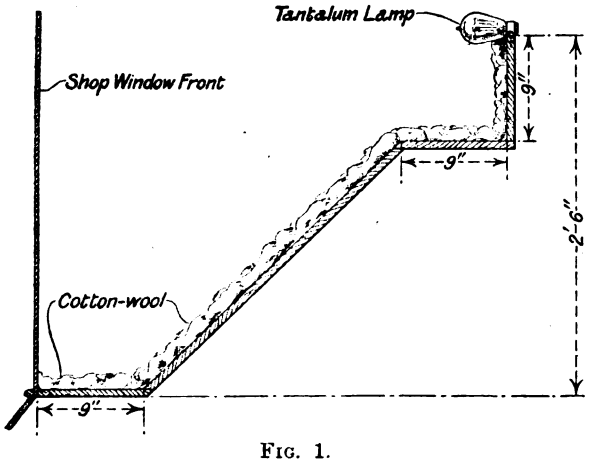


FIG. 1.

were displayed about 100 celluloid combs, a large number of tortoiseshell combs, jewellery, &c. On the top of the vertical nine-inch board were clamped lamp-holders, arranged so that the lamps would be at right angles to the board, and projecting over it into the window. Where the lamps projected the cotton-wool was cut away in a circle. There were in all 20 16-c.p. tantalum lamps, arranged two in series on a 240-volt circuit, the wiring being by means of 24/40 flexible. The length of the window was about 25 ft., so that the lamps must have been at about 1 ft. 3 in. centres. All the previous work carried out by this firm of contractors in the buildings had been in accordance with the Phœnix Fire Office rules, but on this occasion these had not been adhered to strictly, as one of their rules is that flexible cord conductors must not be used for shop-window lighting where there are inflammable goods, except in efficient flame-proof covering, and this was not done. It may also be mentioned that no notice was given to the electric supply authority, *i.e.*, the Battersea Borough Council, that these extra lights were being added, apparently through a misunderstanding on the part of the contractors, who were under the impression that one of the partners would do this, as he had done on a previous occasion. Connection was made with the existing meter, which was a 50-ampere meter, the load thereon being 34·3 amperes, and the increase, owing to new lights, being 9 amperes. There was no suggestion that, as far as the actual work of installation was concerned, this was not efficiently carried out.

These, then, were the circumstances on the day of the fire. About 4.30 p.m. an assistant went to this window and reached into it with the object of obtaining a necklace, when, according to his account—and also to the accounts of others in the vicinity—he heard an explosion or loud noise, and immediately the cotton-wool was on fire. He attempted to beat it out with his hands, but the celluloid combs also caught fire, and in a very few seconds the whole window was ablaze. Beyond these very indefinite statements no other information was available as to what actually happened. The assistant who reached into the window in the present case was positive that he did not break a lamp by coming into contact with it in leaning over the board upon which they were placed. The wiring contractor suggested that the assistant, when leaning over into the window, had knocked a lamp and broken it, or leaned on to it and pushed it downwards. The result would be a short circuit of the filament of the lamp, and the full voltage would be transferred to the other lamp with which it was in series. This might have the effect of blowing out the filament of the second lamp, and he believed it was possible for a lamp to break from such a cause. The Coroner pointed out that this would have meant two explosions or noises, but there was no evidence to this effect. So far as the present installation was concerned, witness had an idea of the nature of the goods which were to be placed in the window, and warned the firm not to place them near the lamps. He felt that the installation was quite safe, after it was completed. It was possible that the heat from the lamps might be sufficient to set celluloid combs alight. On the question of giving notice, witness admitted, in cross-examination, that it was usual for the contractor to notify the electric supply authority when new work was added to the mains.

In order to assist in elucidating the point as to the breaking of lamps, Mr. S. G. Castle Russell, electrical adviser to the Phœnix Assurance Co., was called on behalf of Messrs. Arding & Hobbs. It appears that, so far as the fire insurance goes, Messrs. Arding & Hobbs had permission to add temporary lighting for Christmas, and until 1908 Mr. Russell had, in his private capacity, inspected all such additions. Last Christmas, however, Mr. Russell was not called in, forgetfulness being given as the reason. Mr. Russell stated that previous work in the buildings had been carried out in a perfectly satisfactory manner, the wires being run in screwed steel barrel, and all apparatus enclosed in cast-iron cases. No expense was spared to ensure security from fire. With regard to the cause of the fire in the present instance, Mr. Russell said that in his opinion it was very probably caused by the breaking of an electric lamp. It was quite possible for a globe to break due to atmospheric pressure. Another cause was that the filament would sag to such an extent as to touch the globe, and then it would in all probability break. On the question of

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a broken filament setting fire to cotton-wool, he had made some experiments since the previous sitting with tantalum lamps, although the voltage was not quite the same as at Battersea. The tests were made at the General Electric Co.'s offices in Queen Victoria Street. In the first experiment, a tantalum lamp was suspended over dried cotton-wool at a distance of about three inches, and the globe broken with a hammer. The broken filament instantly set fire to the cotton-wool. No cut-outs or fuses went. In a second experiment the cotton-wool had not been dried, and was in the state in which it would be purchased. In this case, the cotton-wool did not catch fire, but it was very badly burned. The fuses on this occasion went. In a third experiment, a tantalum lamp was again suspended over cotton-wool at a distance of three inches. The cotton-wool was thinned out, and underneath the lamp was placed a celluloid telephone mouthpiece. On breaking the lamp, both the wool and the celluloid immediately caught fire.

In answer to questions by the Coroner, Mr. Russell said the danger of broken incandescent electric lamps was well known. They were forbidden in mines except in strong glass cases, and were also forbidden in gunpowder factories. He did not think that working engineers or wiring contractors gave sufficient thought to such questions. In cases of temporary wiring, such as this, he agreed that a consulting engineer should be called in. He was afraid that similar installations under similar circumstances were put in all over London. He regarded them as so dangerous as to recommend his company not to accept the insurance risk, and this had frequently been done. He understood that in the present case no lamps were nearer to the cotton-wool than nine inches, but his experiments were dangerous up to four inches, and undoubtedly the danger would be there at nine inches.

On this point we would refer our readers to the sketch Fig. 2. We have shown the lamps at 1 ft. 3 in. centres.

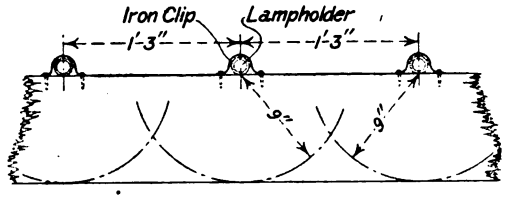


FIG. 2.

The upright board on which they were placed (see Fig. 1) was 9 in. high, and it was stated that the cotton-wool covered this, and was brought up to the top except for a space of 9 ins. around each lamp, where it was cut away. From Fig. 2. in which 9-in. circles are struck from each lamp, it is seen that there is a discrepancy in this, and that as the cotton-wool was brought to the top of the board between the lamps, it must have been considerably nearer to them than nine inches. One or two facts in regard to the occurrence may be of interest. It appears that the walls and ceilings of the buildings were made of match-boarding, and this, no doubt, accounted for the rapidity with which the flames spread, in conjunction with a strong wind blowing into the windows. It is also a fact that although the electricity was cut off at the main switch, the gas supply was not cut off.

In the course of his summing up, the Coroner said that undoubtedly electric light had great advantages compared with other illuminants, but no one would deny that there were fire risks in connection with it. It did not seem that the actual installation work was at fault, although it was surprising that no notice was given to the supply authority. The work also ought to have been supervised by a consulting engineer. He could not see that any blame was to be attached to Messrs. Arding & Hobbs for having used the lamps under such circumstances, but anyone doing so, in spite of the knowledge which had been gained as a result of that inquest, would involve themselves in very grave legal responsibilities.

The jury returned a verdict to the effect that the fire was due to the breaking of an electric lamp in one of the windows, and that the deaths of the eight victims were caused thereby. They regarded such window dressing as extremely dangerous.

After the circumstances of a disaster such as this have been fully investigated, it is our duty to consider whether they point to any modification in existing practice being necessary. We are, of course, not concerned with the question of fire drill and the effective arrangement of the fire appliances, but only with the actual cause of the fire, and the precautions that should be taken to render a repetition of the circumstances impossible. It is undeniable that of late the great safety and convenience of electric light have led to growing carelessness with regard to the surroundings of the lamps. No sane person would place highly inflammable materials, such as cotton wool and celluloid, in large quantities close to any other form of lamp. Yet the electric lamps employed in lighting the shop window in question were placed only nine inches above these materials, which had naturally become so thoroughly dried by the heat within the enclosed window that the merest spark or a single speck of glowing metal would have been sufficient to ignite them. We hesitate to accept the theory that a lamp broke of its own accord; but there is always a possibility of a lamp being smashed, and, in any case, the public should remember that even electric lamps are hot, and that the filaments within them retain their high temperature momentarily after the glass is broken. Neither in the illumination of shop windows nor in the lighting of ordinary rooms should inflammable materials be placed within a few inches of electric lamps, nor in such positions that they can come in contact with them. In fact, no other departure from present methods is needed than the exercise of ordinary common sense in the disposition of the lamps and their surroundings.

NEW PORTABLE SUCTION CLEANER

AN interesting development in electrical domestic apparatus is the "Arnold" portable suction cleaner, which is being placed on the market by Messrs. Drake & Gorham, Ltd. (66 Victoria Street, Westminster, London, S.W.). Contrary to some patterns of so-called "vacuum cleaners," this device is entirely self-contained. It comprises a small centrifugal blower, to the inlet of which is attached the fan-shaped mouth or suction nozzle. The blower is driven by a small high-speed motor. Nozzle, blower, and motor are built up together in a compact form, and are attached to the end of a pole, the whole having the appearance of an awkward-looking broom. Fitted over the exhaust pipe of the blower is the neck of a large cloth bag, the opposite end of which is attached to the pole. The dust is drawn up with the air by the blower, and the bag, which is always distended, allows the air to be blown through it, but acts as a filter and retains the dust, which can be removed afterwards. There is a ball-and-socket joint between the pole and the device proper, so that the cleaner can be adjusted to the convenience of the operator. A braided cable connects the motor to the wall-plug, and there is a switch on the motor case. The apparatus can be obtained with motors for any pressures from 100 to 250 volts, and the 200-volt pattern takes only 0·5 amp., or 100 watts. Thus, with a power rate of 2d. per unit, the cost of working would be only ½d. per hour, and only ¼d. per hour if run off the lighting circuit with a rate of 5d. per unit.

Telephone-Letters in London on Sunday.—Arrangements have been made whereby, in the absence of a Sunday delivery of letters in London, a combination of postal and telephone services will be inaugurated on Sunday next. This will enable country residents to post to London on Saturday afternoon letters the contents of which will be delivered by telephone on Sunday morning. In addition to the ordinary postage on the latter, a fee of 3d. per message of thirty words, and 3d. for each additional thirty words, has to be paid.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

[*Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."*]

CONTINUOUS CURRENT MOTORS.—No. E.E. 3 of the Phœnix Bulletin, issued by the Phœnix Dynamo Manufacturing Co., Ltd. (Thornbury Works, Bradford), contains very complete particulars of the company's series of continuous current motors. Not only is there a full description with excellent illustrations showing the detailed construction of the machines, but there is a good deal of information which, together with the views of motors applied to the driving of very diverse classes of machinery, will be found of use to those drawing up schemes for electric driving of works, &c. Particular attention should be drawn to the completeness of the lists of variable speed motors. A variation of as much as 6 to 1 (or in special cases even more) is obtainable by shunt regulation alone in consequence of the perfection of design of the auxiliary poles, in the application of which the company were pioneers. The company will be glad to send a copy of this issue of their bulletin to anyone interested.

METAL FILAMENT LAMPS AND FITTINGS.—A new catalogue from the Armorduct Manufacturing Co. gives particulars of a long range of sizes of "Gral" metal filament lamps for high and low voltages, together with accessories and fittings, including auto-transformers, series adapters, shock absorbers, cluster fittings, interior and exterior shop lighting, and other fittings of great variety and holophane, and other reflectors, globes, &c. Several new fittings are illustrated which make their appearance for the first time.

LINE MATERIAL.—A comprehensive new catalogue from British Insulated & Helsby Cables, Ltd., gives particulars of a great variety of poles, fittings, and tools for the erection of overhead telegraph and telephone lines. Both wood and iron poles are included, with suitable arms, brackets, supports, and other fittings, and a great deal of useful information regarding their use is given. The tool section is also very complete, and the utility of the list is enhanced by an alphabetical index.

ELECTRICITY SUPPLY.—A booklet entitled "The Electricity Consumer's Guide" is being issued by the Grimsby Corporation Electricity Department, with the object of providing would-be consumers with information of assistance in wiring and fitting up their premises for electric lighting and heating. The hints given are of a thoroughly practical nature, and the section on the choice of lamps is particularly useful.

THE I.C.S. STUDENT.—The January number of the Magazine of International Correspondence Schools, Ltd., contains, besides news of the doings of those connected with the Schools in various parts of the world, several articles of engineering interest, including a description of the new King's Dock, Swansea.

ARC LAMPS.—An illustrated leaflet is to hand from the Foster Arc Lamp & Engineering Co., Ltd. (Warple Road, Wimbledon, London, S.W.), giving particulars and prices of the "Q" type flame arc lamp. This lamp is fully described on another page of this issue.

ELECTRICITY IN LAUNDRY WORK.—The South Park Laundry (South Park Road, Wimbledon) have sent us postcards illustrating their stand at the Wimbledon Electrical Exhibiton of November last. Girls are shown manipulating electrically-heated flat irons of Messrs. Eastman & Warne's make, and an electric heater for goffering irons can also be seen.

ALLGEMEINE ELEKTRICITATS-GES.—A pamphlet is to hand from the Allgemeine Elektricitäts-Ges., of Berlin, containing a reprint (in German) of an article by Conrad Matschoss giving the history of the development of that company during the first twenty-five years of its existence.

AUTO-TRANSFORMERS.—A leaflet from the M. & C. Manufacturing Co. (Conduit Place, Paddington, W.) gives prices and particulars of auto-transformers for use with low-voltage metal filament lamps.

H.-T. SWITCHGEAR.—A folder from the British Thomson-Houston Co. illustrates and gives prices of oil switches and oil-switch panels for colliery and other work, either with slate panels or with the whole structure of iron plate.

TUBULAR FUSES.—The latest leaflet from Messrs. A. Reyrolle & Co. (Hebburn-on-Tyne) gives full particulars of the company's well-known tubular low-tension fuses, with a new list of code words and accurate drilling dimensions.

CALENDARS, &c.—An ingenious date-card, with the last two figures of 1910 in red, is being sent out by the Morgan Reeve Co. (12 Newgate Street, E.C.), who are well known in connection with advertising schemes. The card, which will be supplied to anyone on application, will be of special use during the first few weeks of the new year, as a reminder in dating letters, &c.

The same firm also issue a telephone card and a large sheet calendar for 1910, with particularly distinct figures. The company will be pleased to supply copies to firms who have not already received them on application.

A neat pocket calendar, diary, and engagement book accompanies the season's compliments from Messrs. Johnson & Phillips, Ltd., Victoria Works, Charlton, Kent.

The D.P. Battery Co.'s calendar is always attractive, and this year is decorated with a coloured view of Lumford Pack Horse Bridge, built in the fifteenth century, with the D.P. works (Bakewell, Derbyshire) in the background.

Messrs. S. Davis & Co. are issuing, at the price of half-a-crown, a bulky electrical engineer's diary, interleaved with blotting paper bearing advertisements of electrical plant and apparatus, and containing a quantity of useful information and tables relating to electric light and power, list of supply authorities, and tables showing in which London streets the different companies and borough councils have mains.

We have received a set of refill cards for their calendar of last year from Messrs. Venner & Co. (6 Old Queen Street, Westminster, S.W.). The company will be glad to send these to any possessor of last year's calendar who has not received them.

The pocket-book and diary issued by the British Electrical Trade Supply & Bitumen Co. is handsomely got up, and contains a well-chosen series of unit tables and a well-arranged collection of useful information. The company inform us that they will be very pleased to send copies of their pamphlet entitled "What is Bitumen?" (*see* ELECTRICAL ENGINEERING, December 9th, page 1044) to anyone who has not already received it.

WIRELESS TELEGRAPHY

Arrangements have been concluded by the Marconi Wireless Telegraph Co. for the equipment of the Donaldson Line steamers *Athenia, Cassandra,* and *Saturnia.*

At a conference of representatives of the Australian Admiralty, the Commonwealth, New Zealand, and Fiji, which recently met at Melbourne to consider the question of wireless telegraphy in the Pacific, the establishment of high-power stations at Sydney, Doubtless Bay (N.Z.), Suva, and Ocean Island, and medium-power stations in the New Hebrides and Solomon Island was recommended. All the stations will be under Government control.

The Electrical World of New York states that Representative Roberts, of Massachusetts, has introduced a resolution in the House at Washington providing for the creation of a Wireless Telegraph Board. The duties of the Board, according to the resolution, shall be "to prepare a comprehensive system of regulations to govern the operation of all wireless plants afloat and ashore which come under the cognisance of the United States, with due regard for Government and commercial interests." It is provided that within thirty days of the appointment of the Board a report, with recommendations, shall be submitted to Congress. The Board is to consist of seven members, consisting of "one expert each from the War, Navy, and Treasury Departments, three experts representing commercial wireless telegraph and wireless telephone interests, and one scientist well versed in the art of electric-wave telegraphy and telephony.

Railways and Tramways Competition.—In consequence of the competition of the electric tramways in North Greenwich, Poplar, Canning Town, and Cheshunt, the Great Eastern Railway Co. have decided to make further reductions in their fares.

Fire at an Underground Sub-station in Shoreditch.—On December 30th last a fire broke out in an underground sub-station in Clifton Street, Finsbury, belonging to the Shoreditch Borough Council. The sub-station contains some motor-generators, but these were not damaged. It appears that the cables in a trench under the floor caught fire, but the origin of the outbreak is unknown. The damage was confined to the cables, and fortunately the fire occurred in the morning, so that there was ample time to repair the damage before the night load came on. We understand that everything was in working order six hours after the outbreak, and that the supply was only slightly disturbed.

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a broken filament setting fire to cotton-wool, he had made some experiments since the previous sitting with tantalum lamps, although the voltage was not quite the same as at Battersea. The tests were made at the General Electric Co.'s offices in Queen Victoria Street. In the first experiment, a tantalum lamp was suspended over dried cotton-wool at a distance of about three inches, and the globe broken with a hammer. The broken filament instantly set fire to the cotton-wool. No cut-outs or fuses went. In a second experiment the cotton-wool had not been dried, and was in the state in which it would be purchased. In this case, the cotton-wool did not catch fire, but it was very badly burned. The fuses on this occasion went. In a third experiment, a tantalum lamp was again suspended over cotton-wool at a distance of three inches. The cotton-wool was thinned out, and underneath the lamp was placed a celluloid telephone mouthpiece. On breaking the lamp, both the wool and the celluloid immediately caught fire.

In answer to questions by the Coroner, Mr. Russell said the danger of broken incandescent electric lamps was well known. They were forbidden in mines except in strong glass cases, and were also forbidden in gunpowder factories. He did not think that working engineers or wiring contractors gave sufficient thought to such questions. In cases of temporary wiring, such as this, he agreed that a consulting engineer should be called in. He was afraid that similar installations under similar circumstances were put in all over London. He regarded them as so dangerous as to recommend his company not to accept the insurance risk, and this had frequently been done. He understood that in the present case no lamps were nearer to the cotton-wool than nine inches, but his experiments were dangerous up to four inches, and undoubtedly the danger would be there at nine inches.

On this point we would refer our readers to the sketch Fig. 2. We have shown the lamps at 1 ft. 3 in. centres.

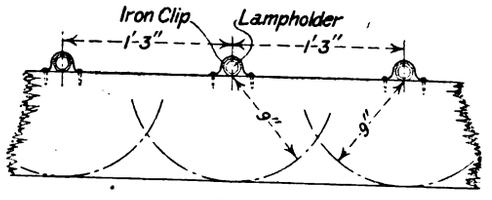


FIG. 2.

The upright board on which they were placed (see Fig. 1) was 9 in. high, and it was stated that the cotton-wool covered this, and was brought up to the top except for a space of 9 ins. around each lamp, where it was cut away. From Fig. 2. in which 9-in. circles are struck from each lamp, it is seen that there is a discrepancy in this, and that as the cotton-wool was brought to the top of the board between the lamps, it must have been considerably nearer to them than nine inches. One or two facts in regard to the occurrence may be of interest. It appears that the walls and ceilings of the buildings were made of match-boarding, and this, no doubt, accounted for the rapidity with which the flames spread, in conjunction with a strong wind blowing into the windows. It is also a fact that although the electricity was cut off at the main switch, the gas supply was not cut off.

In the course of his summing up, the Coroner said that undoubtedly electric light had great advantages compared with other illuminants, but no one would deny that there were fire risks in connection with it. It did not seem that the actual installation work was at fault, although it was surprising that no notice was given to the supply authority. The work also ought to have been supervised by a consulting engineer. He could not see that any blame was to be attached to Messrs. Arding & Hobbs for having used the lamps under such circumstances, but anyone doing so, in spite of the knowledge which had been gained as a result of that inquest, would involve themselves in very grave legal responsibilities.

The jury returned a verdict to the effect that the fire was due to the breaking of an electric lamp in one of the windows, and that the deaths of the eight victims were caused thereby. They regarded such window dressing as extremely dangerous.

After the circumstances of a disaster such as this have been fully investigated, it is our duty to consider whether they point to any modification in existing practice being necessary. We are, of course, not concerned with the question of fire drill and the effective arrangement of the fire appliances, but only with the actual cause of the fire, and the precautions that should be taken to render a repetition of the circumstances impossible. It is undeniable that of late the great safety and convenience of electric light have led to growing carelessness with regard to the surroundings of the lamps. No sane person would place highly inflammable materials, such as cotton wool and celluloid, in large quantities close to any other form of lamp. Yet the electric lamps employed in lighting the shop window in question were placed only nine inches above these materials, which had naturally become so thoroughly dried by the heat within the enclosed window that the merest spark or a single speck of glowing metal would have been sufficient to ignite them. We hesitate to accept the theory that a lamp broke of its own accord; but there is always a possibility of a lamp being smashed, and, in any case, the public should remember that even electric lamps are hot, and that the filaments within them retain their high temperature momentarily after the glass is broken. Neither in the illumination of shop windows nor in the lighting of ordinary rooms should inflammable materials be placed within a few inches of electric lamps, nor in such positions that they can come in contact with them. In fact, no other departure from present methods is needed than the exercise of ordinary common sense in the disposition of the lamps and their surroundings.

NEW PORTABLE SUCTION CLEANER

AN interesting development in electrical domestic apparatus is the "Arnold" portable suction cleaner, which is being placed on the market by Messrs. Drake & Gorham, Ltd. (66 Victoria Street, Westminster, London, S.W.). Contrary to some patterns of so-called "vacuum cleaners," this device is entirely self-contained. It comprises a small centrifugal blower, to the inlet of which is attached the fan-shaped mouth or suction nozzle. The blower is driven by a small high-speed motor. Nozzle, blower, and motor are built up together in a compact form, and are attached to the end of a pole, the whole having the appearance of an awkward-looking broom. Fitted over the exhaust pipe of the blower is the neck of a large cloth bag, the opposite end of which is attached to the pole. The dust is drawn up with the air by the blower, and the bag, which is always distended, allows the air to be blown through it, but acts as a filter and retains the dust, which can be removed afterwards. There is a ball-and-socket joint between the pole and the device proper, so that the cleaner can be adjusted to the convenience of the operator. A braided cable connects the motor to the wall-plug, and there is a switch on the motor case. The apparatus can be obtained with motors for any pressures from 100 to 250 volts, and the 200-volt pattern takes only 0·5 amp., or 100 watts. Thus, with a power rate of 2d. per unit, the cost of working would be only ½d. per hour, and only ¼d. per hour if run off the lighting circuit with a rate of 5d. per unit.

Telephone-Letters in London on Sunday.—Arrangements have been made whereby, in the absence of a Sunday delivery of letters in London, a combination of postal and telephone services will be inaugurated on Sunday next. This will enable country residents to post to London on Saturday afternoon letters the contents of which will be delivered by telephone on Sunday morning. In addition to the ordinary postage on the latter, a fee of 3d. per message of thirty words, and 3d. for each additional thirty words, has to be paid.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

[*Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."*]

CONTINUOUS CURRENT MOTORS.—No. E.E. 3 of the Phœnix Bulletin, issued by the Phœnix Dynamo Manufacturing Co., Ltd. (Thornbury Works, Bradford), contains very complete particulars of the company's series of continuous current motors. Not only is there a full description with excellent illustrations showing the detailed construction of the machines, but there is a good deal of information which, together with the views of motors applied to the driving of very diverse classes of machinery, will be found of use to those drawing up schemes for electric driving of works, &c. Particular attention should be drawn to the completeness of the lists of variable speed motors. A variation of as much as 6 to 1 (or in special cases even more) is obtainable by shunt regulation alone in consequence of the perfection of design of the auxiliary poles, in the application of which the company were pioneers. The company will be glad to send a copy of this issue of their bulletin to anyone interested.

METAL FILAMENT LAMPS AND FITTINGS.—A new catalogue from the Armorduct Manufacturing Co. gives particulars of a long range of sizes of "Gral" metal filament lamps for high and low voltages, together with accessories and fittings, including auto-transformers, series adapters, shock absorbers, cluster fittings, interior and exterior shop lighting, and other fittings of great variety and holophane, and other reflectors, globes, &c. Several new fittings are illustrated which make their appearance for the first time.

LINE MATERIAL.—A comprehensive new catalogue from British Insulated & Helsby Cables, Ltd., gives particulars of a great variety of poles, fittings, and tools for the erection of overhead telegraph and telephone lines. Both wood and iron poles are included, with suitable arms, brackets, supports, and other fittings, and a great deal of useful information regarding their use is given. The tool section is also very complete, and the utility of the list is enhanced by an alphabetical index.

ELECTRICITY SUPPLY.—A booklet entitled "The Electricity Consumer's Guide" is being issued by the Grimsby Corporation Electricity Department, with the object of providing would-be consumers with information of assistance in wiring and fitting up their premises for electric lighting and heating. The hints given are of a thoroughly practical nature, and the section on the choice of lamps is particularly useful.

THE I.C.S. STUDENT.—The January number of the Magazine of International Correspondence Schools, Ltd., contains, besides news of the doings of those connected with the Schools in various parts of the world, several articles of engineering interest, including a description of the new King's Dock, Swansea.

ARC LAMPS.—An illustrated leaflet is to hand from the Foster Arc Lamp & Engineering Co., Ltd. (Warple Road, Wimbledon, London, S.W.), giving particulars and prices of the "Q" type flame arc lamp. This lamp is fully described on another page of this issue.

ELECTRICITY IN LAUNDRY WORK. The South Park Laundry (South Park Road, Wimbledon) have sent us postcards illustrating their stand at the Wimbledon Electrical Exhibiton of November last. Girls are shown manipulating electrically-heated flat irons of Messrs. Eastman & Warne's make, and an electric heater for goffering irons can also be seen.

ALLGEMEINE ELEKTRICITATS-GES. A pamphlet is to hand from the Allgemeine Elektricitats Ges., of Berlin, containing a reprint (in German) of an article by Conrad Matschoss giving the history of the development of that company during the first twenty-five years of its existence.

AUTO-TRANSFORMERS. A leaflet from the M. & C. Manufacturing Co. (Conduit Place, Paddington, W.) gives prices and particulars of auto-transformers for use with low-voltage metal filament lamps.

H.-T. SWITCHGEAR.—A folder from the British Thomson-Houston Co. illustrates and gives prices of oil switches and oil-switch panels for colliery and other work, either with slate panels or with the whole structure of iron plate.

TUBULAR FUSES.—The latest leaflet from Messrs. A. Reyrolle & Co. (Hebburn-on-Tyne) gives full particulars of the company's well-known tubular low-tension fuses, with a new list of code words and accurate drilling dimensions.

CALENDARS, &c.—An ingenious date-card, with the last two figures of 1910 in red, is being sent out by the Morgan Reeve Co. (12 Newgate Street, E.C.), who are well known in connection with advertising schemes. The card, which will be supplied to anyone on application, will be of special use during the first few weeks of the new year, as a reminder in dating letters, &c.

The same firm also issue a telephone card and a large sheet calendar for 1910, with particularly distinct figures. The company will be pleased to supply copies to firms who have not already received them on application.

A neat pocket calendar, diary, and engagement book accompanies the season's compliments from Messrs. Johnson & Phillips, Ltd., Victoria Works, Charlton, Kent.

The D.P. Battery Co.'s calendar is always attractive, and this year is decorated with a coloured view of Lumford Pack Horse Bridge, built in the fifteenth century, with the D.P. works (Bakewell, Derbyshire) in the background.

Messrs. S. Davis & Co. are issuing, at the price of half-a-crown, a bulky electrical engineer's diary, interleaved with blotting paper bearing advertisements of electrical plant and apparatus, and containing a quantity of useful information and tables relating to electric light and power, list of supply authorities, and tables showing in which London streets the different companies and borough councils have mains.

We have received a set of refill cards for their calendar of last year from Messrs. Venner & Co. (6 Old Queen Street, Westminster, S.W.). The company will be glad to send these to any possessor of last year's calendar who has not received them.

The pocket-book and diary issued by the British Electrical Trade Supply & Bitumen Co. is handsomely got up, and contains a well-chosen series of unit tables and a well-arranged collection of useful information. The company inform us that they will be very pleased to send copies of their pamphlet entitled "What is Bitumen?" (*see* ELECTRICAL ENGINEERING, December 9th, page 1044) to anyone who has not already received it.

WIRELESS TELEGRAPHY

Arrangements have been concluded by the Marconi Wireless Telegraph Co. for the equipment of the Donaldson Line steamers *Athenia, Cassandra,* and *Saturnia.*

At a conference of representatives of the Australian Admiralty, the Commonwealth, New Zealand, and Fiji, which recently met at Melbourne to consider the question of wireless telegraphy in the Pacific, the establishment of high-power stations at Sydney, Doubtless Bay (N.Z.), Suva, and Ocean Island, and medium-power stations in the New Hebrides and Solomon Island was recommended. All the stations will be under Government control.

The Electrical World of New York states that Representative Roberts, of Massachusetts, has introduced a resolution in the House at Washington providing for the creation of a Wireless Telegraph Board. The duties of the Board, according to the resolution, shall be "to prepare a comprehensive system of regulations to govern the operation of all wireless plants afloat and ashore which come under the cognisance of the United States, with due regard for Government and commercial interests." It is provided that within thirty days of the appointment of the Board a report, with recommendations, shall be submitted to Congress. The Board is to consist of seven members, consisting of "one expert each from the War, Navy, and Treasury Departments, three experts representing commercial wireless telegraph and wireless telephone interests, and one scientist well versed in the art of electric-wave telegraphy and telephony.

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LOCAL NOTES

ABERDEEN: *Supply to Tramways Co.*—The Electricity Committee have once again discussed the situation arising out of the refusal of the Aberdeen Suburban District Tramways Co. to accept the award of Mr. W. H. Patchell regarding the price which they shall pay the Corporation for electrical energy. It was stated that counsel's opinion had been received as to the ways in which the award might be enforced, and it has been decided to remit the whole matter to the Town Council.

BARTON-UPON-IRWELL: *Electric Lighting Order Revoked.*—The Board of Trade have revoked the Electric Lighting Provisional Order granted to the Council in 1906.

BECKENHAM: *Mechanical Stokers.*—Messrs. Kincaid, Manville & Dawson, consulting engineers to the Council, have written stating that the two mechanical stokers recently installed have satisfactorily passed the prescribed tests, and recommend authority being given to fit a mechanical stoker to an additional boiler.

BRADFORD: *Removal of Electricity Department Offices.*—The offices of the Corporation Electricity Department have been removed from temporary premises at Whitaker Buildings, Victoria Square, to the newly completed extensions at the Town Hall. A small showroom has been fitted up adjacent to the inquiry office, and two installations of the Moore vacuum tube light—one yellow, for general office lighting, and another white, to demonstrate colour matching—are to be erected.

DUBLIN: *Proposed Increase in the Electricity Charges.*—A report has been prepared by the Electric Lighting Committee setting out the position of the electrical undertaking. It is pointed out that metal filament lamps have resulted in a saving to consumers of at least £15,000 during the past year, and, in view of the fact that the undertaking is being worked at a loss, the Committee think it not unreasonable that they should receive some benefit from the new lamp. They accordingly recommend that the rate for lighting purposes should be increased by 10 per cent. In a letter from the City Treasurer, which is appended to the report, it is stated that the bank overdraft now amounts to over £43,000, and that no provision is being made for renewals or depreciation. The City Treasurer states that if the Committee cannot induce the Council to approve of the readjustment of the lighting charges, he will be forced, for his own safety, to refuse to allow the Committee to avail themselves of existing credit balances of other accounts as a means of carrying on the undertaking. At the meeting of the Corporation on Monday, it was decided to increase the electric lighting charges by 10 per cent. as proposed, for one year.

GRANGEMOUTH: *Electric Lighting.*—Negotiations have been taking place between the Council and the Scottish Central Electric Power Co. for the company to take over the Council's Electric Lighting Order. The agreement between the parties is now practically completed.

INDIA: *Bombay: Tramway Fares.*—The Bombay Electric Supply and Tramways Co. have placed certain proposals before the Corporation with regard to a revision of the existing tramway fares. They state that there is nothing in the conditions governing the working expenses of tramways in Bombay to justify the existing unreasonably low fares. At present the average fare is one anna per passenger, a return which they claim is not commensurate either with the cost of operation or with the character of the company's service. They now ask for sanction to increase some of the long-distance fares.

Madras: Condition of the Tramway Track.—In consequence of complaints received as to the condition of the permanent way and rolling stock of the Madras Electric Tramways Co., the Madras Government have requested the Madras Corporation to instruct its Engineer to make periodical inspections.

LEYLAND: *Electric Lighting Order Revoked.*—The Board of Trade have revoked the Electric Lighting Provisional Order granted to the Council in 1902.

LIVERPOOL: *Electric Supply Charges.*—Mr. A. B. Holmes, the Corporation's consulting electrical engineer, has prepared a report upon the charges for electric lighting and power. With regard to the present maximum charge of 3½d. per unit for lighting to the ordinary consumer, and the minimum charge of 1½d. per unit for lighting, and ½d. per unit for power to exceptionally large consumers, Mr. Holmes does not consider these unreasonable, and is unable to recommend any alterations. He calls attention, however, to the system of charging a fixed sum per annum on the rateable value of houses in use at Norwich, and recommends a trial of this system for twelve months for houses of a rateable value of not less than £20. He recommends a fixed quarterly charge of 3 per cent. on the rateable value of the house, plus 1d. per unit for all energy consumed.

LONDON: *Camberwell: Tube Railway to the Crystal Palace.*—The Upper Norwood Ratepayers' Association have forwarded a resolution to the Council approving of the proposed tube railway to the Crystal Palace. It may be remembered that the Syndicate promoting this undertaking decided a short time ago not to proceed with it until the result of the General Election was known. No Bill has been deposited for the next session of Parliament.

Shoreditch.—The Electricity Department have reduced the charge for electricity used for lighting arc lamps and signs outside shops, &c., to a flat rate of 2½d. per unit from the December meter readings. A meter rate of 1s. per quarter will also be charged.

MORECAMBE: *Electricity Supply.*—A recommendation to supply a local firm named Messrs. T. W. Ward, Ltd., with electricity at 1½d. per unit, the firm guaranteeing to use 1,000 units per week, has been rejected by the Council by fourteen votes to seven, on the ground that an expenditure of £2,500 would be involved. The Consulting Engineer to the Council recommended the acceptance of the offer and the expenditure of the capital named on the ground that extensions will in any case be necessary in the near future.

OLDHAM: *Electricity Supply.*—The Royton District Council have agreed to grant the application of the Corporation to supply electricity in Royton upon the same terms as in Oldham on condition that all damage to roads in laying cables is made good. The question of shutting down Rhodes Bank generating station was discussed at the last meeting of the Corporation. It was suggested that the station should only be used for the peak load. It was also mentioned that an additional 5,000 kw. of plant could be installed at the Greenhill station without new buildings. No decision was come to.

ROTHERHAM: *New Power Station.*—The Corporation's new power station at Wincobank has been running experimentally during the past few weeks. With regard to the application of the Sheffield Corporation for an electric lighting provisional order for the parish of Tinsley, the Electricity Committee have been instructed to take any necessary steps to safeguard the interests of the Corporation in the matter.

UXBRIDGE: *Electric Supply.*—The official receiver-in-charge as liquidator of the Uxbridge & District Electric Supply Co., Ltd., is endeavouring to make arrangements for its being taken over as a going concern. At the present time the Metropolitan Electric Supply Co., Ltd., hold most of the debentures, and certain proposals are coming from them with a view to the property being released in favour of the debenture holders in satisfaction of the charge, and it is possible that they may offer some inducement, so that such will represent a dividend to the creditors. The Council has been informed of the position of affairs in case they should contemplate taking over the undertaking.

WORCESTER: "*Sales Engineer.*"—Mr. Shaw, the Borough Electrical Engineer, recommends the appointment of a "Sales Engineer," on the basis of salary and commission. A sub-committee is to prepare a statement of the duties of the proposed canvasser.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BELFAST.—The Tramways and Electricity Committee invite tenders for two water-tube boilers, superheaters, mechanical stokers, economisers, &c., and pipe work. Tenders to the Town Clerk by January 31st. (See an advertisement on another page.)

BIRMINGHAM.—The Tramways Committee invite tenders for stores, including electrical sundries and insulating materials. Particulars from the General Manager, and tenders by Feb. 1st.

CANADA.—An application has been made by the Burrard Power Co., Ltd., for powers to work a dam at the lower end of Lillooet River, British Columbia, and for the construction of an electric power station in connection therewith.

LAUNCESTON (TASMANIA).—Tenders are invited for the supply of about 1,100 tons of steel tramway rails and fastenings. Particulars from Messrs. John Barry & Co., 7 Great Winchester Street, London, to whom tenders by Feb. 11th.

LONDON: *Stepney.*—The Electricity Supply Committee require (*a*) boilers and accessories; (*b*) turbo-generator and accessories, converting plant, switchgear, &c. Particulars from the Borough Electrical Engineer, and tenders by January 24th. (See an advertisement on another page.)

Miscellaneous

AUSTRALIA.—It is stated that the Australian Postmaster-General's Department will shortly invite tenders for 2,356 knots of submarine cable at an estimated cost of £3,500.

BRADFORD.—The city electrical engineer will be glad to receive particulars of new apparatus for introduction to consumers.

BRAZIL.—The plans submitted by the Rio Janeiro Tramway,

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Light & Power Co. for the electrification of the Corcovado Railway have been approved.

CANADA.—It is stated that a scheme has been prepared for the construction of 3¾ miles of subway tramway, and 18 miles of surface tramway in Toronto. The estimated cost is about £1,000,000.

CHILE.—The Chile Telephone Co., Ltd., have obtained a concession to extend their Concepcion and Talcahuano telephone service to San Rosendo, Yumbel, Los Angeles, Santa Fe, Renaico, Angol, Mulchen, Sauces, Collipulli, Traiguen, and Victoria.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

BIRMINGHAM.—Business premises. E. Harper, Ruskin Chambers, Corporation Street, Birmingham.

BRIGHTON.—Day training college, Richmond Terrace (£7,000). Surveyors, T. Simpson & Son, 16 Ship Street, Brighton.

EXETER.—Church. Architect, A. J. Dunn, 1 Waterloo Street, Birmingham.

Additions to Blind Asylum and school (£2,000). Architect, J. Jerman, Bedford Circus, Exeter.

KING'S HEATH (Birmingham).—Church. Architect, H. Harper, Long Row, Nottingham.

LIVERPOOL.—Schools, Fladwys Street (£10,000). Architects, Sproat & Warwick, 25 Lord Street, Liverpool.

MACCLESFIELD.—Bakehouse at Workhouse (£1,300). Builders, Gorton & Wilson, Macclesfield.

MERTHYR TYDFIL.—Dormitories at Workhouse (£1,350). Architect, T. Roderick, Clifton Street, Aberdare.

NORTH BERWICK.—High school (£3,000). Architect, T. S. Robinson, North Berwick.

NORTHFLEET.—Fire station. Builders, W. Archer & Son, Northfleet.

NORTHAMPTON.—Proposed public elementary school, Victoria Park; also additions (£3,000) Town and County school. S. Beattie, Secretary, Northampton Education Committee.

READING.—Workhouse buildings. Architect, W. Howell, Blagrave Street, Reading.

RICHMOND-ON-THAMES.—Alterations at Holy Trinity School, Lower Mortlake Road; also alterations to County School for Boys. H. Sagar, Secretary, Richmond Education Committee.

STANLEY.—Council offices (£4,000). Architect, J. Wilson, 3 Coleshill Street, Sutton Coldfield.

TOTTENHAM.—Clothing factory. Architect, Clifford Tee, 50 Moorgate Street, E.C.

WOOD GREEN.—Public baths (£8,000). Architect, H. Burgess, 51 Dunloe Avenue, West Green.

TENDERS RECEIVED AND ACCEPTED

AUSTRALIA.—The Western Electric Co. have received a tender for the erection of a glow lamp magneto telephone switchboard at Edgecliffe, a suburb of Sydney.

BELFAST.—The following tenders have been accepted:—Messrs. Stewarts & Lloyds, Ltd., tramway poles; Messrs. George Webb & Co., brackets and scrolls; Messrs. W. Boydell & Sons, Ltd., bases, collars, and finials.

BRISTOL.—The tender of Messrs. Henley's Telegraph Works Co., Ltd., has been accepted for the supply of joint and junction boxes at £233.

CLECKHEATON.—An order has been placed with Messrs. Siemens Bros. & Co., Ltd., for cable.

ECCLES.—The Council have accepted the tender of the British Westinghouse Co., for the annual supply of electricity meters.

LONDON: *Woolwich.*—The Council received the following tenders for two miles of service cable: W. T. Henley's Telegraph Works Co., Ltd., £330; Siemens Bros. & Co., Ltd., £334; W. T. Glover & Co., Ltd., £335; British Insulated & Helsby Cables, Ltd., £341.

SALFORD.—The following tenders have been accepted by the Town Council:—J. Collier & Co. (Manchester), £65, for the installation of electric light and bells at Gardner Street Fire Station; General Electric Co., Ltd., 15 dozen 16-c.p. Robertson carbon filament lamps, 220 volts, 6s. 9d. per dozen: 5 dozen 50-c.p. Osram lamps, 220 volts, 2 dozen 50-c.p. ditto, 110 volts, and 1 dozen 50-c.p. ditto, 75 volts, 4s. 3d. each, less 20 per cent., and 10 per cent.; Smith, Major & Stevens, Ltd. (Salford), £85 15s., for supplying and fixing new single lift and motor, together with the necessary gearing, switches, and cable, at Pendleton Town Hall.

SOUTH AFRICA: *Johannesburg.*—The Council have accepted the tender of Messrs. Reunert & Lenz for a 3,000-kw. turbo-alternator, including condensing plant and exhaust pipes with foundations erected, complete with all necessary switchgear and cable connections, at £15,365.

The tender of the United States Steel Products Co. has been accepted for the supply of 3,900 flexible copper bonds at £223, and 1,500 solid copper bonds at £161. Delivery to be made in 18 weeks from receipt of order.

TODMORDEN.—An order has been placed with the British Westinghouse Co., Ltd., for a Leblanc condenser.

The BARROW-IN-FURNESS Council have placed an order with the D.P. Battery Co., Ltd., for the renewal of one of their storage batteries, and its maintenance for a term of ten years. The same firm's tender has also been accepted for the renewal of the batteries of the Urban Electric Supply Co., Ltd., at Dartmouth and Newton Abbot, and their maintenance for ten years.

The Skinningrove Iron & Steel Co., of Carlin How, have placed another order with Messrs. Ehrhardt & Sehmer for a further 1,650-h.p. gas engine to be direct-coupled to an electric generator. This is the third repeat order received from this company during the current year.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £63 to £63 10s. per ton (last week, £62 5s. to £62 15s.).

LIQUIDATIONS, BANKRUPTCIES, WINDINGS UP, &c.—The last day for receiving proofs in the bankruptcy of E. Goodman, electrical engineer, 30 Hertford Street, Coventry, is January 17th. Mr. C. J. Band, 8 High Street, Coventry, is Official Receiver.

A petition has been presented by Joseph Langley, of 51 Fairbank Street, St. Luke's, London, E.C., for the compulsory winding-up of the London Electrobus Co., Ltd. The petition will be heard before Mr. Justice Neville on Tuesday.

ANDERSTON FOUNDRY CO.'S LONDON OFFICE.—Owing to increased inquiries for the vertical, high-speed, multi-cylinder gas engines which the Anderston Foundry Co., Ltd., have recently put on the market, an office has been opened in London at Queen Anne's Chambers, Westminster. Mr. Frank Adcock, who has been associated with the development of this engine since its inception, is in charge of this office.

PROPOSED NEW WORKS.—The rapid development of the demand for the new lubricants "Oildag" and "Aquadag" has led to sending an expert from the parent works at Niagara Falls to England to confer with the British agents, Messrs. Crosier, Stephens & Co., Newcastle-on-Tyne, and make arrangements for the establishment of works in England.

CANADIAN AGENCIES WANTED.—A Manchester firm manufacturing electric light and power machinery, main switches, and switchboards, &c., desires to appoint a reliable Canadian agent.

A Toronto firm wishes to obtain agencies of United Kingdom manufacturers of electrical apparatus.

Further particulars of the above may be obtained from the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W.

BRAULIK ENGINEERING CO.—Owing to the large increase in the engineering department of the business of Mr. G. Braulik, 8 Lambeth Hill, London, he has decided to separate this from his ordinary supply business. He has commenced a new department under the name of the Braulik Engineering Co., 8 Lambeth Hill, London, which will be in charge of Mr. E. Eugene Brown. This department will deal with generating machinery, switchgear, instruments, cranes, lifts, telephone and telegraphic apparatus, &c.

FIRE AT EDISON & SWAN CO.'S PREMISES.—The Edison & Swan United Electric Light Co., Ltd., inform us that the fire which broke out in their premises in Queen Street, London, E.C., on Monday morning, was confined entirely to the test room and basement, and will in no way interfere with business.

AGENCY.—Messrs. Wallach Bros., Ltd. (Royal London House, Finsbury Square, E.C.), inform us that they have been appointed sole agents for the Turner Oil Filter Co., and request that all inquiries for these filters may be addressed to them.

Embezzlement.—At Bow Street, on Friday, Vincent Edward Moir was again charged with embezzling money belonging to the National Society of Telephone Employees. The society was formed in 1905 by telephone employees for the protection of their interests, and prisoner was appointed secretary. It is now alleged that the total defalcations in 1906 were £50, in 1907 £254, and in 1908 £200. The prisoner was again remanded.

University College, London.—In addition to the postgraduate course of lectures by Professor J. A. Fleming on "The Theory of the Propagation of Electric Currents in Telegraph and Telephone Cables and in Electric Conductors," already announced, two other postgraduate courses have been arranged, namely, "The Ideal Arch, Metal and Masonry, Theory and Design," by Professor Karl Pearson, beginning on January 21st, and "Steam Turbines," by Mr. W. J. Goudie and Mr. E. G. Izzard (of Messrs. Willans & Robinson, Ltd.), beginning on January 21st.

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NEW COMPANIES

ALUMINIUM CORPORATION, 34 Old Broad Street, London. Capital, £450,000, in 5,000 participating shares of 1s. each, and 149,750 preferred, and 300,000 ordinary shares of £1 each. To acquire the business of the Aluminium Corporation, Ltd., incorporated in 1907. The first directors are:—S. G. Bibby, Dashwood House, New Broad Street, E.C.; K. M. Clark, Sudbourne Hall, Orford, Suffolk; E. Manville, St. Stephen's House, Victoria Embankment, S.W.; W. C. Stennett, 116 Victoria Street, S.W.; and W. Williamson-Wylie, Vulcan Works, Johnstone, N.B.

SUTER'S PATENTS.—Registered by H. A. Scott, 53 Chancery Lane, London. Capital, £1,000. To carry on business of general electrical engineers. Subscribers: F. Suter, 16 Percy Street, London, electrical engineer; and J. W. Stephen, of the same address.

LUMINATOR WATER CO., registered by Messrs. Mayo, Elder & Co., 10 Drapers Gardens, London. Capital, £25,000. Electricians, engineers, &c.

BROUGHTON MACHINERY CO., 291 Bury New Road, Broughton. Capital, £1,000. To acquire the electrical and mechanical engineering business of M. E. Mercier at the above address.

ELECTRO SCRIP SIGN CO., 16 Holborn Viaduct, London. Capital, £1,000. To manufacture and deal in "Electro scrip" in the united Kingdom and the British Colonies.

BIRMINGHAM GUILD, 45 Great Charles Street, Birmingham. Capital, £12,500. To acquire the business now carried on as the Birmingham Guild of Handicraft, which includes the supply of electrical fittings, &c.

HILO IGNITION, LTD.—17 Fenchurch Street, London. Capital, £50,000. To acquire the "Hilo" system of ignition, and to carry on the manufacture of electrical appliances, &c.

COMPAGNIE GENERALE ELECTRIQUE DE LA CHAMPAGNE, LTD.—1 Broad Street Place, London. Capital, £80,000 in £4 shares. To distribute electric power in the Valley of Geippe, Rheims, and in Aisne, Ardennes, and Marne.

FIXED PRICE LIGHT CO.—Caxton House, Westminster, London. Capital, £10,0000 in £1 shares (100 deferred shares). Electricians and mechanical engineers and suppliers of electricity for all purposes. The subscribers are Mr. G. von Chauvin, 356 Caxton House, Westminster, London, S.W., telegraph engineer; Mr. W. Wheeler, 356 Caxton House, Westminster, S.W., accountant; Mr. J. S. Huddleston, 356 Caxton House, Westminster, S.W., electrical engineer. Mr. G. von Chauvin and Mr Huddleston are first directors.

PEEL-CONNER TELEPHONE WORKS, 31 Copthall Avenue, London, E.C.—Capital, £124,000 in 120,000 preference shares of £1 each, and 80,000 ordinary shares of 1s. each. To adopt agreements with the General Electric Co., Ltd., and M. S. Conner, and to take over the business formerly carried on by the General Electric Co. at Peel Works, Salford, Manchester. The subscribers are G. Byng, 71 Queen Victoria Street, London; H. Hirst, 71 Queen Victoria Street, London; M. S. Conner, Peel Works, Adelphi, Salford; J. Fraser, 31 Copthall Avenue, London; E. C. Byng, 71 Queen Victoria Street, London; and F. Samuelson, 46 Queen Victoria Street, London. The first directors are G. Byng, H. Hirst, and M. S. Conner.

SCOTTISH POWER CO.—Capital, £160,000 in 75,000 preference shares, 75,000 ordinary "A" shares, and 10,000 ordinary "B" shares. To acquire the share capital of the Scottish Central Electric Power Co., and to construct tramways, supply electrical energy, &c. The subscribers include Mr. A. W. Tait, chartered accountant, and Mr. George Balfour, M.I.E.E.

GYROSTATE TURBINES.—Registered by Ashurst, Morris, Crisp & Co., 17 Throgmorton Avenue, London. Capital, £10,000 in 8,280 "A" shares of £1 each, and 3,440 "B" shares of 1s. each. To adopt agreement with T. H. Holroyd and B. L. Barrow, and to carry on the business of electrical and general engineers.

G. WESTON & SONS, 153 Fenchurch Street, London.—Capital, £5,000, including 3,000 preference shares. To adopt an agreement with G. Weston, A. P. Stone, and H. Hill, and to acquire the business carried on at 153 Fenchurch Street, London, and also at Sheen and Finchley, as electric light contractors.

CHAPMAN & STEPHENSON.—Registered by Jordan & Sons, 116 Chancery Lane, London. Capital, £3,000. To acquire patents of an improved photometer invented by H. Chapman. The subscribers are H. Chapman, Ryecroft Villas, Meersbrook Road, Sheffield, electrical engineer; and A. Stephenson, Graystone House, Adwalton, near Bradford, electrical engineer.

Dr. Ludwig Mond's Will.—The will of the late Dr. Ludwig Mond bequeaths the sum of £50,000 to the Royal Society of London for the endowment of research in natural science, more particularly in chemistry and physics. A further sum of £50,000 is bequeathed to the University of Heidelberg for similar objects.

Central Technical College Old Students' Association.—The annual dinner will be held on February 12th, and not February 19th, as stated in the December "Central."

APPOINTMENTS AND PERSONAL NOTES

Eccles Town Council has appointed Mr. Harold F. Barnes, of Portsmouth, as switchboard attendant, in place of Mr. W. P. Hooper (resigned).

Mr. John Kerr, the Chairman of Messrs. Dick, Kerr & Co., Ltd., has joined the Board of the London Bank of Mexico and South America.

Mr. Hemming, Assistant Electrical Engineer to the Leek Council, has tendered his resignation. A successor is to be advertised for at a salary of £100 per annum.

Mr. John Grahame, Manager of the Brisbane Electric Light Co., has been appointed Manager of the Rockhampton (Queensland) Tramways.

Mr. Arthur P. Haslam, M.I.E.E., has commenced business and opened an office at Suffolk House, Laurence Pountney Hill, Cannon Street, E.C., where he is prepared to act as representative for two or three manufacturers of electrical or engineering specialities.

NEW PUBLICATIONS

The Writers' and Artists' Year-book, 1910. (London: A. & C. Black.) 1s.

Who's Who Year-book, 1910. (London: A. & C. Black.) 1s.

Proceedings of National Electric Light Association Convention, 1909. Three volumes. (New York: The Association.)

"Practical Engineer" Electrical Pocket-Book and Diary for 1910. (London: Technical Publishing Co., Ltd.) 1s.

"Practical Engineer" Pocket-Book for 1910. (London: Technical Publishing Co., Ltd.) 1s.

Handbook for Wireless Telegraph Operators Working Installations Licensed by H.M. Postmaster-General. Revised Edition. (London: Eyre and Spottiswoode, Ltd.) 3d.

The Practical Electrician's Pocket-Book and Diary, 1910. Edited by H. T. Crewe. (London: S. Rentell & Co.) 1s.

MISCELLANEOUS CITY NOTES

MELBOURNE TRAMWAY & OMNIBUS CO.—A dividend at the rate of 15 per cent. per annum has been declared upon the ordinary shares for the quarter to December 31st.

HALIFAX & BERMUDAS CABLE CO.—An interim dividend of 5 per cent. per annum has been declared on the ordinary shares for the past half-year.

A New South African Engineering Institution.—According to *South Africa*, the first annual meeting of the South African Institute of Electrical Engineers was held recently under the chairmanship of Mr. J. R. Bradley. Applications for membership have been received from 158 persons, of which 71 have been elected members, 65 associate members, 14 associates, and 8 students. The question of amalgamation with other local engineering societies has been considered by the Provisional Committee, but it was not possible to lay any details before the meeting. Mr. C. M. R. Campbell was elected President, and Mr. W. Eldson-Dew and Mr. M. Rohman were elected Vice-presidents.

Telegraph Traffic.—On the 28th ulto. the cable between Obok and Djiboriti was restored, while the landlines between Alexandrette and Beyruth and between the latter place and Alep were interrupted.—On the 29th ulto. there still existed delay to Dando and Malange in Angola, but the cable between Reunion and Mauritius was put through again successfully on that day.—The Bagdad-Bassorah line ceased working on the 29th ulto., and on the 31st the Indo-European Telegraph Company was able to place the Lowestoft-Emden cable on the active list.—The first day of the New Year saw the repair of the Saigon-Tonkin cable and of the line between Medan—Kotarodga. - On the 2nd inst. the Russian landlines were repaired, and on the following day the cable between Bathurst and Bissao was again in order. On the same day direct communication between Saigon and Bangkok was down for a short while, and telegrams were sent via Paksé—Abone, subject to some delay.—We find, also, that the Lagos—Kotonow cable was awaiting repair on the 3rd inst.—Statements appeared recently in the daily press that the islands of St. Vincent and Jamaica were cut off from telegraphic communication. These statements were unfounded.—With reference to our recent notice on the question of the purchase of controlling interests by the Mackay Companies from the Western Union Telegraph Co. in certain telephone companies of New York, it is interesting to note that at the last quarterly meeting of the Western Union Telegraph Co. Messrs. J. N. Vail, president, E. J. Hall, H. B. Thayer, vice-presidents, and H. S. Howe, director of the American Telephone & Telegraph Co., were appointed directors.—The Postmaster of Jamaica, in his Report for 1908-9, states that £2,839 12s. 4d. was collected for foreign telegrams at out-stations, and was paid to the Direct West India Cable Company, Ltd., while the payment to the West India & Panama Telegraph Company, Ltd., on the same account was only £148 19s. 5d.

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ELECTRICAL BILLS IN THE NEXT SESSION OF PARLIAMENT

[*This Summary is compiled by our own Editorial Staff, and is strictly copyright.*]

IN our issues for November 25th and December 2nd, we gave some particulars of the electrical Bills which were to be deposited for the next session of Parliament. We are now able to supplement these by full information taken from the actual Bills themselves, the statutory period for their deposit having expired. As usual, a certain number of proposals, of which notices had been given, are not to be proceeded with, but none of these can be regarded as of first importance. New constructional works, apart from tramway extensions, are entirely absent. There are, however, several points of interest to be noted in the electrical Bills, although they do not affect matters of important principle.

Probably the most ambitious scheme, although it is mainly financial, is the proposed amalgamation of the Great Northern, Piccadilly and Brompton, the Charing Cross, Euston, and Hampstead, and the Baker Street and Waterloo Railways, and their future working as one undertaking, to be known as the London Electric Railways Co., with a capital of £12,000,000. A physical connection is to be made between the Charing Cross, Euston and Hampstead Railway at Charing Cross station, and the Baker Street and Waterloo Railway Co. at the Embankment station, and also the Charing Cross station of the District Railway Co. This arrangement should render possible great economies in the working and administration of the railways, and it also serves to emphasise the very great extent to which underground communication in London has been carried on by means of comparatively small and isolated undertakings. Apparently the Great Northern and City Railway Co. do not intend to proceed with their application for an extension of time for the construction of their railway from Moorgate Street to the Bank, as no Bill has been deposited, and the extension of the line is therefore not being proceeded with.

The Bill of the Yorkshire Electric Power Co. is of interest, in that it asks for powers to invest capital in industrial and municipal concerns who take a supply of electrical energy from them. A similar proposal was made last session by the County of Durham Electric Power Co., but the Unopposed Committee of the House of Commons decided that such an application of funds was rather beyond the functions of an electric power company. On this occasion Mr. E. Moon, K.C., Speaker's Counsel, reminded Mr. C. H. Merz of the north-country saying that the "Cobbler should stick to his last."

It will be noticed that the Leeds Corporation are applying for powers to use the "trolley omnibus." Hastings Corporation have agreed to avoid the opposition of the Electrical Contractors' Association, by inserting in the clause in their Bill relating to wiring and fitting of premises for electric supply the words, "through a contractor but not otherwise." Several other Corporations, however, including Middlesbrough, Warrington, and Middleton, have not, so far, come into line with the views of the Association as to the wording of this clause, and are presumably prepared to meet with opposition.

The amalgamation of the Baker Street & Waterloo Railway Co. and the Charing Cross, Euston & Hampstead Railway Co. with the Great Northern, Piccadilly & Brompton Railway Co. is proposed, and a new company is to be incorporated bearing the title of the London Electric Railways Co. The Bill contains very detailed financial proposals for the carrying out of this scheme, and provides for the increase of the combined capitals of the three companies concerned by £7,195,000, making £12,600,000 in all. Of the new capital £9,450,000 will be in £10, ordinary shares, and the remainder in 4 per cent. preference stock. When the amalgamation is carried out the guarantee by the Underground Electric Railways Co. of London of the interest on the Great Northern, Piccadilly & Brompton Railway Co.'s preference and debenture stock will cease to exist.

In the Bill promoted by the Baker Street & Waterloo Railway Co., it is proposed, among other things, to construct a subway under Oxford Street from their Oxford Street station joining up with Regent Street. Powers are also taken to enable the Central London Railway Co. and the Great Northern, Piccadilly & Brompton Railway Co. to subscribe towards the construction of this subway.

The Charing Cross, Euston & Hampstead Railway Co. propose the construction of an extension line at Charing Cross to make a physical junction with the Baker Street & Waterloo Railway at their Embankment station, and the Metropolitan District Railway at their Charing Cross station. A period of five years is asked for for completion. Powers are also taken to raise £400,000 new capital. Another clause stipulates that £175,000 of the company's ordinary capital may, by permission of the ordinary shareholders, be converted into preference shares, to be known as Charing Cross, Euston & Hampstead Railway 4 per cent. preference stock.

Metropolitan District Railway Co. seek to raise £187,500 additional 4 per cent. guaranteed stock. The Bill also provides for the extinction of the arrears of guaranteed stock dividends by distributing new guaranteed stock to the extent of £184,375. The construction of certain new lines is also proposed.

Metropolitan Railway Co. ask for an extension of time by four years granted by the Act of 1902 for the enlargement and improvement of Baker Street Station. The construction of small additional lines is proposed as well as a subway in connection with their Edgware Road Station. Subways are also proposed at Moorgate Street, to be jointly constructed by the Metropolitan District Railway Co., the City & South London Railway Co., and the Great Northern & City Railway Co.

Middleton Corporation seek authority to supply and fix electrical fittings, and to supply electrical energy in Chadderton, Royton, and Prestwich. Other clauses relate to the supply of electrical energy in bulk outside the borough; to accept transfers of electric lighting undertakings; and to purchase electricity in bulk.

The incorporation of the North and South Shields Electric Railway Co. is proposed, and the revival of the powers granted to the company in 1902 for the construction of an electric railway under the River Tyne.

An extension of time is asked for by the North-east London Railway Co. for two years for the purchase of land, and a similar period for the construction of the railway. An extension is also asked for in which the capital of the company is to be raised. In the company's original Act of 1905, a period of twelve months was inserted for this purpose, but it has been extended annually since. The promoters now asked for a period of six years to be inserted in the Bill. Another clause authorises agreements with the Metropolitan District Railway Co.

Nottingham Corporation propose the construction of new tramways, for which borrowing powers are sought of £24,000, for construction, repayable in thirty years, and £9,250 for electrical equipment repayable in twenty years. An extension of time is also asked for the construction of tramways authorised in 1905.

Yorkshire Electric Power Co. asks for power to issue new capital in the form of preference shares, and to invest capital not exceeding £100,000 in industrial or municipal undertakings to which the Company supplies electrical energy.

An extension of time until 1913 is asked for by the London United Tramways, Ltd., for tramways in Kew authorised in 1902. It is also proposed to vary section 31 of the Company's Act of 1902, which relates to the protection of the Richmond Corporation. This variation is by agreement. Another clause provides for an extension of time until 1913 for the construction of light railways in Middlesex and Surrey authorised in 1908.

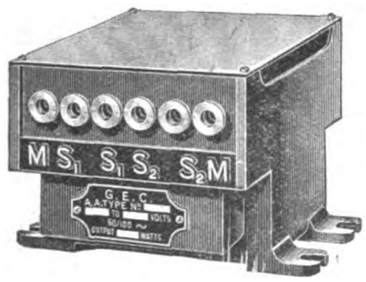
Powers are sought by the Leeds Corporation to use trolley omnibuses on a route from the City Square along Wellington Street, Aire Street, Whitehall Road, and terminating at the boundary of the city at Drighlington, the undertaking to form part of the tramways undertaking of the Corporation. Borrowing powers are sought to the extent of £5,000, repayable in ten years, for the provision of omnibuses, and £9,000, repayable in twenty years, for electrical equipment.

The Bishops Stortford Urban District Council are asking for a two years' extension of time for putting into force the Electric Lighting Order which they obtained in 1905.

The Southampton Corporation propose the construction of new tramways, and ask for powers to borrow £10,440, repayable in thirty years, for construction, and £1,540, repayable in twenty years, for electrical equipment.

The Bradford Corporation propose to construct new tramways and to supply electricity in bulk to districts outside the borough boundaries. Powers are taken to borrow £81,632 for the construction of the tramways specified in the Bill, to be repaid in thirty years, and £42,748 for other tramway purposes. It is

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also proposed to borrow £22,800, repayable in twenty years, for feeder cables, switchboard plant, and apparatus for tramway purposes. Among the other clauses in the Bill is one providing for the erroneous registration of electricity meters. When any error is detected, this is to be taken as having commenced from the preceding quarter unless the error is proved to have arisen during the current quarter.

A Bill proposes the amalgamation of the Bishops Stortford & District Gas Co., Sawbridgworth Gas Co., Epping Gas Co., Newport (Essex) Gas Co., Ongar Gas Co., Much Hadham Gas Co., and the Dunmow Gas Co., and for powers to supply electricity and gas in Bishops Stortford and the districts of the various companies amalgamated by the Bill.

The Devonport & District Tramways Co. propose considerable amendments of their agreement with the Devonport Corporation. Instead of the fixed annual rents provided for by the agreement under the Act of 1898 in respect of the lines leased from the Corporation, the company suggest that the Corporation should be paid the net revenue from these lines. It is further provided that the price for electrical energy paid to the Corporation should be cost price (this to be determined by arbitration) plus 5 per cent. It is also proposed to extend the period for working the lines, which is stipulated in the Act of 1898 as for twenty-one years from that date, to twenty-eight years.

The incorporation of the Farnham Gas & Electricity Co. is proposed for the supply of electricity in Farnham, Surrey. The capital is £60,000 in £10 shares, of which £1,000 is to be in £10 preference shares.

The Handsworth Urban District Council ask for powers to construct thirteen sections of new tramways, and also to make waiting-rooms and shelters. It is proposed to borrow £15,000, repayable in sixty years, for the necessary street widenings, and £77,500, repayable in thirty years, for the construction of the tramways.

The incorporation of the Havant Gas & Electricity Co. is proposed, with a capital of £23,500, to supply electricity in the parishes of Havant, Bedhampton, and Harblington, in the county of Southampton.

Hastings Corporation seek to compulsorily acquire the land upon which their existing generating station stands. They also ask for powers to undertake the wiring and fitting of consumers' premises for electric lighting "through a contractor, but not otherwise." The accounts of this department, when it is inaugurated, are to be kept separately.

The Reading & District Electric Supply Co. seek an extension of area to include Caversham, Goring, and Bradfield. Powers are also taken to supply electrical energy in bulk to authorised distributors in Wokingham, Bradfield, Walford, and Henley. Authority to supply and fix electrical fittings is also asked for. Another clause seeks to compulsorily acquire the land upon which the present generating station stands.

Rhondda Urban District Council propose the erection of new tramways, which are to be leased, and for which borrowing powers are sought for £29,000 for construction, repayable in thirty years, and £5,000 for electrical equipment.

The incorporation of the Wimbledon & Sutton Electric Railway Co. is proposed, with a capital of £350.000. The first directors are Sir H. G. Smallman, Mr. H. D. Searl Wood, Mr. W. E. R. Innes, Mr. F. Wellstead, Mr. H. G. Hoare, and Mr. E. K. Burstal. Five years are taken in which to complete the line, and interest may be paid out of capital during construction at the rate of 4 per cent.

In an Omnibus Bill by the Warrington Corporation powers are taken to supply and fix electrical fittings, &c.

Mersey Railway Co. ask for an extension of time in which to pay out of capital the interest on the debenture stock authorised in 1900 and 1906 in connection with the electrical equipment of their railway.

Middlesbrough Corporation, in an Omnibus Bill, ask for powers to supply and fix electrical fittings. Powers are also taken to build sub-stations under streets. The stand-by clause is also included.

The Tramways Bill of the London County Council deals with the tramways in various parts of London, details of which have already been given in our columns. Authority is taken to spend £1,595.000 upon capital account up to and including the year 1911. An extension of time is asked for for three years in respect of certain tramways authorised in 1903. Powers are also taken to construct pedestrian subways under Victoria Embankment at Charing Cross.

The Cavehill and Whitehill Tramways Co. are asking for compulsory running powers over certain lines of the Belfast Corporation, and offer reciprocal running powers over their lines.

The incorporation of the Chipping Norton Gas & Electricity Co. is proposed for the supply of electricity in Chipping Norton. The company takes powers to supply and fix electrical fittings and apparatus. The capital of the proposed undertaking is £12.C00 in £5 shares.

Below is the complete list of applications for electric lighting provisional orders for next session. Where the name of the promoter is not given, it is the municipality. Ardrossan, Saltcoats, and District (George Balfour); Ballyclare; Rural District of Bath; Brixham and a portion of the Rural District of Totnes (R. A. Lister & Co., Ltd.); Brumby and Frodingham; Portion of the Special Lighting District of Cambuslang, Lanark; Borough of Hemel Hempstead and the Parishes of Bovingdon and Kings Langley in the Rural District of Hemel Hempstead (Chesham Electric Light & Power Co., Ltd.); Church; Clevedon; Cowdenbeath and Lochgelly, &c. (George Balfour); Dawlish [Amendment] Order (Electric Supply Corporation, Ltd.); Derby [Extension]; Frimley; Gorseinon (Gorseinon Electric Light Co., Ltd.; Huddersfield [Extension to South Crosland]; Navan; Ormskirk [Amendment]; Radcliffe (Lancashire Electric Power Co.); Runcorn and Weston (Castner-Kellner Alkali Company, Ltd.); Runcorn Urban and Runcorn Rural (Messrs. George Henry Cox and Herman John Falk); Skelmorlie and Wemyss Bay (Messrs. William Cornfoot Philip and Reginald Vandezee Farnham); Smethwick [Transfer] Order (Birmingham & Midland Tramways, Ltd.); Swinford; Templemore; Widnes [Amendment].

Carbons for Flame Arc Lamps.—A patent specification, No. 23,171 of 1909, by the firm of Gebr. Siemens & Co., of Berlin, covers the incorporation in flame carbons of phosphoboric acid (BPO_4) obtained by the action of boric acid on phosphoric acid. It is said to act like borates in producing steady burning, but is practically infusible. Unlike phosphoric acid, it has no tendency to solidify water-glass, and is therefore suitable as an addition to core materials made up with water-glass. It is further stated that whereas with carbons containing borates, the arc ruptures with alternating current at 35 volts, with phosphoboric acid, and the usual illuminating salts, potentials of 45 or 50 volts can be reached with either continuous or alternating current without rupture of the arc.

Fire at the Edison & Swan Co.'s Premises.—Shortly before eight o'clock on Monday morning, a fire broke out in the test-room at the premises of the Edison & Swan United Electric Light Co., 36 Queen Street, London, E.C. It appears that the firemen had some considerable difficulty in locating and suppressing the outbreak, but we understand from the Edison & Swan Co. that though the test-room has suffered considerably, the only other damage is that done by the water in the basement, and that the fire will in no way interfere with business. As yet, the cause of the outbreak has not been ascertained.

Push-button Control of Motor Starters.—When a motor starter is controlled from one or more distant points, as, for example, in printing-press driving, difficulty has been experienced in providing simple means for de-energising the no-voltage release magnet without interrupting the field circuit. A patent specification (No. 2,217 of 1909) by the Adams Manufacturing Co., Ltd., and others, published last month, describes an arrangement in which an alternative circuit to the release magnet coil is provided, and a two-way push-button is so interposed that both circuits cannot be broken at the same time. Normally the field circuit passes through the release coil and through a closed contact of the push-button switch. If the push-button is pressed, it first short-circuits the release coil by closing the alternative circuit through a second contact, and a further movement breaks the first contact, so that the arm of the main switch flies back to the off position. The field circuit is thus not broken at the push-button, and a closed path is left for the field to discharge itself through in the ordinary way. Push-button can be fitted at several points and without any alteration to an existing starter. Series motors can be provided with a similar arrangement with a series hold-on coil, and the invention is applicable to both D.-C. and A.-C. motors.

Electric Lighting in Churches.—The December issue of the *A.-E.-G. Zeitung* contains among other things an illustrated article on the applications of electricity in churches in Germany. Arc lamps only are used in a church at Neuburg, while in some churches, as in the new Berlin Cathedral, an arrangement of arc and glow lamps combined is used. Indirect lighting with arc lamps is employed with good effects in some old churches, and Nernst lamps are also used. Candle lamps for altar lighting are extensively employed, and in the Hildesheim Cathedral there is a large circular candelabra with electric candle lamps. The Protestant church of Bad Elster is lighted exclusively with 122 candle lamps. Most of the new churches are fitted with ordinary glow lamps on suitable pendants and brackets. Miniature glow lamps are used with striking effects for the illumination and decoration of the altars and pictures in some of the Catholic churches. Some particulars of the electric driving of organ blowing equipments and of the belfry mechanism are also given. Thus in a new church at Bitterfeld, four bells weighing 5·5, 1·8, 1·0, and 0·6 tons respectively are swung by means of suitable automatic gear from a main shaft driven by a 5 h.p. motor. For manual working, eight men would be required, and the running costs would, it is stated, be about three times as much as those with electrical working, including the cost of current.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Dec. 30th, 1909

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

1,414–5/09. **Heating and Cooking Apparatus.** A. F. BERRY (London). These two patents cover methods of connecting the low-pressure thick wire heating windings of A.-C. hot-plates to auto-transformers. The arrangement described in the first consists in connecting one end of each of several hot-plate windings to the transformer winding at symmetrical points, and connecting the ends to multiple-way switches affording connection to various intermediate points on the transformer winding. In this way the load is distributed along the winding at all loads, and undue heating of certain parts avoided. Three claims, three figures. In the second arrangement the temperature of each hot-plate is varied by altering the length of the low-pressure heating winding connected to the auto-transformer or by connecting its parts in series or parallel. Switches for effecting this and a combination of both methods of control are described. Three claims, two figures.

6,809/09. **Cable Armouring.** E. A. CLAREMONT and J. STRATTON (Manchester). In cables armoured with steel tape wound spirally in two overlapping layers, the turns are liable to coincide and thus expose the cable. To prevent this, the inner tape is given a longitudinal corrugation or rib at its centre, and the outer turns are kept in position by the ribs of the two adjacent inner turns. One claim, two figures.

16,328/09. **Manufacture of Tungsten Filaments.** C. H. WEBER (Berlin). Tungsten powder in a state of fine division is subjected to the action of pyridine or quinoline. This is done by mixing, for instance, pyridine (C_5H_5N) with alcohol, and causing the mixture to trickle slowly through the tungsten powder. The powder takes up the solution, and a certain amount of chemical action takes place. The product oxidises less readily than pure tungsten, and requires the addition of only a small amount of a binding agent for squirting. The binding agent is removed from the filaments by heating in a vacuum at 800° C., and the filaments are sintered in an inert atmosphere at 3,000° C. Three claims.

17,342/09. **Furnace for Electric Smelting of Iron.** AKTIEBOLAGET ELEKTROMETALL (Stockholm). This comprises a smelting chamber into which project three electrodes, and a vertical shaft above it with a gradually decreasing section towards the smelting chamber end. Part of the pressure of the ore is therefore taken up by the conical walls of the shaft, so that the ore is not forced up into the free spaces round the electrodes. The brickwork is thus protected from contact with the ores and the introduction of gases rendered possible. Two claims, two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Names in italics indicate communicators of inventions from abroad.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MÜLLER [Supply system with gas-engine driven generators] 7,595/09.

Dynamos, Motors, and Transformers: JACOBY [A.-C. commutator motors] 27,967/08; PUNGA [Single-phase series motor] 133/09; BOECKEL, GRUNBERG, KOUKOVSKI, and LUXEMBOURG [Machines] 1,327/09; CARTER [Machines] 3,352/09; MARKS (*Allmanna Svenska Elektriska Aktiebolaget*) [Polyphase commutator machines] 12,782/09.

Electric Ignition: ROBERT BOSCH [Sparking-plugs] 15,985/09.

Electrometallurgy and Electrochemistry: SKELTON [Ozonisers] 27,107/08; TUCKER [High-potential primary cell] 6,443/09; AKTIEBOLAGET SWEDISH NITRIC SYNDICATE [Concentrating acid] 10,591/09.

Incandescent Lamps: FRÉNOT, 7,073/09; LEWY [Pocket lamps] 22,032/09.

Instruments and Meters: NORTH [Meters] 3,300/09; YOUNG and R. LAIDLAW & SON, LTD. [Prepayment meters] 10,141/09; O'KEENAN [Shunt arrangement for power measurement] 15,298/09; COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIAL D'USINES À GAZ [Meters indicating maximum demand] 17,138/09, and [Induction motor meters] 19,277/09.

Storage Batteries: NYA ACKUMULATOR AKTIEBOLAGET JUNGNER, ESTELLE and EVERS [Negative plates for alkaline cells] 7,338/09.

Switchgear, Fuses, and Fittings: BAKER [Switch] 27,168/08; MARSHALL [Switch mechanism] 27,244/08; SIEMENS BROS. DYNAMO WORKS, LTD., and SCHUPP [Motor-starters] 2,464/09; PARSONS (Detachable Couplings) 7,345/09; BRAMPTON and OSBORNE [Conduit fittings] 8,601/09; BELEUCHTUNG SYSTEM FORTUNY-GES. [Reflectors] 11,556/09.

Telephony and Telegraphy: CLEMENT [Telephone Exchange] 27,139/08; COOPER, and BRITISH INSULATED & HELSBY CABLES, LTD. [Alarm fuses for telephone exchanges] 3,573/09; FESSENDEN [Wireless signalling] 14,826/09; SIEMENS BROS. & CO. (*Siemens & Halske Akt.-Ges.*) [Order signalling] 19,684/09; CLEMENT [Telephone exchanges] 24,615-6/09; SIEMENS & HALSKE AKT.-GES. [Telegraphic signalling] 28,169/09.

Traction: GOULD [Automatically stopping trains] 27,151/08; HOLDSWORTH [Trolley collectors] 27,852/08; KAY [Apparatus for grooving trolley wire] 2,052/09; HEILMANN [Brakes] 7,324/09; FIORIO [Rail-joints] 14,026/09; SIEMENS BROS. & CO. (*Siemens & Halske Akt.-Ges.*) [Track signalling] 14,120/09; BAXTER [Anchoring rails] 15,163/09.

Miscellaneous: STELJES [Electric dial movement] 25,577/08; POWELL [Magnetic separators] 27,020/08; KELVIN & JAMES WHITE, LTD., and CLARK [Mariners' compass] 7,021/09; EASTWOOD [Lifting magnets] 10,283/09; KEITH [Fans] 12,289/09; KING, KING, and HAMER [Electromagnetic coupling] 19,431/09; DOBBIE [Mariners' compass] 20,563/09; DICK, KERR, & CO. (*Braun*) [Electromagnetic friction brakes] 20,845/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: BINET and GUENNE [Casings] 28,849/09.

Electrochemistry: EYCKEN, LE ROY, and MORITZ [Electrolytic production of oxygen and hydrogen] 24,716/09.

Storage Batteries: SOC. INDUSTRIELLE DE L'ACCU MIXTE L'EMERGEQUE [Plates] 29,228/09.

Telephony: SIEMENS & HALSKE AKT.-GES. [Exchanges] 28,825/09.

Miscellaneous: ROBERT BOSCH [Insulation of windings] 22,479/09.

Opposition to Grant of Patents

16,260/08. **Utilisation of Exhaust Steam.** J. HOWDEN & CO., LTD., and W. H. OWEN. The grant of this patent has been allowed in spite of opposition. It covers the admittance of live steam into the low-pressure reservoir by means of an automatic valve when the supply of exhaust steam fails.

17,438/08. **Tungsten-Nickel Alloy.** SIEMENS & HALSKE AKT.-GES. This patent was granted in November last in spite of opposition, but an appeal has just been lodged against the Comptroller's decision. Full particulars will be found on another page of this issue.

3,604/09. **Depositing Metal on Metal.** A. SANG. Opposition has been entered to the grant of this patent. The specification describes a process in which the wire or object to be covered with a metallic film is immersed in a powder of the metal or of an oxide of the metal to be deposited, and a current is passed through the wire or object to heat it. If an oxide is used, a reducing agent must be introduced.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

870 of Jan. 13th, 1896. **Pumps.** J. G. MERRYWEATHER and G. HARRIS. A pump suitable for driving by a high-speed motor comprises three cylinders arranged radially and symmetrically about the crank-shaft centre.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Magnetite flame electrodes] 18,484/05.

Dynamos, &c.: W. E. BURNAND [Transformers] 21,410/97; W. R. MARSHALL [Sub-divided pole-shoes] 18,530/01; SIEMENS BROS. & CO. (*Siemens Schuckertwerke-Ges.*) [Inter-pole turbo-generator] 18,401/05; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Traction motor control] 18,846/05.

Electrometallurgy and Electrochemistry: J. HARGREAVES [Alkali manufacture] 21,178/97.

Incandescent Lamps: J. R. QUAIN [Multiple filament "turn-down" lamp] 18,569/01.

Storage Batteries: J. VON POPENBURG [Plates] 16,408/00; C. B. ASKEW [Plates] 18,381/05.

Switchgear, &c.: J. H. TUCKER [Tumbler switch] 20,217/96; BRITISH THOMSON-HOUSTON CO. (*E. F. Case, U.S.A.*) [Resistances for traction controllers] 18,332/01; J. W. CLARKE (*J. B. Foote*) [Automatic pressure regulator] 18,597/01; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Mercury motor-starter] 18,447/05; H. HIRST and J. H. COLLINGS [Ball-and-socket joint for lamp fittings] 18,646/05.

Telephony and Telegraphy: A. MUIRHEAD [Relays, &c.] 18,610/01, and [Duplex telegraphy] 20,009/04.

Traction: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Block signalling] 19,890/04, and [Automatic device for petrol-electric drive] 18,448/05; H. NIBLETT [Collectors] 18,852/05.

Miscellaneous: M. WILDERMAN and R. L. MOND [Thermopiles] 19,758/04; E. LEDERER [Disintegrating mercury] 18,513/05; J. DENHOLM [Electrically driven saw] 18,546/05; R. WAYGOOD & CO. and A. J. MILES [Lift control] 18,744/05.

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ELECTRICAL ENGINEERING

No. 159 [Vol. VI., No. 2] THURSDAY, JANUARY 13, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.

Canada. 8s. 8d. per Annum.

Other Colonies and Abroad. 13s. per Annum.

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Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON AND WESTMINSTER BANK (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

BINDING "ELECTRICAL ENGINEERING." — Vol. V. of "Electrical Engineering" (Jan.—Dec. 1909) closed with our issue of Dec. 30. An index for the volume is now ready, and copies may be ordered from any newsagent or bookseller at the price of 1d. each (or post free, 1½d.). Binding Cases, including index, are also ready, price 2s. each, post free 2s. 4d. (Abroad 2s. 6d.) Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to us, carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad.

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"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

SUMMARY

IN an article by a special correspondent, the ingenious methods are described by which the electrical effects in the Drury Lane pantomime now running are produced, and some interesting figures of the amounts of cable, &c., used are given. (Page 19.)

AN Order in Council has been made confirming the Board of Trade Electrical Standards except as regards the ohm, in regard to which a slight alteration of the temperature of the observation has been made in order to bring it into line with the International Standards proposed by the Conference of 1908. (Page 20.)

ON Tuesday evening Mr. Hugo Hirst, Managing Director of the General Electric Co., addressed a meeting of some 300 of the London employees of that company, on the subject of Tariff Reform, with particular reference to the business of the General Electric Co. Some interesting particulars were given as to the arrangements for the manufacture of Osram lamps. Mr. Hirst also said that two or three large German firms had intimated that they wished to erect works in this country in conjunction with the company should Tariff Reform be introduced. (Page 20.)

IN a Paper read before the Institution of Mechanical Engineers on Friday last, Mr. C. W. Jordan described the generating station of the Ontario Power Co., which is situated at the base of the Horseshoe Fall, Niagara. When completed, the total capacity of the plant will be over 200,000 h.p. Current is supplied at 12,000 volts from 12,000-h.p. three-phase generators coupled to horizontal Francis-type turbines, to a distributing station at the top of the cliff, where it is transformed up to 62,000 volts, and transmitted in various directions. The turbine valves, generators, and switchgear are all controlled electrically from the distributing station. Aluminium cables are almost exclusively employed for the overhead lines. At present, the maximum distance of transmission is 160 miles, namely, from Niagara to Syracuse. (Page 21.)

THE general arrangements and lighting of the new offices and stores of the supplies department of Messrs. Siemens Bros. Dynamo Works, Ltd., are described. Lamps are stored in portable boxes, which are stacked up on the Unit system. A showroom has been provided particularly for the benefit of the trade. (Page 23.)

IN order to check careless driving, and so affect a saving in current consumption, the Interborough Rapid Transit Co. have equipped some coaches on the Manhattan Elevated Railway with devices which record

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the total time during which the car is coasting. (Page 24.)

A SHORT article describes the meter-testing plant of Simplex Conduits, Ltd. (Page 24.)

WE give particulars of the principal electrical law-suits which are down for hearing during the Hilary sittings. There are a number of important appeals, including British Westinghouse Co., Ltd., *v.* Braulik, and Holmes *v.* Associated Newspapers, Ltd. In the Chancery Court, actions are down concerning the multiple-unit system of train control, electrical winding, and metal filament lamps. There are also a few Kings Bench Division cases of some interest. (Page 25.)

AT a meeting of the South Wales Section of the Institution of Mining Electrical Engineers, a General Purposes Committee was elected. A Paper on "Shocks" will be discussed at the next meeting at Cardiff on January 29th. (Page 26.)

SOME modifications have been made in the conditions under which tenders were invited by the Australian Commonwealth for wireless telegraph stations. We give some of the details of the specification. Attempts are being made, both in America and Canada, to make the carrying of wireless telegraph apparatus on ships compulsory. (Page 26.)

THE Tudor Accumulator Co. reply to Mr. Vicarino's letter in our last issue. A well-known firm of contractors call our attention to a fire which has been wrongly ascribed to electrical causes. (Page 26.)

THE second report of the London Traffic Branch of the Board of Trade expresses a very decided opinion that in the future motor omnibuses will be a serious factor in locomotion in London, and will tend to supersede electric tramways, especially in narrow streets. Mention is made of the fact that an application by the London County Council for permission to use trailer cars for passenger service is under consideration by the Board of Trade. Good progress is being made with the construction of the Euston-Watford Electric Railway. The report discusses at considerable length the advantages and drawbacks of electric traction for suburban railway service. (Page 27.)

THE Paper by Messrs. Lepine and Stelling on the German electrical industry has been further discussed by the Birmingham Section of the Institution of Electrical Engineers. It was agreed by several speakers that the greater prosperity of the German industry was largely due to the financial conditions, and it was clearly brought out that there has been some exaggeration of the differences in organisation of British and German firms in the Paper. (Page 28.)

ANOTHER new solder for aluminium and its alloys has been introduced. No flux is required, and the softest grade can be used with an ordinary bit. (Page 28.)

THE following books are reviewed in this issue:—"Chats on Electricity," by F. Broadbent; "Heat for Engineers," by C. R. Darling. (Page 29.)

THE claims upon the Bournemouth Corporation in respect of the tramway accident in May, 1908, amount to £8,508.—A recommendation of the Estates and Finance Committee of the Dublin Corporation to go to law with the Dublin Tramways Co. concerning tramway wayleaves has been rejected.—Winchester Corporation propose to purchase the local electric supply company.—The Anglo-Argentine Tramway Co. is providing 125 new tramcars and 80 additional trailers.—A large scheme of subway tramways is to be carried out in Buenos Aires.—An offer has been made to the Aberdeen Corporation by the local tramway company with regard to the dispute concerning the supply of electricity. (Page 29.)

BELFAST Corporation require water-tube boilers, superheaters, &c., and the Stepney Borough Council a turbo-generator, converting plant, and switchgear.—Transformers, arc lamp carbons, &c., are required at Plymouth, and stores at Rochdale and Acton.—Messrs. Harrison, Ainslie & Co. proposed to increase their electrical pumping plant at an estimated cost of £18,000.—A loan of £3,200 has been granted at Rhyl.—Loans of £3,500 and £1,500 respectively are required by the Sutton Coldfield and Worksop Councils. (Page 30.)

A COMBINED lighting and power meter has been introduced, having an additional "power" terminal connected to a tapping on the series coil, so that the current taken by the power or heating circuit flows through only a portion of this coil. The meter thus registers the units consumed for lighting, and, in addition, that proportion of the power consumption which, charged for at the lighting rate, equals the total power consumption charged for at the power rate. (Page 33.)

AMONG the specifications published by the Patent Office on Thursday last was one by T. Holdsworth for a device for attaching to trolley arms to protect the head from injury when it leaves the trolley wire and strikes a cross-wire.—A. Boeckel describes an improved form of the continuous-current generator, in which the field is rotated electrically in a direction opposite to that of the armature; the field winding is supplied with three-phase current from the armature.—An apparatus for grooving trolley wire when already strung up is covered by B. Kay; this comprises a bar clamped to the wire, and a reciprocating frame with two horizontal cutting discs.—F. W. Carter describes a means of improving commutation by providing the trailing edge of the brush with projections, which rapidly reduce the area of contact between the brush and the segment during the last moments of commutation.—A patent for a dry cell with vertical air-passages through the depolariser, has been granted to H. Hunte, in spite of opposition. (Page 34.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JANUARY 13TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. Second Kelvin Lecture, "Lord Kelvin's Work in Telegraphy and Navigation," by Prof. J. A. Ewing, F.R.S.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science.

SATURDAY, JANUARY 15TH.

Birmingham and District Electric Club.

7 p.m. At Colonnade Hotel, New Street. Presidential Address by G. O. Donovan.

TUESDAY, JANUARY 18TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology. "The High Tension Spark Discharge in Air," by P. Kemp and W. A. Stephens.

Faraday Society.

8 p.m. At Institution of Electrical Engineers, 92 Victoria Street, London. (1) "The Conditions which Determine the Composition of Electrodeposited Alloys," by Samuel Field; (2) "Studies in the Electrodeposition of Metals," by Dr. F. M. Perkin and W. E. Hughes.

WEDNESDAY, JANUARY 19TH.

Royal Society of Arts.

8 p.m. At St. John Street, Adelphi, London. "The Japan-British Exhibition, 1910," by Count Hirokichi Mutsu.

Institution of Civil Engineers.

Students' visit to the new Horseferry Road station of the Westminster Electric Supply Corporation.

FRIDAY, JANUARY 21ST.

Physical Society.

5 p.m. At Imperial College of Science. (1) "The Polarisation of Dielectrics in a Steady Field of Force," by Prof. W. M. Thornton; (2) "On the Use of Mutual Inductometers," by A. Campbell.

Northampton Institute Engineering Society.

5.45 p.m. At the Institute. "The Choice of Prime Movers for Power Stations," by E. T. Driver.

SATURDAY, JANUARY 22ND.

Junior Institution of Engineers.

3 p.m. Visit to the new generating station of the Westminster Electric Supply Corporation, Horseferry Road, Westminster.

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ELECTRICAL EFFECTS AT THE DRURY LANE PANTOMIME

(By Our Special Correspondent)

WHILE it would perhaps be scarcely correct to liken a Drury Lane pantomime produced without the aid of electricity to the play of *Hamlet* without the Prince of Denmark, it is permissible to say that the performance would be shorn of a considerable amount of its beauty if electricity were an unknown factor. Certain it is that similar effects could be produced with no other form of illuminant, while the use of naked flames would be attended with considerable risk in any case. The authorities at Drury Lane were among the earliest, if not the very first, to appreciate the value of electric lighting for what are technically known as "stage effects," and, having gained more and more experience as the years have gone by, they have now attained to a degree of perfection which can hardly be realised even by those who watch the gorgeous spectacles from the auditorium. The thing is an art in itself, and can only be properly carried out by a person who has an intimate knowledge of theatre technique as well as a wide acquaintance with the rules and regulations affecting ordinary lighting. Moreover, the scale of illumination is gigantic, as may be realised from the fact that on certain occasions electrical energy is being consumed on Drury Lane stage at a rate equal to that in an entire town of several thousand inhabitants, while the weekly wages bill for the electrical staff runs well into three figures.

In *Aladdin*, which is now running at Drury Lane, the first feature of electrical interest occurs in Part I., when the Princess (Miss Ida René) and her ladies bathe in the sea. The scene consists mainly of a cloth painted to represent rolling waves, but immediately the stage lights are extinguished this is drawn up, leaving a plain cloth through which several holes are pierced. Through these holes the ladies place their heads and shoulders and go through graceful motions to imitate swimming. At the same time a cinematograph in the first circle is brought into action, and throws upon the screen a remarkably good reproduction of a moving seascape; so quickly is the change brought about that the illusion is complete. It may be mentioned that this cinematograph picture is the largest which has ever been shown, the screen measuring no less than 38 ft. square, whereas the usual size is about 25 ft. square. The film was taken specially for the purpose, and the machine itself is of an extra powerful type. It is housed in a fireproof box and takes normally about sixty amperes. For purposes of supply a special pair of 19/14 cables have been run to it from the stage intake.

Earlier in the play, Abanazar (Mr. Geo. Graves) makes his entry in an aeroplane fitted with a ½ h.p. motor, which serves the double purpose of driving the propeller and playing the "Merry Widow" waltz on a small barrel organ. Needless to say, other means are also provided for preventing the aeroplane and its occupant from reaching the stage in a too precipitate manner.

In the scenes which conclude Part I. the most interesting electrical effects are produced; here Aladdin (Miss Marie George) enters the mystic cave, his apparent descent being effected by raising a semi-transparent curtain, through which he can just be seen. While this is in progress, two "effect" curtains are lowered at the back of the stage, this operation being invisible to the audience. Each of these curtains carries 100 lamps of different colours wired by flexibles to forty plugs, which are all brought to a special iron platform situated on the prompt side, and some 30 ft. above the stage. When required, these plugs are quickly inserted into sockets permanently connected to spring contact-makers, which bear upon a wooden cylinder. Wound in the form of a spiral on the cylinder are two parallel brass strips, which thus serve to effect connection with the contact-makers as the cylinder is rotated. The cylinder and contact-makers somewhat resemble the familiar cylinder and comb of the musical box, with the exception that the little steel spikes on the cylinder are replaced by the spiral brass strips. Hence, when the cylinder is slowly rotated by hand, each lamp lights up when the first brass strip touches its contact-breaker, goes out, and lights up again for the second brass strip. The two strips are placed close together, so that the ultimate effect is that of a double flash succeeded by a definite period of inaction. When seen at a distance the result is particularly charming, and gives the impression of a vast number of twinkling coloured lights. The voltage employed is 100, and each lamp is provided with a small wire guard to avoid breakage during the process of raising and lowering. Some idea of the labour involved by this "effect" may be gained when it is realised that no less than three miles of flexible cord were necessary in wiring the curtains.

Following close on the cave scene is that depicting "The Garden of Light," which exhibits a most delightful scheme of colouring. In this scene no fewer than 1,000 "effect" lamps are employed. At the same time there are used twelve battens, each carrying 260 lamps, twenty-six portable battens, each carrying thirty lamps, and thirty-six stage arc lamps. That is to say, exclusive of stage arcs, practically 5,000 lamps, most of which are of 32 c.p., are in use at the same time. The wiring for this scene involved no less than one and a-half miles of fitting wire.

Scene 4 in Part II. represents the gardens of Aladdin's Palace, and is responsible for a considerable expenditure of electrical energy. The palace is outlined with coloured lamps to the number of about 1,200, for connecting up which some two and a-half miles of fitting wire were required. These lamps are fed from stage plugs, the leads consisting of twin flexibles whose aggregate length is 1,500 ft. Each conductor is composed of 130 strands of No. 40 S.W.G., the whole being insulated with vulcanised rubber and covered with a special compounded braiding. The leads are extremely flexible and are admirably suited to withstand the severe usage to which they are subjected. They were manufactured by the Liverpool Cable Co., and were supplied by Messrs. Baxter & Caunter, who also supplied 1,000 ft. of 300/40 constructed in a similar fashion. In addition to the 1,200 "effect" lamps, a large number of battens and arcs are employed in this scene. On the magic lamp being rubbed the palace is caused to float away in full view of the audience, and this is effected in an extremely ingenious manner. After the scene had been designed and set it was photographed, and a properly coloured lantern slide was made of it. The palace itself is an elaborate structure built up on one of the electric bridges, which can be raised or lowered at will, and immediately before it is caused to disappear a dense cloud of steam is projected upwards in front of it, thus cutting it off from the view of the audience. Under cover of this cloud, the structure is lowered and a plain sky cloth takes its place. Behind this cloth is a travelling telescopic ladder, something similar to those used for repairing overhead trolley wires, on the top of which is fixed a projection lantern. This lantern throws an image of the above-mentioned slide on to the sky

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cloth, and this is what is now seen by the audience when the steam has cleared away. It is then a simple matter to push the ladder and lantern diagonally across the stage so that the picture travels across the cloth, gradually getting smaller and smaller, until it finally disappears. The effect of perspective is remarkable, and the illusion a very clever one, as the lantern is raised simultaneously with the traversing motion, so that the palace not only appears to be moving further away but also to be ascending.

In addition to the "effects" described above there are also others of minor character, such as the production of arcs between carbons held in the hands, the lighting up of long vacuum tubes by high-frequency currents, and similar examples of theatrical "magic." There are also the extremely pretty spectacles produced by the aid of portable accumulators, of which about 100 are in daily use. These accumulators are carried by girls and are used for lighting up miniature lamps hidden among flowers, &c. It is interesting to note that a special charging room for these small cells has been built at Drury Lane, and that every facility exists for dealing with this work efficiently and economically. Also, it may be observed that a separate switchboard is employed for all "effect" lamps. This is of the usual slate type, with twenty-four quick break switches and fuses, each capable of dealing with 25 amps. Some 2,000 metal filament lamps are used on the battens.

In concluding this article, we wish to express our indebtedness to the management of Drury Lane Theatre for their kindness in permitting our representative to examine the work, and to the theatre electrician, Mr. H. Mather, who so courteously devoted his time to explanations.

IMPERIAL ELECTRICAL STANDARDS

AN Order in Council has been made and is published in the *London Gazette* relating to the adoption of the units and standards recommended by the International Conference of Electrical Units and Standards, 1908. The question of agreement between the standards as defined by the Conference and the existing Board of Trade standards is gone into, and it is stated that they agree within the limits of accuracy obtainable, as already defined, except that in the case of the ohm the temperature should be 16·4° C., in place of 15·4° C., as specified in the original Order in Council relating to these Board of Trade standards. The new Order approves the denominations of the standards as set out in the following schedule:—

Standard of Electrical Resistance.—A standard of electrical resistance denominated one Ohm agreeing in value within the limits of accuracy aforesaid with that of the International Ohm, and being the resistance between the copper terminals of the instrument marked "Board of Trade Ohm Standard Verified. 1894 and 1909," to the passage of an unvarying electrical current when the coil of insulated wire forming part of the aforesaid instrument and connected to the aforesaid terminals, is in all parts at a temperature of 16·4° C.

Standard of Electrical Current.—A standard of electrical current denominated one Ampere, agreeing in value within the limits of accuracy aforesaid with that of the International Ampere, and being the current which is passing in and through the coils of wire forming part of the instrument marked "Board of Trade Ampere Standard Verified, 1894 and 1909," when on reversing the current in the fixed coils the change in the forces acting upon the suspended coil in its sighted position is exactly balanced by the force exerted by gravity in Westminster upon the iridioplatinum weight marked A, and forming part of the said instrument.

Standard of Electrical Pressure.—A standard of electrical pressure denominated one Volt, agreeing in value within the limits of accuracy aforesaid with that of the International Volt, and being one-hundredth part of the pressure which, when applied between the terminals forming part of the instrument marked "Board of Trade Volt Standard Verified, 1894 and 1909," causes that rotation of the suspended portion of the instrument which is exactly measured by the coincidence of the sighting wire with the image of the fiducial mark A before and after application of the pressure, and with that of the fiducial mark B during the application of the pressure, these images being produced by the suspended mirror, and observed by means of the eyepiece.

In the use of the above standards the limits of accuracy attainable are as follows:—For the Ohm, within one-hundredth part of one per cent. For the Ampere, within one-tenth part of one per cent. For the Volt, within one-tenth part of one per cent.

THE GENERAL ELECTRIC CO., TARIFF REFORM, AND OSRAM LAMSP

AT the request of some members of the staff of the General Electric Co., Mr. Hugo Hirst, managing director, addressed a meeting of some three hundred employees of the London offices of the company on the subject of Tariff Reform, with particular reference to the business of the General Electric Co. The meeting was held on Tuesday evening, at the Mansion House Restaurant, London. Tariff Reform was, said Mr. Hirst, a business and not a political question, but competent business men had not been consulted in the matter by the Government. Tariff Reform could be considered as a means of getting security of work, and continuity of employment. When foreign competitors were busy at home, they left us our own market, but we could not be sure of the work, and so were unable to organise properly in order to be always prepared for it. The profits of the company were not so large as was sometimes thought. He had gone into the matter, and the auditors would bear him out when he said that if the wages of the employees were increased 20 per cent. all round, there would be nothing left to pay the debenture interest.

With regard to the Osram lamp business, the lamps were originally wholly imported from Germany, but the directors, partly due to the protection offered by the 1907 Patents Act, partly because they saw a different kind of protection coming, and partly because they wished to make the Osram lamp business a manufacturing business, had decided to erect works for the manufacture of these lamps in this country. The erection of these new works at Hammersmith increased the value of the land there, benefited the building trade, and secured labour for 700 people. In a few months' time the number would be increased to 1,100. Specimens of the machines used in making the lamps had been brought from Germany, and the rest made here; men skilled in the processes employed had been brought here to instruct the workers. The sum paid in wages to the employees of the new Osram lamp works at Hammersmith would soon be £1,000 per week. Was it not better that this should go to Hammersmith and not to Berlin? They need not think that the staff employed in the import trade would suffer, as the increase in the manufacturing business would provide more than enough work for them. They hoped to manufacture Osram lamps for the Colonies as well as for home consumption.

Two or three German firms with which the company had business relations had intimated that they would erect works in England in conjunction with the G.E.C. if Tariff Reform were introduced. This would mean employing a large additional amount of labour, and it was to be remembered that he was only speaking of one firm in an industry which was a very small proportion of the industry of the whole country. Even if Tariff Reform were to make food dearer, a living wage would be given, as the labour would be required. As another example, Mr. Hirst mentioned the Robertson Works, which turned out, he said, five million carbon filament lamps a year. This country imported as well some 10 million lamps, and if a duty were imposed on these imported lamps, the output of the Robertson Works might be increased by, say, two million. The increased manufacture would lower the cost of production, and enable them to sell them even cheaper than before, and thus a duty would effect a reduction in price.

The Witton carbon works were another example. When these started work, the price of carbons in this country dropped immediately, but remained the same in other countries. Were they to stop manufacturing, the price would rise again at once. These works were being run at a loss. In the case of a tender for Hackney, they lost the contract by only £1, although their carbons were the only ones of British manufacture. At Woolwich they only obtained a £190 contract at much below cost price, and this they did only by working it as nineteen orders of £10 each, to evade certain clauses in the general conditions attached to the larger contracts, which would have increased the cost of manufacture still more.

Mr. Hirst, in reply to a question as to whether labour was sweated in protected countries, referred to the reports of the various committees which had recently investigated the matter in Germany and America. They had not found any sweating going on, but had reported most favourable conditions of the working classes.

Electric Railway between Denmark and Sweden.—A definite proposal has been put forward for the construction of a tunnel between Denmark and Sweden, starting at Copenhagen, and connecting up with Malmoe. Connection would be made on the way with the small islands of Amager and Saltholm, and the electric trains which it is proposed to run through the tunnel would run on the surface on these islands in order to reduce the underground journey as much as possible. If the scheme is carried out, it is estimated that the trip could be made in 1½ hours.

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ONTARIO POWER PLANT AT NIAGARA FALLS

ON Friday last, a Paper describing the plant of the Ontario Power Co. at the Niagara Falls, was read by Mr. C. W. Jordan, before the Institution of Mechanical Engineers. This company's development comprises the taking of water from the Upper Niagara River above the Horseshoe Fall, leading it through pipes and penstocks to turbines in a station below the Fall, and there generating electric power, which is transmitted to a second station on the hill above, and thence distributed. There is a fall in level of 55 feet in the rapids above the Fall, and to take advantage of this the headgates are placed just above the rapids. From the headgates three steel and concrete tunnels will, when complete, convey nearly 12,000 cubic feet of water per second to the top of the cliff above the power-house, and just beyond the Fall. Thence it will pass through twenty-two steel penstocks in shafts and tunnels down and out through the cliff to an equal number of horizontal shaft turbines in the power-house at the foot of the Fall. From the generators, the cables pass through tunnels to the distribution station on the hill above, and thence to the transmission lines beyond. The total capacity of the whole installation, when complete, will be over 200,000 h.p. The intake, which is nearly 600 ft. long, stretches across the inlet at Dufferin Island almost parallel with the current in the river. Throughout its whole length, a concrete curtain wall extends down 9 ft. into the water, which is 15 ft. deep at this spot, so that the gate openings beneath admit only deep water, and this at right angles to the swift exterior surface flow, which, sweeping the full length of the curtain wall, carries the floating ice past to the rapids beyond. The intake is divided into twenty-five bays, through which the water is admitted at a velocity of 5 ft. per second. The main conduits are of 0·5-in. riveted and reinforced steel imbedded in concrete, 18 ft. and 20 ft. in diameter, and 6,500 ft. long, sunk beneath the surface. The water flows through them at an approximate velocity of 15 ft. per second. Riveted to the bottom of each main conduit are tapered steel-castings leading to the valves and penstocks below, each supplying water at 10 ft. per second to a single horizontal shaft turbine. Each valve is operated by a 30-h.p. induction motor controlled either locally or from the switchboard in the generating station, and may be fully opened or closed in three minutes.

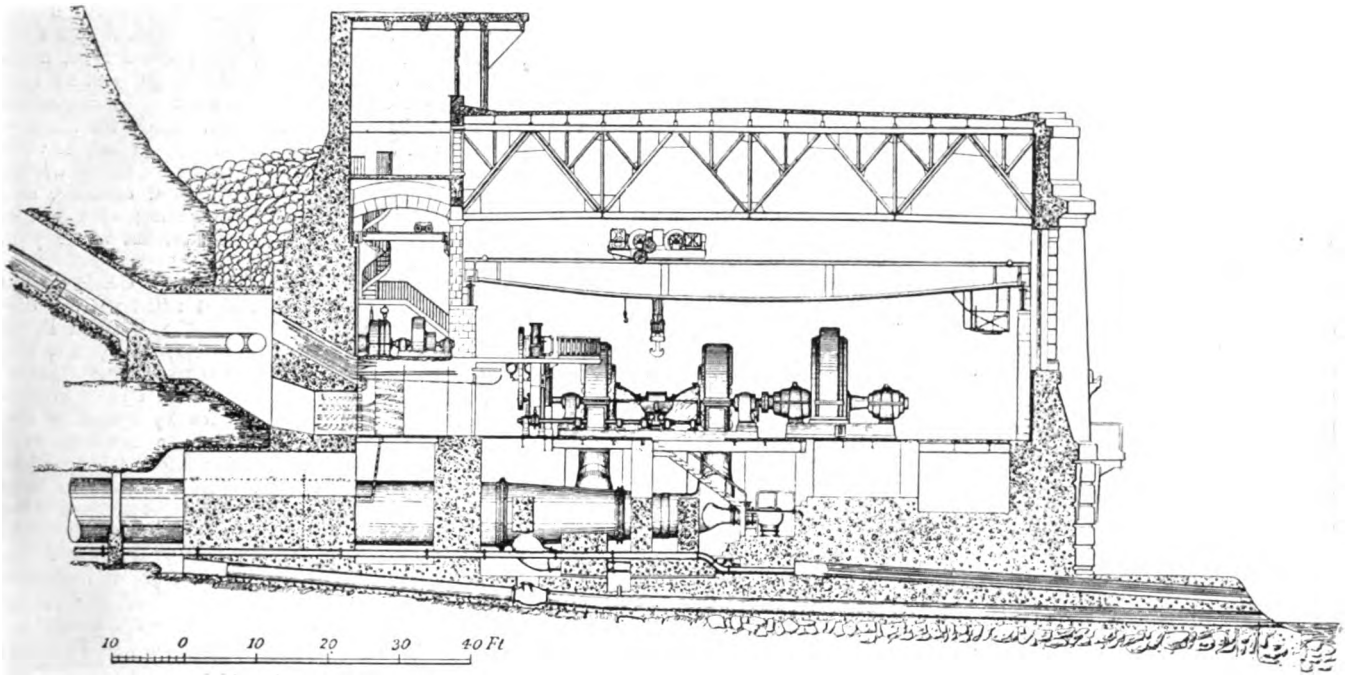


FIG. 1.—CROSS SECTION THROUGH THE NIAGARA GENERATING STATION OF THE ONTARIO POWER CO.

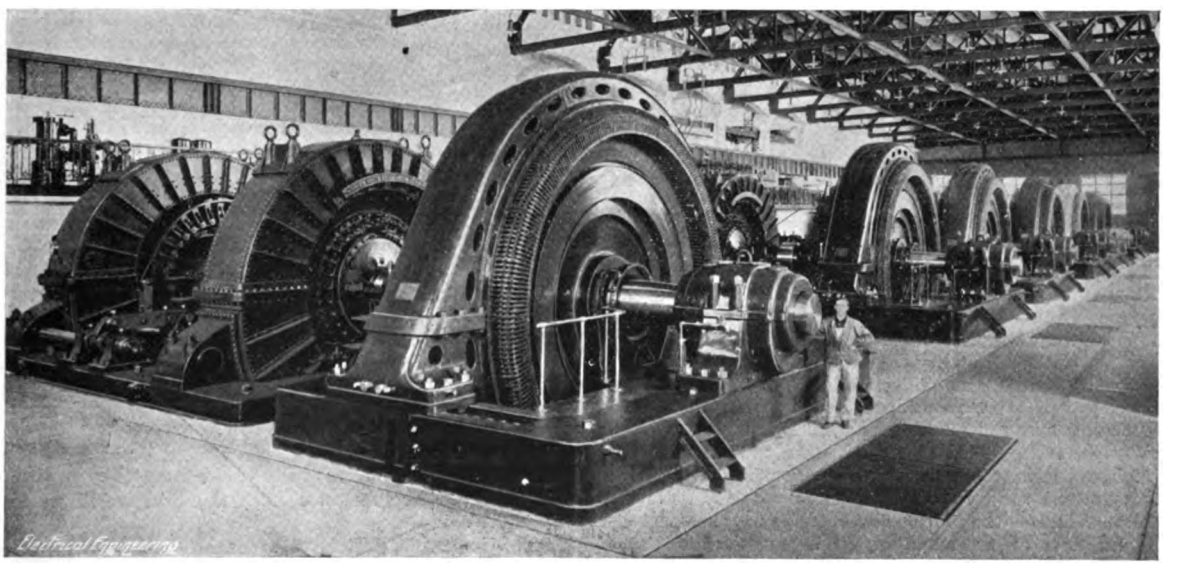


FIG. 2.—INTERIOR VIEW OF POWER STATION, SHOWING SIX 12,000-H.P. TURBINE UNITS.

The illustration of Fig. 3 shows the position of the power-house in relation to the Falls, and is especially interesting as showing the ice jam which occurred on March 5th, 1906.

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Fig. 2 is an interior view of the station, and Fig. 1 is a cross-section to show the general arrangement of the plant. Each generating unit consists of a horizontal double turbine direct coupled to a generator. The latter machines are wound for three-phase, 12,000 volts, 25 cycles, and run at 187 r.p.m. The total weight of each generator is 231 tons, and each was entirely assembled on the spot, including the building up of the laminated iron rotor, and the winding and insulating of the armature. The exciters are 375 kw., 300 r.p.m., 250 volt machines, direct coupled to turbines on the gallery overlooking the turbine floor, and supplied with water through 30-in. penstocks that connect with the main conduit through the cable tunnel. Each exciter can supply the fields of six generators. The turbines are of the Francis or inward-flow type, double, central discharge or balanced twin turbines, and are designed to deliver



FIG. 3.—VIEW OF POWER STATION, SHOWING HORSESHOE FALLS AND 1906 ICE JAM.

12,000 h.p. at 175 ft. head. Their shafts are 24 in. maximum diameter, and each carries two 78-in. cast-steel runners. Immediately above the cable tunnel entrance are mounted the main generator switches, and on one side the two turbine-driven exciters and their governors, and on the other the motor-actuated main field rheostats. In front of the switches are a few panels carrying exciter rheostats and switches, and the gear for actuating the penstock valves. To avoid dampness from spray from the adjacent fall, and to ensure the generators keeping cool in hot weather, a cold-air supply is led to each generator from a sub-floor chamber, communicating with external shafts, and the heated air is released through large roof ventilators.

The cables from the generators are single conductors, insulated with treated cambric. These cables are mounted on porcelain insulators in separate compartments, built up of thin shelves of reinforced concrete fastened to the concrete substructure of the power-house, and closed by asbestos doors readily removable for inspection. At no place are the cables of more than three generators brought near one another. Field circuits, exciter leads, and control wires are carried in iron conduits. The switchgear already outlined is controlled from the distribution-station on the hill above the power-house, and ordinarily the engineer in the latter has merely to attend to the supply of exciting current, but in case of serious trouble, the control of the first generator oil-switch, and of the field-switch is at his command. All communications, and orders from the distribution-station to the power-house, and *vice versa*, are effected by means of a "telautograph," thus ensuring a written confirmation of every order given. The outgoing generator-cables from the oil-switches go to cable heads supported directly under the gallery. Here they branch into three-core cables, two being required for each generator. These are paper insulated and lead covered, with steel armouring, covered with jute. These cables are taken to the distribution-house through a tunnel approximately 9ft. square with arched roof cut through the solid rock. This tunnel starts on a level with the main floor of the power-house, extends through the rear wall, and rises at an angle of 30 degrees until it has passed under the main water-conduits. For this portion of the distance it accommodates the two 30-in. diameter penstocks for the exciter turbines. After passing under the main conduits it rises at an angle of 60 degrees, and opens in a manhole half-way up the hill at the distributing station. The control cables for the operation of the governors, field-switches, and penstock valves are carried in iron conduits secured to the roof of the tunnel by hangers. At intervals a space is left in the conduit, and a wooden clamp holds the cable, and bears against the end of the conduit

The generating and distributing stations are nearly 600 feet apart with a difference of 260 feet in elevation. The distributing-station is divided into three longitudinal bays. The front bay contains the switches, bus-bars, &c., at generator pressure; the rear bay contains those at transmission pressure. Between, is the main bay, divided into two long transformer-rooms. Each generating unit has its individual cables, switches, and switchboard, section of bus-bars, transformers, interrupters, and high-pressure switches complete to the transmission lines, enabling independent operation. The low-pressure bay contains on the main floor the 12,000-volt automatic oil circuit breakers. In the transformer-rooms, the transformers stand in pits 6 feet below floor-level. Each transformer is fitted with a recording thermometer, and is of the oil-insulated, water-cooled type, three to a unit, connected in delta on the low voltage, and in star with earthed neutral on the high-voltage side. The secondary (line) voltage is approximately 62,000 volts. Each transformer has a normal capacity of 3,000 k.v.a., and weighs, complete with oil and case, approximately 50 tons. The high-voltage wiring from the transformers is insulated with treated cambric, and further protected by a braided fireproof covering of asbestos. It is supported on large porcelain insulators in the upper part of the transformer pits.

The area of distribution of the Ontario Power Co. is shown in the map of Fig. 4. Two 60,000-volt lines run from the distributing station for 6 miles to a point on the Niagara River near the town of Queenstown, where they cross the gorge, and connect with the lines of the Niagara, Lockport, and Ontario Power Company, delivering power for use in the United States. These lines consist of aluminium conductors 1⅛ inches in diameter, carried on steel towers 55 feet high to the top wire, with an average span of 500 feet. The insulators for this line are of porcelain, and weigh 35 lb. each. The cables are brought across the river in three spans, from steel cantilevers at the top of the cliff to steel towers at the water's edge on the other side. The Niagara, Lockport, & Ontario Power Co. is a transmission company only, and buys the power from the Ontario Power Co. From the Niagara River to Lockport, a distance of 16 miles, there are two lines, each capable of transmitting 30,000 h.p. From Lockport to Mortimer, a distance of 57 miles, there is a line having a capacity of 20,000 h.p., and from Mortimer East to Syracuse, a distance of 81 miles, there is a line having a capacity of 10,000 h.p. From Lockport to a point about 11 miles east, and then south to the West Shore, thence on the West Shore to Pittsford is a line having a capacity of 20,000 h.p. From Pittsford on the West Shore right-of-way east to Syracuse is a line having a capacity of 10,000 h.p. From Lockport south to a point south of Buffalo, there are two transmission lines, each having a capacity of 30,000 h.p. These two

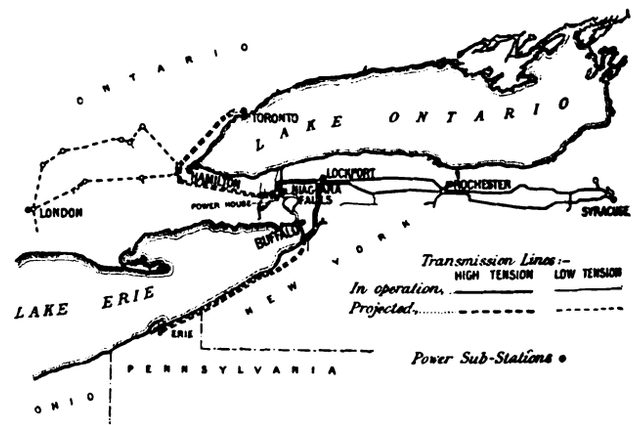


FIG. 4.—MAP SHOWING AREA SUPPLIED FROM THE ONTARIO POWER CO.'S NIAGARA STATION.

lines south will be eventualy extended through to the Niagara River, and so they are constructed for the full capacity of 30,000 h.p. The distance from the Niagara River to Syracuse is 154 miles.

The main-line structures are nearly all steel towers, and the standard line span 550 feet. On some portions, however, much longer spans are used, the longest at present installed being 1,253 feet. In every case on the 60,000-volt lines, each line of towers carries only one three-phase circuit. The main-line conductors installed so far are all of aluminium cable, except on a portion of the line between Mortimer and Syracuse, where, because of the long spans employed, it is preferable to use copper. The first of the steel towers installed were of the tripod type, made of lap-welded pipe; but the later towers are of structural shapes and galvanised. The insulator used on all

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the main-line construction consists of three shells cemented together by means of neat Portland cement, the whole insulator being cemented to a steel pin before attachment to the tower. The total height is 19 inches, and the diameter 14·5 inches.

The power generated by the Ontario Power Co. furnishes part or all of the public and private lighting in Niagara Falls, Welland, Stamford, and St. Catherines, Ontario; and Lockport, Depew, West Seneca, Hamburg, Batavia, Rochester, Canandaigua, Auburn, Baldwinsville, Phœnix, Fulton, and Syracuse, New York. Further, power is supplied to electric furnaces for the reduction of iron, copper, and other ores, and the manufacture of cement, calcium carbide, and lime nitrates in Port Colborne, Welland, Niagara Falls, and Thorold, Ontario, and Lewiston, Lockport, and Caledonia, New York. The railways and tramways supplied include the systems in Syracuse, Rochester, Canandaigua, Geneva, West Seneca, and Hamburg; and the interurban lines Syracuse, Lake Shore and Northern Syracuse and South Bay, Rochester and Geneva, Rochester and Mount Morris (Erie Railroad), Buffalo, Lockport and Rochester, Buffalo and Hamburg, and Buffalo and Dunkirk. Further, several large steel and other works requiring power are supplied.

In the early part of the year 1909 the Niagara River was partially frozen, and a large quantity of ice coming down from the lakes accumulated above the Falls, entirely blocking the American Fall, and partially blocking the Horseshoe Fall. This state of affairs did not in any way inconvenience the Ontario Power Company, who continued at work. Later, however, the lower river became blocked with ice, which piled up in the gorge and covered the Rapids, and finally even the Whirlpool (see ELECTRICAL ENGINEERING, April 29th, 1909, Vol. V., pp. 404 and 429). It appears that the water rose over forty feet above ordinary level and flooded the power-house. In April last, the company was still taking power in bulk from the Electrical Development Co., and the Canadian Niagara Co., whose power-houses, being situated on the Upper River, were not affected. The plant must have been submerged for some time, and it is anticipated that very considerable repairs and renewals will be required.

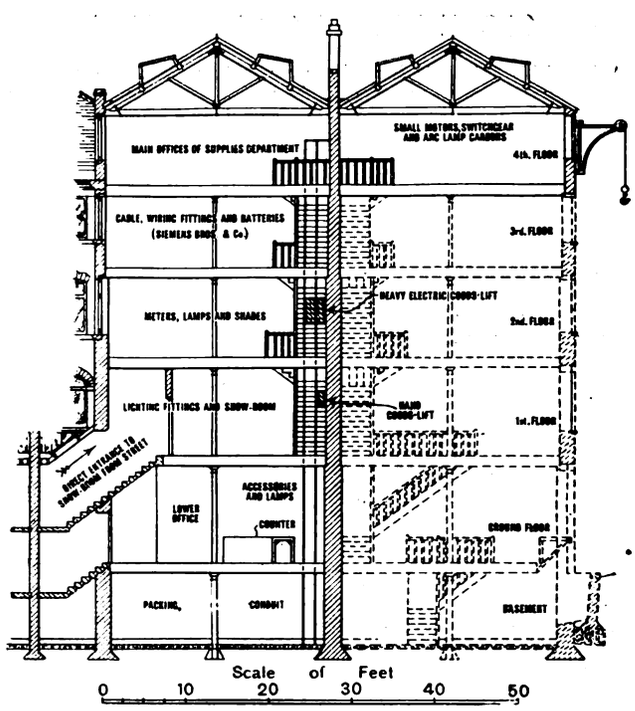
DISCUSSION.

Prof. W. C. UNWIN said that the development of 600,000 h.p. in the Niagara district in a comparatively short time, could be attributed to the financial, commercial, and engineering courage of the United States and Canada. The first installation had been dominated by the consideration that nothing was to be done to injure the beauty of the Falls. The generating station was placed two miles above the Falls, and the tail water was lead away by an underground tunnel, and discharged below the Horse Shoe Fall, nothing showing except a very unobtrusive tunnel mouth. That involved placing the turbines at the bottom of an excavation 200 ft. deep, and necessitated the use of vertical-shaft turbines. When the first installation, which now aggregated 200,000 h.p., was on the way, the United States engineers and financiers became a little disturbed at the prospect of competition from Canada, and obtained a concession on the Canadian side. That concession had now been developed by the Canadian Niagara Power Co., which had built a turbine house intended for 200,000 h.p., and a large part of this had already been installed. This power station had been modelled on the same principles as the original one, with vertical-shaft turbines placed at the bottom of a deep excavation, the tail water discharging through an underground tunnel in the same way. Another company proceeded on the same lines a little higher up the Niagara River, but as the ease of access for discharging the tail water below the Horse Shoe Fall was already occupied, this company made a tunnel for the tail water right under the Fall. Then the Ontario Power Co. came along, but found that they could not work on the same lines as the previous companies, and they carried their intake high up the river, and brought the water in underground pipes to a point a little below the Horse Shoe Fall, and then dropped it down to the generating station below the Fall. The Ontario Power Co. foresaw that the water in the lower river might flood their generating station, but they thought they were safe in placing the floor of the generating station about 20 ft. above the ordinary lower river level. This varied very little indeed in the ordinary way. Niagara River was supplied by an immense chain of lakes of an enormous area, and had an extraordinary constant supply of water all the year round. The only thing that changed the level of the river above or below the Falls were occasional winds which drove back the water in Lake Erie, and ice blocks which occurred in the lower river. As mentioned in the Paper, however, last winter there was an unprecedented ice block, and this provision proved to be insufficient. He believed they had had heaps of ice on the floor of the station, and had not yet started the works again. Probably the detail which had done most to make these hydraulic installations a success, and which had enabled the working of the large alternators in parallel, was the relay governor. This was very sensitive, and had no other function than just to open a small valve one way or the other, and so put in action a powerful hydraulic relay.

SIEMENS' LONDON STORES

THE extensive premises in Upper Thames Street, London, E.C., recently acquired by Messrs. Siemens Bros. Dynamo Works, Ltd., for offices and stores in connection with their Supplies Department, present several features of interest as regards both the general arrangements and the lighting. A few weeks ago we referred to the opening of these stores, and the equipment is now complete, and the business transferred from other premises in London is now in full swing.

As shown in the accompanying section, the main offices are situated on the top floor of the building, while the remaining four floors and the top floor of the adjacent building are devoted chiefly to stores. Packing is done in the basement, where there are also racks for wood casing and steel conduit. General sales, both to trade and the public, are conducted over the counter on the ground floor, where there is also a small office, an inquiry bureau, and the telephone exchange. In the large racks behind and to the side of the counter are tantalum lamps of the sizes most in demand, general wiring fittings, and accessories, arranged according to list numbers. The first floor is divided into two parts: one has been artistically decorated and fitted up as a showroom, and the other has racks and shelves for arc lamps and lighting fittings of all kinds. On the second floor are transformers, meters, tantalum and carbon-filament lamps, and holophane and other glass shades. The meters are arranged according to type and list number in open boxes, which slide out from the rack partitions like drawers and can be carried about if desired. The lamps are stored in deep wood boxes with metal-protected edges and hand-holes for carrying. All



SECTION THROUGH SIEMENS' UPPER THAMES STREET STORES BUILDING.

the boxes are of the same size, and each holds a definite number of lamps (in packing). These boxes are stacked on their sides so as to form partitioned shelves on the "Unit" system, each box bearing a label as to its contents, &c.

The third floor is devoted entirely to the manufactures of Messrs. Siemens Bros. & Co., and besides racks for cable, flexible and the metal-sheathed cable for the O.S. and other wiring systems, has a number of cupboards with sliding doors for the small fittings and accessories. Insulating tape, batteries, and the other products of the Woolwich Works are stored on this floor. The main offices of the Supplies Department are on the floor above, and adjacent to these is the stock of small motors, starters, fans, switch and fuse boxes, and arc-lamp carbons. Though only one floor is devoted to these commodities, there is a considerable stock of each, as the building is very much deeper than it is broad, and the available space has been utilised to the best advantage by the judicious placing of the racks.

The general lighting of all the floors, including the main offices and the basement, is by small "Economy" enclosed arc lamps taking 5 amps. and giving 24 burning hours. The counter on the ground floor and desks in corners and other places not well illuminated by the arcs have pendant tantalum lamps, while along each passage between the racks are hanging hand-lamps on the "Laurie" system. A steel wire is stretched along the

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ceiling for the certain distance of the rack, and the cable from the ceiling-rose at one end is suspended from the wire in a series of loops by rings which can run easily along the wire. The hand-lamp is suspended by a piece of braided cable from the last ring, and can be readily brought to any partition.

Steam-heating has been adopted, and there are only one or two motors running in the building, but a power circuit has been provided for the heating apparatus, &c., in the showroom. The main wiring from floor to floor is in steel conduit, but all the rest is surface wiring on the O.S. system. The new "Z" cartridge-type fuses are used. A private telephone system affords communication between the counter and offices and the various store-rooms, and there are two lifts: a 1-ton Waygood electric goods lift with rope control, and a small hand-operated lift.

As indicated in the sketch, the showroom can be reached direct from the street without passing through the sales room, and contractors can take or send their customers to inspect or choose fittings. It is thus a trade showroom, and should prove of considerable use to contractors who have not room at their offices to stock a large selection of fittings and accessories.

The head of the Supplies Department is Mr. A. H. Bate, who has his office on the top floor. In the lower office will be found Mr. T. Gladdy, who is always ready to give valuable advice on installation matters to contractors. Mr. W. H. Hitchcock, who is assisting Mr. Gladdy, needs no introduction from us, as he is already well known among the contractors of the London district in connection with the Aldchurch Yard depôt, the business of which has been transferred to these new premises.

CLOCK METERS ON TRAMCARS

SEVERAL attempts have been made to reduce the excessive energy consumption of electric trains and tramcars due to careless driving. On the elevated railways in Chicago and Philadelphia signals were set up at certain points to remind the drivers when to start coasting, &c., but this system, though it had a good effect, does not give any comparative record of the methods of different drivers. Meters were tried in many places, but proved to be too delicate for the work. As stated in ELECTRICAL ENGINEERING, October 14th, 1909, page 898, clocks indicating the total time current is on have been used with considerable success in Berlin. A new method, which is giving much satisfaction on the Manhattan Elevated Railway of the Interborough Rapid Transit Co., of New York, is to connect a similar clock in such a manner that the total time during which the car is coasting is recorded. This system is described in a recent issue of the *Electric Railway Journal* (New York), and its chief advantage over the Berlin system is that it affords a check both on the efficiency of controller manipulation and braking.

The coasting clock consists of a time-recording apparatus electrically interlocked with the air brake and the electrical control. One circuit is made through a contactor of the multiple-unit control system, and another through the piston of the brake cylinder, which closes the circuit when the piston is in the off position. Both of these circuits must be closed to allow the clock to run. The device works, therefore, only during the period in which current is shut off from the motors and before the application of the brakes. An automatic record of the time during which the clock runs is printed on a strip of paper contained within the case of the clock. Each motorman is provided with a key of distinctive design. When this key is inserted in the clock case at the beginning of a run it stamps the paper record in the clock with the motorman's distinguishing number. At the end of the run the motorman removes the key inserted in the clock at the beginning of the run, and by so doing stamps the final time on the paper slip, together with his number. The record can then be detached by the motorman and handed in with his time card. The results obtained with some experimental sets in New York have been so satisfactory that a large number of cars are to be equipped with this apparatus.

Iron and Steel Institute.—The annual general meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers, Great George Street, on May 4th and 5th, and the annual dinner on May 4th. The autumn meeting will be held at Buxton on September 27th to 29th. Members of the Institute are specially invited to attend the International Congress of Mining, Metallurgy, Applied Mechanics, and Practical Geology which is to be held at Düsseldorf in June.

High-lift Centrifugal Pumps.—Messrs. Drysdale & Co. (Bon Accord Engine Works, Yoker, Glasgow) are making a special form of high-lift centrifugal pump, and we learn that they recently obtained an 83 per cent. efficiency on a small pump with only an 8-inch diameter over blades. Two of their 14-inch pumps have been in use at the Yoker generating station of the Clyde Valley Electrical Power Co. for some little time for handling the circulating water, and are giving good results.

SIMPLEX ELECTRICITY METERS

SINCE the establishment, some months ago, of a meter-testing department at 116 Charing Cross Road by Simplex Conduits, Ltd., this branch of the firm's business has rapidly developed, and we are informed that among the users of the meters which the company are supplying are some of the largest

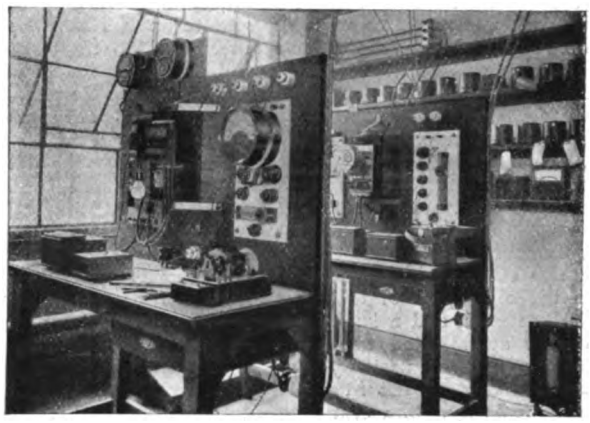


FIG. 1.—METER-TESTING BENCHES.

electricity corporations throughout the country. The new catalogue just issued gives particulars of a considerable range of patterns of both watt-hour and ampere-hour meter for continuous as well as for alternating currents, with diagrams of connections, and curves of accuracy at various loads. Time meters are also included, and two rate meters, with and without combined clock switch. A useful appliance listed is a portable check meter for testing house meters *in situ*. Considerable stocks of the most used types of meters are carried. We understand that some of these meters are being submitted to the Board of Trade for approval.

The meter-testing department, part of which is shown in Fig. 1, is equipped with extensive plant for carrying out complete tests on all types of electricity meters and for the calibrating thereof. Every meter is tested before being sent out,

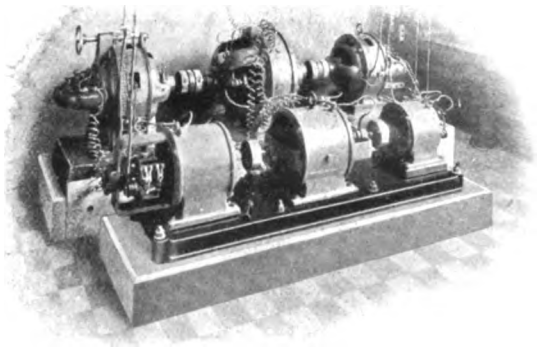


FIG. 2.—SPECIAL MOTOR-GENERATORS FOR METER TESTING.

in addition to being calibrated at the works. A special set of converting machinery (shown in Fig 2) is installed for changing the ordinary supply to give any phase displacement and frequency and all voltages up to 600. There are two separate motor-generators, one for continuous and one for alternating current, each comprising a motor driving two generators, one for the current circuit and one for the voltage circuit of the meter. In the case of the alternating set, the stator of the voltage machine can be shifted to give any phase displacement relatively to the current from 0 to 360°.

The Constantinople Telephone Contract.—The *Financial News* Constantinople correspondent states that a French company, jointly with the East European Cable Co., have lodged a protest in the Ottoman Chamber against the grant of the Constantinople telephone concession to the combined French, English, and American Syndicate. The French company asks for the contract to be cancelled, and has requested the intervention of the French Ambassador at Constantinople. It also announces its intention, if it does not obtain satisfaction in this direction, of bringing an action for 2,000,000f. damages.

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PENDING ELECTRICAL LAWSUITS

(Compiled by our own Editorial Staff and Strictly Copyright.)

THE first "electrical" appeal case which will be heard during the Hilary sittings is that in which the British Westinghouse & Manufacturing Co. appeal against the decision of Mr. Justice Joyce in October last in the arc lamp infringement action brought by them against Mr. G. Braulik.

The judge's decision was that the patent in question (the Bremer flame arc lamp patent, No. 18,786 of 1902) was invalid for want of subject-matter, and that, consequently, there was no infringement. The arguments and evidence in the case and the decision were fully reported in ELECTRICAL ENGINEERING, Vol. V. (1909), pages 571, 617, and 909.

Another case on the list is the appeal of J. H. Holmes & Co. from the judgment of Mr. Justice Neville in October last, in the action brought by them against the Associated Newspapers, Ltd., for alleged infringement of the Clatworthy patent for the electric driving of printing presses.

The judge decided that the patent was invalid, as the invention claimed had been described in a previously published article on an American system. The facts of the case, evidence, and decision were given in ELECTRICAL ENGINEERING, Vol. V., pages 915, 936, 948.

The General Incandescent Co., Ltd., are appealing against the verdict in October of a special jury before Mr. Justice Ridley in the action brought against them by the Armorduct Manufacturing Co., Ltd.

The latter company obtained judgment for the repayment of monies due to them, and alleged to have been paid to the General Incandescence Co. by a former agent of the Armorduct Co. (See ELECTRICAL ENGINEERING, October 21st, 1909, Vol. V., page 917.)

"Dr." Bodie is appealing against the verdict of a common jury in November last, according to which he had to refund the sum of £1,000 paid him by Mr. C. H. Irving as a premium. (See ELECTRICAL ENGINEERING, Vol. V., pp. 953 and 970.)

Among the other cases which are down for hearing is an action brought by the British Thomson-Houston Co., Ltd., against the Midland Railway Co.

This will be heard with witnesses before Mr. Justice Parker in the Chancery Division. It was down for hearing before Mr. Justice Warrington last sittings, but did not come on. The British Thomson-Houston Co. allege that the Midland Railway Co. have infringed their patents covering the multiple unit control system for electric traction. The equipments in question were supplied by Siemens Bros. Dynamo Works, Ltd., in connection with the conversion to electric traction on the single-phase system of the Heysham-Morecambe section of the Midland Railway Co.'s system.

Another interesting and important action down for hearing before Mr. Justice Parker is that brought by the Donnersmarckhütte Oberschlesische Eisen- und Kohlenwerke Akt.-Ges., of Zabcze, Germany, against the Electric Construction Co., Ltd., for alleged infringement of the two Ilgner patents for the automatic control of electrical flywheel sets in connection with the driving of reversing rolling-mills.

The hearing of this case is announced for Wednesday next, January 19th, subject to anything part heard. In the same list, but some considerable way down, is the hearing of an appeal against the Comptroller's decision in a dispute between the same parties. This was with regard to the method of procedure and the submission of evidence in connection with an application made by the Electric Construction Co. that the patents in question should be revoked under Section 27 of the Patents Act, 1907, on the ground that the patented articles are manufactured mainly outside the United Kingdom. Abstracts of the two patents in question, together with the Comptroller's decision with regard to the submission of evidence, were given in ELECTRICAL ENGINEERING, Vol. V., page 305. In the event of the Donnersmarckhütte Ges. losing their case for infringement, doubtless the Electric Construction Co. will withdraw their application for the revocation of the two patents, which would then be of less importance to them.

Mr. Justice Parker will also hear an action brought by the "Z" Electric Lamp Syndicate against Marples, Leach & Co., Ltd. (now the Adnil Electric Co., Ltd.), for alleged infringement of their patent No. 21,654 of 1906, granted to Dr. Hollefreund & Co., of Berlin.

The patent is for the use of phospham or other similar compound in the manufacture of metal filaments for the purpose of removing the carbon remaining over from the organic material used for binding together the tungsten particles for squirting. The patent was given in full in ELECTRICAL ENGINEERING, July 29th, Vol. V., page 685. An application was made by the "Z" Lamp Co. for further particulars from the defendants in reply, but this was dismissed by Mr. Justice Warrington. An appeal against this decision before Lords Justices Cozens-Hardy, Fletcher Moulton, and Farwell in October last was unsuccessful, and so the original objections to the patent put forward by the defendants will stand.

The list of causes for trial before Mr. Justice Neville in the Chancery Division include one between the Chemische Fabrik Griesheim Elektron and the Badische Anilin- und Sodafabrik. The petitions by Messrs. Dick, Kerr & Co., Ltd., and Messrs. A. Schonfield & Co., for the winding up of the British Aluminium Co., Ltd., and a summons against the Amalgamated Radio-Telegraph Co., Ltd., to restrain the sale of shares, will also be heard before Mr. Justice Neville. The cases before Mr. Justice Eve include one between Lloyds Bank, Ltd., and the Aluminium Corporation, Ltd.

Among the chief King's Bench actions is one by the Gravesend & District Electric Tramways Co., Ltd., against the Gravesend Corporation.

The Corporation supply electrical energy to the Tramway Co., and there is a dispute with regard to the metering of the current supplied for this purpose. The action may involve a question of principle with regard to the certification of meters.

A special jury action is down for hearing, in which Messrs. Ganz & Co. are suing Messrs. Willans & Robinson in respect of plant supplied, as sub-contractors, to the South Wales Electrical Power Distribution Co.

Messrs. Willans & Robinson were not paid in full by the Power Co., and consequently did not pay their sub-contractors in full. Messrs. Ganz claim that under their agreement they are entitled to full payment.

Other actions are by Mr. J. H. Lukach against the British Westinghouse Co., the North-Eastern Steel Co., Ltd., against Messrs. R. W. Blackwell & Co., Ltd., and the Surbiton Council *v.* Callender's Cable & Construction Co. There are also a number of actions against the London County Council, the London United Tramways Co., and the London Electrobus Co., for personal injuries.

Telegraph Traffic and Movements of Cable Ships.—It is gratifying to be able to announce the restoration of the cable between Paramaribo and Cayenne, the *bête noir* of the Compagnie Française des Cables Télégraphiques. On the 3rd inst. direct communication between Saigon and Bangkok was interrupted, and telegrams had to be routed *viâ* Pakse and Obone. Restoration was effected on the 9th inst., on which day the El Arich route ceased working. The following day saw the Bagdad-Bassorah line again working as usual. Among the cables yet to be repaired are those between Perim-Assab, Dakar-Conakry, Saigon-Doson, Bathurst-Bissao, and between Tourane and Amoy. The cable steamer *Henry Holmes* repaired the Jamaica-Colon cable, which was disturbed by the recent hurricane, and the *Ponyer Quetier* is off French Guiana attending to another cable. The *Mackay-Bennett*, of the Commercial Cable Co., is in company with the *Colonia*, of the Telegraph Construction and Maintenance Co., attending to the diversion of another of the former company's cables to Newfoundland, the shore end of which has already been laid off Cuckold's Cove, near St. Johns. The *Colonia* will then lay another cable between St. Johns and New York, and thus, notwithstanding the great outcry in connection with the landing rights, &c., at Newfoundland, the Commercial Cable Co. will have a duplicate route. The Anglo-American Telegraph Co.'s ship *Minia*, returned to Halifax, Nova Scotia, after a repair, and left again for a fault near Cape Breton. The *Contre Amiral Coubet* was in dock idle. The *Cambria*, of the Telegraph Construction and Maintenance Co., is repairing the Western Union Cables. She has been off the Flemish Cap for close on three months, working in about two miles of water in bad weather, and it is believed that new cable has had to be laid in to the extent of about 50 miles. The cable steamer *Relay* left Jamaica after repairing the cable there, and is now at New York. The members of the Royal West Indian Commission have left for New York, *en route* to the West Indies, to inquire into the possibilities of Canadian—West Indian trade, and in particular the subject of telegraphic communication. The Commission will report in what manner the complicated telegraphic conditions in the Caribbean may be improved, and the possibilities of wireless in this connection will be studied.

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THE INSTITUTION OF MINING ELECTRICAL ENGINEERS

A MEETING of the South Wales Section of the Institution of Mining Electrical Engineers was held at the Park Hotel, Cardiff, on Saturday, January 8th. Owing to the unavoidable absence, through a railway breakdown, of the President, Mr. Sydney F. Walker, the chair was taken by Mr. G. L. Stone (Mountain Ash). The meeting was well attended, not only by electrical engineers connected with collieries, but also by colliery managers and other engineers intimately connected with mining in general.

After the minutes of the last meeting had been read by the Secretary (Mr. E. Ivor Davies), the following gentlemen were elected to act on the General Purposes Committee:—Mr. J. A. Howell (Aberamman), Mr. James Phillips (Tredegar), Mr. W. J. Richards (Maesteg), Mr. C. G. Davies (Pontnewynydd), Mr. G. F. Soars (Swansea), Mr. C. Jones (Treorchy), Mr. L. Fokes (Treharris), Mr. G. L. Stone (Mountain Ash), Mr. T. G. Nelson (Pyle), Mr. A. Brodie (Tylorstown), and Mr. R. A. Gower (Ystradgynlais).

As will be noticed, the meeting endeavoured to elect a committee that would be, as far as possible, representative throughout the whole of South Wales. It was decided that the secretary should write to each member asking him if he is prepared to submit evidence in the inquiry which the Institution is making into electrical accidents in mines.

The membership is gradually creeping up, and no doubt before much time has elapsed, will be upwards of several hundreds.

The next meeting will be held at the Park Hotel, Cardiff, on January 29th, at 4 p.m., when Mr. Maurice's Paper on "Shocks" will be discussed. The Secretary, E. Ivor Davies, 96 Gt. Western Street, Moss Side, Manchester, will be pleased to send all information to prospective members.

WIRELESS TELEGRAPHY

CONSIDERABLE modifications have been made in the conditions under which the Australian Commonwealth are inviting tenders for the erection and equipment of wireless telegraph stations at Sydney and Fremantle (ELECTRICAL ENGINEERING, December 30th, p. 1107). Originally the tenders were to include alternative quotations for stations with a range of 500 miles and 1,000 miles. In accordance, however, with the opinions expressed at the recent wireless telegraph conference in New Zealand, firms are being requested to include quotations for stations having a range of 1,250 nautical miles, so as to assure continuous communication with New Zealand. Preference is also to be given to systems which will emit a definite musical note. The specification for these stations practically leaves all matters of detail to the tenderers. No tender will be considered in which is included any condition restricting the use of the apparatus to the purpose of communication with similar or specified apparatus only, it being the intention that, so far as the technical arrangements of the accepted installations will admit, the Government shall be at liberty to utilise the stations for communication without regard to the type of station communicated with. The stations are to be equipped so as to conform in every way to the requirements of the Radiotelegraphic Convention; and preference will be given to installations which are capable of rapid tuning on both sides of the normal wave-length. Either recorders or telephones may be used as receivers. Preference will also be given to a system in which waves equal in power but differing in length by more than a stated percentage, preferably not exceeding 3 per cent., may be rendered non-interfering at will. The system should also be capable of receiving damped or undamped waves. The stations shall have such a range as to enable them to exchange signals under the conditions of test at the guaranteed speed of working during day or night, and under any conditions as to temperature, or as to dryness or humidity of the atmosphere. The test includes communication with one of H.M. ships fitted with an Admiralty pattern of wireless equipment; or one of the R.M. steamships fitted with any standard system of wireless equipment; or any other steamship fitted with a system of wireless equipment approved for the purposes of the test by the Government and the contractor. The necessary buildings will be provided by the Government, but the tenders are to include prices for power plants as well as for the wireless installation itself.

Of 282 steamships that carried steerage passengers to and from the United States during the first half of 1909, says the *Electrical World* (New York), 143 were equipped with wireless telegraph apparatus. Of the 167 prominent coastwise vessels 97 are provided with wireless equipments. Secretary Nagel has recommended the passage of a Bill requiring wireless installations on passenger steamers carrying more than a certain number of passengers over more than a given distance.

The Stornoway cable broke down on Christmas Day, and has not yet been repaired, says the *Pall Mall Gazette*. All telegrams from and to Lewis, Harris, Uist, and Barra are being transmitted through the wireless stations at Lochboisdale and Tobermory, and their efficient handling is in striking contrast with the conditions which prevailed during previous breakdowns before the stations were established.

Arrangements have been made with the Natal Government by Marconi's Wireless Telegraph Co. for the erection of a wireless telegraph station at the Bluff, Durban, with a range of 350 miles.

It is announced that Dr. Lee De Forest has erected a wireless telephone apparatus on the top of the Metropolitan Opera House, New York, for the purpose of transmitting operas by means of wireless. He calculates that it will be possible for anyone within a radius of 50 miles to hear the opera by use of wireless receivers.

An American consular report states that a wireless telegraph and telephone station has been erected at Ebereswald, Germany, by the Telegraphenbau Anstalt C. Lorenz A.G., of Berlin. The system used is the Poulsen-Lorenz. The station has a range of 5,000 km.

A Bill has been read in the Canadian Parliament for the first time, the object of which is to compel all vessels over 1,000 tons leaving Canadian ports to have a wireless telegraph installation on board.

CORRESPONDENCE

THE T.A.C. TRAIN LIGHTING SYSTEM.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—We have read Mr. C. Vicarino's letter, and think that the system to which he refers was patented by him in this country in 1899 (No. 24,634). The system described in this patent has nothing whatever in common with ours, except the use of the differential dynamo, accumulators, and other devices common to most known systems, the method of automatic regulation being entirely different.

It may be interesting to note that some of the claims of Vicarino's patent are anticipated by Crompton's patent No. 5,168 of 1886. With regard to the use of iron-wire resistances for train lighting, which are an important feature of our system, this is due to Dr. Max Buttner, of the Gesellschaft fur Elektrische Zugbeleuchtung, Berlin.

It may be that Mr. Vicarino has supplied dynamos to the Russian Tudor Co., who hold from the Gesellschaft für Elektrische Zugebeleuchtung the rights for iron-wire resistances in Russia.

We think that any further comment is unnecessary.

Yours truly,
THE TUDOR ACCUMULATOR CO.,
Per L. R. Fraser.

119 Victoria Street, S.W., 5th Jan., 1910.

ELECTRIC FIRES.

To the Editor of ELECTRICAL ENGINEERING.

DEAR SIR,—As you have from time to time called attention to the absurd way in which fires are attributed to electricity, we send you herewith copy of a letter we have had to send to a number of papers, which had attributed a fire at Rockcliffe Park, near Darlington, to electricity, and as this report appeared in many London papers, and no doubt throughout the provinces, we should like you to give this letter publicity.

Yours faithfully,
COX-WALKERS, LTD.,
T. W. COX-WALKER, Secretary.

Darlington, Jan. 10th, 1910.

[COPY.]

ROCKCLIFFE PARK FIRE.

DEAR SIR,—In your issue giving an account of above, it is stated that the cause of this fire was supposed to be a fusion of electric wires, and as it is becoming a too common practice to ascribe unknown causes of fires to electric wiring, we should be glad if you will make it known that in this instance the fire has been clearly traced to a faulty chimney flue, and that so far from electric lighting being the cause of the fire, it was actually the means of giving the first intimation, through some lights going out, that something was wrong; and it was not until our men, who were engaged on other work in the building, went into the false roof to ascertain the cause that the fire was discovered, which had already been smouldering for many hours, if not days. In the interests of electric lighting generally we shall be glad if you will publish this letter.

Yours faithfully,
(Signed) COX-WALKERS, LTD.

7th Jan., 1910.

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the main-line construction consists of three shells cemented together by means of neat Portland cement, the whole insulator being cemented to a steel pin before attachment to the tower. The total height is 19 inches, and the diameter 14·5 inches.

The power generated by the Ontario Power Co. furnishes part or all of the public and private lighting in Niagara Falls, Welland, Stamford, and St. Catherines, Ontario; and Lockport, Depew, West Seneca, Hamburg, Batavia, Rochester, Canandaigua, Auburn, Baldwinsville, Phœnix, Fulton, and Syracuse, New York. Further, power is supplied to electric furnaces for the reduction of iron, copper, and other ores, and the manufacture of cement, calcium carbide, and lime nitrates in Port Colborne, Welland, Niagara Falls, and Thorold, Ontario, and Lewiston, Lockport, and Caledonia, New York. The railways and tramways supplied include the systems in Syracuse, Rochester, Canandaigua, Geneva, West Seneca, and Hamburg; and the interurban lines Syracuse, Lake Shore and Northern Syracuse and South Bay, Rochester and Geneva, Rochester and Mount Morris (Erie Railroad), Buffalo, Lockport and Rochester, Buffalo and Hamburg, and Buffalo and Dunkirk. Further, several large steel and other works requiring power are supplied.

In the early part of the year 1909 the Niagara River was partially frozen, and a large quantity of ice coming down from the lakes accumulated above the Falls, entirely blocking the American Fall, and partially blocking the Horseshoe Fall. This state of affairs did not in any way inconvenience the Ontario Power Company, who continued at work. Later, however, the lower river became blocked with ice, which piled up in the gorge and covered the Rapids, and finally even the Whirlpool (see ELECTRICAL ENGINEERING, April 29th, 1909, Vol. V., pp. 404 and 429). It appears that the water rose over forty feet above ordinary level and flooded the power-house. In April last, the company was still taking power in bulk from the Electrical Development Co., and the Canadian Niagara Co., whose power-houses, being situated on the Upper River, were not affected. The plant must have been submerged for some time, and it is anticipated that very considerable repairs and renewals will be required.

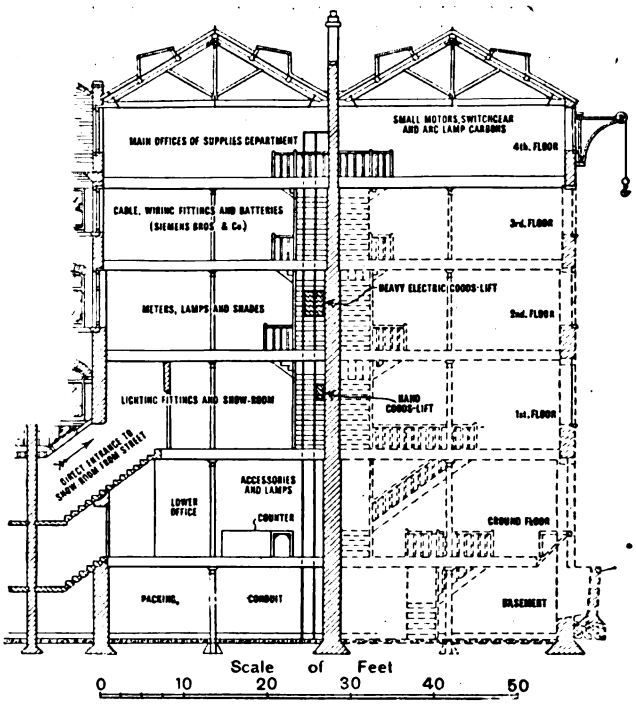
DISCUSSION.

Prof. W. C. UNWIN said that the development of 600,000 h.p. in the Niagara district in a comparatively short time, could be attributed to the financial, commercial, and engineering courage of the United States and Canada. The first installation had been dominated by the consideration that nothing was to be done to injure the beauty of the Falls. The generating station was placed two miles above the Falls, and the tail water was lead away by an underground tunnel, and discharged below the Horse Shoe Fall, nothing showing except a very unobtrusive tunnel mouth. That involved placing the turbines at the bottom of an excavation 200 ft. deep, and necessitated the use of vertical-shaft turbines. When the first installation, which now aggregated 200,000 h.p., was on the way, the United States engineers and financiers became a little disturbed at the prospect of competition from Canada, and obtained a concession on the Canadian side. That concession had now been developed by the Canadian Niagara Power Co., which had built a turbine house intended for 200,000 h.p., and a large part of this had already been installed. This power station had been modelled on the same principles as the original one, with vertical-shaft turbines placed at the bottom of a deep excavation, the tail water discharging through an underground tunnel in the same way. Another company proceeded on the same lines a little higher up the Niagara River, but as the ease of access for discharging the tail water below the Horse Shoe Fall was already occupied, this company made a tunnel for the tail water right under the Fall. Then the Ontario Power Co. came along, but found that they could not work on the same lines as the previous companies, and they carried their intake high up the river, and brought the water in underground pipes to a point a little below the Horse Shoe Fall, and then dropped it down to the generating station below the Fall. The Ontario Power Co. foresaw that the water in the lower river might flood their generating station, but they thought they were safe in placing the floor of the generating station about 20 ft. above the ordinary lower river level. This varied very little indeed in the ordinary way. Niagara River was supplied by an immense chain of lakes of an enormous area, and had an extraordinary constant supply of water all the year round. The only thing that changed the level of the river above or below the Falls were occasional winds which drove back the water in Lake Erie, and ice blocks which occurred in the lower river. As mentioned in the Paper, however, last winter there was an unprecedented ice block, and this provision proved to be insufficient. He believed they had had heaps of ice on the floor of the station, and had not yet started the works again. Probably the detail which had done most to make these hydraulic installations a success, and which had enabled the working of the large alternators in parallel, was the relay governor. This was very sensitive, and had no other function than just to open a small valve one way or the other, and so put in action a powerful hydraulic relay.

SIEMENS' LONDON STORES

THE extensive premises in Upper Thames Street, London, E.C., recently acquired by Messrs. Siemens Bros. Dynamo Works, Ltd., for offices and stores in connection with their Supplies Department, present several features of interest as regards both the general arrangements and the lighting. A few weeks ago we referred to the opening of these stores, and the equipment is now complete, and the business transferred from other premises in London is now in full swing.

As shown in the accompanying section, the main offices are situated on the top floor of the building, while the remaining four floors and the top floor of the adjacent building are devoted chiefly to stores. Packing is done in the basement, where there are also racks for wood casing and steel conduit. General sales, both to trade and the public, are conducted over the counter on the ground floor, where there is also a small office, an inquiry bureau, and the telephone exchange. In the large racks behind and to the side of the counter are tantalum lamps of the sizes most in demand, general wiring fittings, and accessories, arranged according to list numbers. The first floor is divided into two parts: one has been artistically decorated and fitted up as a showroom, and the other has racks and shelves for arc lamps and lighting fittings of all kinds. On the second floor are transformers, meters, tantalum and carbon-filament lamps, and holophane and other glass shades. The meters are arranged according to type and list number in open boxes, which slide out from the rack partitions like drawers and can be carried about if desired. The lamps are stored in deep wood boxes with metal-protected edges and hand-holes for carrying. All



SECTION THROUGH SIEMENS' UPPER THAMES STREET STORES BUILDING.

the boxes are of the same size, and each holds a definite number of lamps (in packing). These boxes are stacked on their sides so as to form partitioned shelves on the "Unit" system, each box bearing a label as to its contents, &c.

The third floor is devoted entirely to the manufactures of Messrs. Siemens Bros. & Co., and besides racks for cable, flexible and the metal-sheathed cable for the O.S. and other wiring systems, has a number of cupboards with sliding doors for the small fittings and accessories. Insulating tape, batteries, and the other products of the Woolwich Works are stored on this floor. The main offices of the Supplies Department are on the floor above, and adjacent to these is the stock of small motors, starters, fans, switch and fuse boxes, and arc-lamp carbons. Though only one floor is devoted to these commodities, there is a considerable stock of each, as the building is very much deeper than it is broad, and the available space has been utilised to the best advantage by the judicious placing of the racks.

The general lighting of all the floors, including the main offices and the basement, is by small "Economy" enclosed arc lamps taking 5 amps. and giving 24 burning hours. The counter on the ground floor and desks in corners and other places not well illuminated by the arcs have pendant tantalum lamps, while along each passage between the racks are hanging hand-lamps on the "Laurie" system. A steel wire is stretched along the

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ceiling for the certain distance of the rack, and the cable from the ceiling-rose at one end is suspended from the wire in a series of loops by rings which can run easily along the wire. The hand-lamp is suspended by a piece of braided cable from the last ring, and can be readily brought to any partition.

Steam-heating has been adopted, and there are only one or two motors running in the building, but a power circuit has been provided for the heating apparatus, &c., in the showroom. The main wiring from floor to floor is in steel conduit, but all the rest is surface wiring on the O.S. system. The new "Z" cartridge-type fuses are used. A private telephone system affords communication between the counter and offices and the various store-rooms, and there are two lifts: a 1-ton Waygood electric goods lift with rope control, and a small hand-operated lift.

As indicated in the sketch, the showroom can be reached direct from the street without passing through the sales room, and contractors can take or send their customers to inspect or choose fittings. It is thus a trade showroom, and should prove of considerable use to contractors who have not room at their offices to stock a large selection of fittings and accessories.

The head of the Supplies Department is Mr. A. H. Bate, who has his office on the top floor. In the lower office will be found Mr. T. Gladdy, who is always ready to give valuable advice on installation matters to contractors. Mr. W. H. Hitchcock, who is assisting Mr. Gladdy, needs no introduction from us, as he is already well known among the contractors of the London district in connection with the Abchurch Yard depôt, the business of which has been transferred to these new premises.

CLOCK METERS ON TRAMCARS

SEVERAL attempts have been made to reduce the excessive energy consumption of electric trains and tramcars due to careless driving. On the elevated railways in Chicago and Philadelphia signals were set up at certain points to remind the drivers when to start coasting, &c., but this system, though it had a good effect, does not give any comparative record of the methods of different drivers. Meters were tried in many places, but proved to be too delicate for the work. As stated in ELECTRICAL ENGINEERING, October 14th, 1909, page 898, clocks indicating the total time current is on have been used with considerable success in Berlin. A new method, which is giving much satisfaction on the Manhattan Elevated Railway of the Interborough Rapid Transit Co., of New York, is to connect a similar clock in such a manner that the total time during which the car is coasting is recorded. This system is described in a recent issue of the *Electric Railway Journal* (New York), and its chief advantage over the Berlin system is that it affords a check both on the efficiency of controller manipulation and braking.

The coasting clock consists of a time-recording apparatus electrically interlocked with the air brake and the electrical control. One circuit is made through a contactor of the multiple-unit control system, and another through the piston of the brake cylinder, which closes the circuit when the piston is in the off position. Both of these circuits must be closed to allow the clock to run. The device works, therefore, only during the period in which current is shut off from the motors and before the application of the brakes. An automatic record of the time during which the clock runs is printed on a strip of paper contained within the case of the clock. Each motorman is provided with a key of distinctive design. When this key is inserted in the clock case at the beginning of a run it stamps the paper record in the clock with the motorman's distinguishing number. At the end of the run the motorman removes the key inserted in the clock at the beginning of the run, and by so doing stamps the final time on the paper slip, together with his number. The record can then be detached by the motorman and handed in with his time card. The results obtained with some experimental sets in New York have been so satisfactory that a large number of cars are to be equipped with this apparatus.

Iron and Steel Institute.—The annual general meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers, Great George Street, on May 4th and 5th, and the annual dinner on May 4th. The autumn meeting will be held at Buxton on September 27th to 29th. Members of the Institute are specially invited to attend the International Congress of Mining, Metallurgy, Applied Mechanics, and Practical Geology which is to be held at Düsseldorf in June.

High-lift Centrifugal Pumps.—Messrs. Drysdale & Co. (Bon Accord Engine Works, Yoker, Glasgow) are making a special form of high-lift centrifugal pump, and we learn that they recently obtained an 83 per cent. efficiency on a small pump with only an 8-inch diameter over blades. Two of their 14-inch pumps have been in use at the Yoker generating station of the Clyde Valley Electrical Power Co. for some little time for handling the circulating water, and are giving good results.

SIMPLEX ELECTRICITY METERS

SINCE the establishment, some months ago, of a meter-testing department at 116 Charing Cross Road by Simplex Conduits, Ltd., this branch of the firm's business has rapidly developed, and we are informed that among the users of the meters which the company are supplying are some of the largest

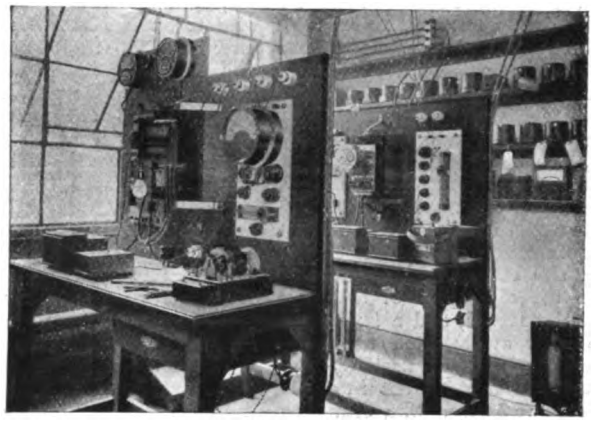


FIG. 1.—METER-TESTING BENCHES.

electricity corporations throughout the country. The new catalogue just issued gives particulars of a considerable range of patterns of both watt-hour and ampere-hour meter for continuous as well as for alternating currents, with diagrams of connections, and curves of accuracy at various loads. Time meters are also included, and two rate meters, with and without combined clock switch. A useful appliance listed is a portable check meter for testing house meters *in situ*. Considerable stocks of the most used types of meters are carried. We understand that some of these meters are being submitted to the Board of Trade for approval.

The meter-testing department, part of which is shown in Fig. 1, is equipped with extensive plant for carrying out complete tests on all types of electricity meters and for the calibrating thereof. Every meter is tested before being sent out,

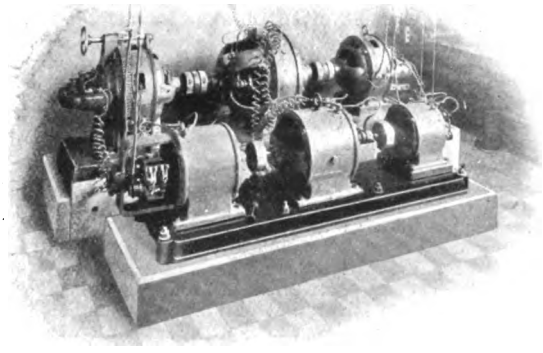


FIG. 2.—SPECIAL MOTOR-GENERATORS FOR METER TESTING.

in addition to being calibrated at the works. A special set of converting machinery (shown in Fig 2) is installed for changing the ordinary supply to give any phase displacement and frequency and all voltages up to 600. There are two separate motor-generators, one for continuous and one for alternating current, each comprising a motor driving two generators, one for the current circuit and one for the voltage circuit of the meter. In the case of the alternating set, the stator of the voltage machine can be shifted to give any phase displacement relatively to the current from 0 to 360°.

The Constantinople Telephone Contract.—The *Financial News* Constantinople correspondent states that a French company, jointly with the East European Cable Co., have lodged a protest in the Ottoman Chamber against the grant of the Constantinople telephone concession to the combined French, English, and American Syndicate. The French company asks for the contract to be cancelled, and has requested the intervention of the French Ambassador at Constantinople. It also announces its intention, if it does not obtain satisfaction in this direction, of bringing an action for 2,000,000f. damages.

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PENDING ELECTRICAL LAWSUITS

(Compiled by our own Editorial Staff and Strictly Copyright.)

THE first "electrical" appeal case which will be heard during the Hilary sittings is that in which the British Westinghouse & Manufacturing Co. appeal against the decision of Mr. Justice Joyce in October last in the arc lamp infringement action brought by them against Mr. G. Braulik.

The judge's decision was that the patent in question (the Bremer flame arc lamp patent, No. 18,786 of 1902) was invalid for want of subject-matter, and that, consequently, there was no infringement. The arguments and evidence in the case and the decision were fully reported in ELECTRICAL ENGINEERING, Vol. V. (1909), pages 571, 617, and 909.

Another case on the list is the appeal of J. H. Holmes & Co. from the judgment of Mr. Justice Neville in October last, in the action brought by them against the Associated Newspapers, Ltd., for alleged infringement of the Clatworthy patent for the electric driving of printing presses.

The judge decided that the patent was invalid, as the invention claimed had been described in a previously published article on an American system. The facts of the case, evidence, and decision were given in ELECTRICAL ENGINEERING, Vol. V., pages 915, 936, 948.

The General Incandescent Co., Ltd., are appealing against the verdict in October of a special jury before Mr. Justice Ridley in the action brought against them by the Armorduct Manufacturing Co., Ltd.

The latter company obtained judgment for the repayment of monies due to them, and alleged to have been paid to the General Incandescence Co. by a former agent of the Armorduct Co. (See ELECTRICAL ENGINEERING, October 21st, 1909, Vol. V., page 917.)

"Dr." Bodie is appealing against the verdict of a common jury in November last, according to which he had to refund the sum of £1,000 paid him by Mr. C. H. Irving as a premium. (See ELECTRICAL ENGINEERING, Vol. V., pp. 953 and 970.)

Among the other cases which are down for hearing is an action brought by the British Thomson-Houston Co., Ltd., against the Midland Railway Co.

This will be heard with witnesses before Mr. Justice Parker in the Chancery Division. It was down for hearing before Mr. Justice Warrington last sittings, but did not come on. The British Thomson-Houston Co. allege that the Midland Railway Co. have infringed their patents covering the multiple unit control system for electric traction. The equipments in question were supplied by Siemens Bros. Dynamo Works, Ltd., in connection with the conversion to electric traction on the single-phase system of the Heysham-Morecambe section of the Midland Railway Co.'s system.

Another interesting and important action down for hearing before Mr. Justice Parker is that brought by the Donnersmarckhütte Oberschlesische Eisen- und Kohlenwerke Akt.-Ges., of Zabeze, Germany, against the Electric Construction Co., Ltd., for alleged infringement of the two Ilgner patents for the automatic control of electrical flywheel sets in connection with the driving of reversing rolling-mills.

The hearing of this case is announced for Wednesday next, January 19th, subject to anything part heard. In the same list, but some considerable way down, is the hearing of an appeal against the Comptroller's decision in a dispute between the same parties. This was with regard to the method of procedure and the submission of evidence in connection with an application made by the Electric Construction Co. that the patents in question should be revoked under Section 27 of the Patents Act, 1907, on the ground that the patented articles are manufactured mainly outside the United Kingdom. Abstracts of the two patents in question, together with the Comptroller's decision with regard to the submission of evidence, were given in ELECTRICAL ENGINEERING, Vol. V., page 305. In the event of the Donnersmarckhütte Ges. losing their case for infringement, doubtless the Electric Construction Co. will withdraw their application for the revocation of the two patents, which would then be of less importance to them.

Mr. Justice Parker will also hear an action brought by the "Z" Electric Lamp Syndicate against Marples, Leach & Co., Ltd. (now the Adnil Electric Co., Ltd.), for alleged infringement of their patent No. 21,654 of 1906, granted to Dr. Hollefreund & Co., of Berlin.

The patent is for the use of phospham or other similar compound in the manufacture of metal filaments for the purpose of removing the carbon remaining over from the organic material used for binding together the tungsten particles for squirting. The patent was given in full in ELECTRICAL ENGINEERING, July 29th, Vol. V., page 685. An application was made by the "Z" Lamp Co. for further particulars from the defendants in reply, but this was dismissed by Mr. Justice Warrington. An appeal against this decision before Lords Justices Cozens-Hardy, Fletcher Moulton, and Farwell in October last was unsuccessful, and so the original objections to the patent put forward by the defendants will stand.

The list of causes for trial before Mr. Justice Neville in the Chancery Division include one between the Chemische Fabrik Griesheim Elektron and the Badische Anilin- und Sodafabrik. The petitions by Messrs. Dick, Kerr & Co., Ltd., and Messrs. A. Schonfield & Co., for the winding up of the British Aluminium Co., Ltd., and a summons against the Amalgamated Radio-Telegraph Co., Ltd., to restrain the sale of shares, will also be heard before Mr. Justice Neville. The cases before Mr. Justice Eve include one between Lloyds Bank, Ltd., and the Aluminium Corporation, Ltd.

Among the chief King's Bench actions is one by the Gravesend & District Electric Tramways Co., Ltd., against the Gravesend Corporation.

The Corporation supply electrical energy to the Tramway Co., and there is a dispute with regard to the metering of the current supplied for this purpose. The action may involve a question of principle with regard to the certification of meters.

A special jury action is down for hearing, in which Messrs. Ganz & Co. are suing Messrs. Willans & Robinson in respect of plant supplied, as sub-contractors, to the South Wales Electrical Power Distribution Co.

Messrs. Willans & Robinson were not paid in full by the Power Co., and consequently did not pay their sub-contractors in full. Messrs. Ganz claim that under their agreement they are entitled to full payment.

Other actions are by Mr. J. H. Lukach against the British Westinghouse Co., the North-Eastern Steel Co., Ltd., against Messrs. R. W. Blackwell & Co., Ltd., and the Surbiton Council *v.* Callender's Cable & Construction Co. There are also a number of actions against the London County Council, the London United Tramways Co., and the London Electrobus Co., for personal injuries.

Telegraph Traffic and Movements of Cable Ships.—It is gratifying to be able to announce the restoration of the cable between Paramaribo and Cayenne, the *bête noir* of the Compagnie Française des Cables Télégraphiques. On the 3rd inst. direct communication between Saigon and Bangkok was interrupted, and telegrams had to be routed *viâ* Pakse and Obone. Restoration was effected on the 9th inst., on which day the El Arich route ceased working. The following day saw the Bagdad-Bassorah line again working as usual. Among the cables yet to be repaired are those between Perim-Assab, Dakar-Conakry, Saigon-Doson, Bathurst-Bissao, and between Tourane and Amoy. The cable steamer *Henry Holmes* repaired the Jamaica-Colon cable, which was disturbed by the recent hurricane, and the *Ponyer Quetier* is off French Guiana attending to another cable. The *Mackay-Bennett*, of the Commercial Cable Co., is in company with the *Colonia*, of the Telegraph Construction and Maintenance Co., attending to the diversion of another of the former company's cables to Newfoundland, the shore end of which has already been laid off Cuckold's Cove, near St. Johns. The *Colonia* will then lay another cable between St. Johns and New York, and thus, notwithstanding the great outcry in connection with the landing rights, &c., at Newfoundland, the Commercial Cable Co. will have a duplicate route. The Anglo-American Telegraph Co.'s ship *Minia*, returned to Halifax, Nova Scotia, after a repair, and left again for a fault near Cape Breton. The *Contre Amiral Coubet* was in dock idle. The *Cambria*, of the Telegraph Construction and Maintenance Co., is repairing the Western Union Cables. She has been off the Flemish Cap for close on three months, working in about two miles of water in bad weather, and it is believed that new cable has had to be laid in to the extent of about 50 miles. The cable steamer *Relay* left Jamaica after repairing the cable there, and is now at New York. The members of the Royal West Indian Commission have left for New York, *en route* to the West Indies, to inquire into the possibilities of Canadian—West Indian trade, and in particular the subject of telegraphic communication. The Commission will report in what manner the complicated telegraphic conditions in the Caribbean may be improved, and the possibilities of wireless in this connection will be studied.

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existing circumstances, could not be worked by this means with commercial advantage.

In addition to the above extracts, the report reviews the progress of locomotion in London for the period mentioned in its widest aspect, including the housing problem, street improvements, regulation of street traffic, accidents on railways, fares, &c. There are also appendices to the report consisting of a comparison of locomotion and traffic conditions in London and in Paris; statistical information regarding railways, tramways, and street traffic; and a large amount of information concerning population and rents. There is also reprinted the evidence given on behalf of the London County Council before the Royal Commission on London traffic.

THE GERMAN ELECTRICAL INDUSTRY

Birmingham Discussion

THE Paper entitled, "Notes on Methods and Practice in the German Electrical Industry," by Messrs. L. J. Lepine and A. R. Stelling, which was read on Thursday, December 9th, before the Institution of Electrical Engineers in London, and was also discussed in Manchester on Tuesday, December 14th, was further discussed by the Birmingham Section of the Institution on January 5th. In the Paper, a long abstract of which was given in our issue of December 16th, Vol. V., page 1057, the authors compared the principal features of German and English manufacture and design of electrical machinery. They considered the following factors contributory to the success of German manufacture:—Commercial enterprise, good general management, close study given to schemes, large capital, and backing by banks. The two-shift system, cheap labour, and thorough specialisation, are also important factors in competition. In design, they said, England is in no way behind, in fact, in several cases the English designers are more far-seeing, and their designs are more practical than those of their German competitors.

Mr. R. K. MORCOM (Messrs. Belliss & Morcom), in opening the discussion, first referred at considerable length to the discussion on the Paper which had previously taken place in London, with special reference to the legitimacy or otherwise of discussing matters affecting electrical engineers generally. He considered that if the ruling of the President on that occasion was to be accepted as final, then it was hard to say what really was open to discussion. He held the view that any question affecting the well-being of the members of the Institution was open to discussion, and referred to clause 3 B. in the Memorandum of Association in support of his contention. Referring to the Paper, Mr. Morcom said that after a recent tour of inspection of German works he came to the conclusion that the shops were not generally so ship-shape as our own. Furthermore, the kw. output per man employed was not so great as in this country. He disagreed with the authors that foreign departments were peculiar to German works, and said that most large English firms had similar departments; in fact, his own firm had separate departments to deal with various portions of the globe.

Mr. R. ORSETTICH (General Electric Co.) was of the opinion that the German banks were strong because of the law which prohibited the issue of shares by any company of less value than £50. This was beneficial to the companies because the shares were held by the banks, being too costly for the average private investor, and therefore the credit of the company was the credit of the bank. He did not consider that double shifts were of great benefit as regards economical production, as he felt that there was considerable over-production in Germany, not only of goods, but also of qualified engineers. So much was this the case that men with high degrees were frequently to be found working as foremen and in charge of stores. Mr. Orsettich laid stress upon the great advantage which Germany obtains from the attention paid to scientific investigation. As an instance of this, he mentioned that during the great trade depression the only department in which expenses were not cut down was that for scientific investigation

Mr. F. J. MOFFETT (Messrs. Moffett & Rosher) considered that English manufacturing firms should take a leaf out of the German book and enter into working agreements "to prevent injurious competition," as was done by the amalgamated firms in Germany. The example had been set in this direction by the railway companies, the cable makers, and to a certain extent by meter manufacturers, and the financial results had quite justified the adoption of such agreements. In connection with the electro-trustee banks, there seemed scope for similar institutions in this country. He had been interested in a water-power scheme in Africa, the concession for which had been obtained from the Portuguese Government, who guaranteed a sufficient payment for the public lighting of the streets, Government offices, and residences, to pay a minimum dividend of 5 per cent. on the capital necessary; but it was not found possible, in spite of repeated efforts to induce any English manufacturing firm to finance the scheme. As regards the foreign departments, he was pleased to find on a visit to Germany that this, in the case of one of the largest firms, was almost entirely staffed by Englishmen. This went to show that it was not English engineers who were at fault, but that it was financial backing which was required. The system which prevailed in Germany of firms insisting on the acceptance of their own specification, tended to make the manufacturers very arbitrary in their methods. When testing some plant for South America at one of the German works, the hinges of the switches were found to be used for carrying current, in spite of the fact that it was specified that they were not to be so used, and great difficulty was experienced in getting this altered. In England, manufacturers had the benefit of the researches and advice of the Engineering Standards Committee, which represented all sections of the industry, including purchaser's engineers, as well as the makers. Consequently a less one-sided view was taken as to the requirements.

Mr. S. P. SMITH (Siemens Bros.' Dynamo Works, Ltd.) said that after the experience of some years in Germany as a research student, he had come to the conclusion that, speaking generally, the plants in that country were elaborate, and the reserves far too large; this also applied to Switzerland and Italy. He considered that the higher training of students and foremen was of no great value to them. In his experience, young engineers usually started at £4 per month instead of £6 5s., as stated by the authors. German designs of electrical machinery were, in his opinion, not so good as ours.

Dr. G. C. GARRARD (General Electric Co.) held that any superiority possessed by Germany was due to the scientific spirit of their engineers.

Mr. L. J. LEPINE, in reply, said that electrical firms could not afford to have representatives stationed abroad as advocated by Mr. Morcom, but suggested that several firms making dissimilar goods should combine and send abroad a representative and staff who could deal with complete schemes on the spot. He said that it would not be possible for English firms to combine as suggested by Mr. Orsettich, because no one could be found who would buy up all the competing firms. The rules of the Verband Deutsche Verein correspond to our Engineering Standards Committee, but the former were frequently not complied with. The author would not admit Mr. Smith's figures as to the salary of German engineers.

Dr. KAPP (Birmingham University), in proposing a vote of thanks to the author, said that he repeatedly received letters from his old students asking him to find them positions in England as they were crowded out in Germany.

[It had been intended that Mr. R. D. Gifford's Paper on "The Influence of various Cooling Media upon the rise in temperature of Soft Iron Stampings," should be read and discussed, but owing to the lateness of the hour it was postponed until the next meeting.]

ALUMINIUM SOLDER

ANOTHER new solder for aluminium and its alloys has just been introduced on the market. This is known as the "Premier" brand, and can be obtained from Charles Ruff & Co. (30 Kirby Street, Hatton Garden, London, E.C.). It is manufactured in three grades. The softest grade can be used with an ordinary copper bit, and is suitable for light work and small repairs; the other two grades are harder, and necessitate the use of a blow-pipe. No flux is required, and of course the ordinary fluxes must on no account be used, as they attack the metal. The parts to be soldered are first cleaned by scraping away the oxide from the surface, and are then uniformly heated with a blow-pipe until sufficiently hot to melt the stick of solder on. This temperature is slightly above that necessary for ordinary solders. After a flow of solder over the surface has been obtained, the molten solder is scratched through with a steel scraper or brush, so as to remove the oxide and cover the surface with a thin clean covering. The two parts are then sweated together with the blow-pipe and allowed to cool slowly. With regard to chemical action, a joint which was made nine months ago shows no sign of corrosion. The solder is an alloy of aluminium, and weighs about half as much as ordinary solder, so that about twice as many sticks go to the pound. The price of all three grades is 12s. per lb. Messrs. Charles Ruff & Co. will be pleased to repair any aluminium casting, such as a broken gear-case, free of charge for any firm desiring a proof of the efficacy of the new solder.

S.E. & C.R. Electrification.—It is stated that, owing to the success of the single-phase line of the London, Brighton & South Coast Railway Co. between London Bridge and Victoria, the directors of the South-Eastern & Chatham Railway Co. are considering the question of dealing with some of their suburban lines in a similar manner. We understand, however, that no detailed scheme has yet been prepared, although the matter has been under discussion.

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REVIEWS OF BOOKS

Chats on Electricity. By Frank Broadbent. 196 pp. 7½ ins. by 5 ins. 25 illustrations. (London: T. Werner Laurie.) 3s. 6d.

WITH the ever-widening range of the applications of electricity in daily life, bringing practically everybody in contact with electrical phenomena, an increasing need arises for "non-technical" persons to have, at any rate, a bowing acquaintance with electrical principles. Mr. Broadbent addresses his remarks to this class, and, without skimming too lightly on the surface, or on the other hand diving too deep in the theoretical, he supplies in a suitable, chatty form enough to enable the average man to understand to some degree what he sees around him and reads about. The first three chapters deal with general principles, but in our opinion it would have been better to commence with the ideas underlying currents and circuits before treating of the less familiar electrostatic phenomena. The succeeding part is more practical, and treats in simple way of electric motive power and traction. A chapter follows entitled Electricity in the Office and at Home, and deals with bells, telephones, light, and heat, and this will probably be the most sought after part of the book. Telegraphy is next considered, and a striking illustration both of the utility and limitations of wireless telegraphy is provided by an extract from the log of the wireless station at Siasconset at the time of the disaster to the ss. *Republic*, showing how seriously the clashing of signals from various sources interfered with one another. The last chapter is entitled Practical Considerations, and gives useful information, causes of fuses blowing, bells refusing to ring, &c., as well as a clear exposition of the maximum demand system.

Heat for Engineers. By C. R. Darling. 430 pp. 8¾ ins. by 5½ ins. 110 illustrations. (London E. & F. Spon.) 12s. 6d.

THIS is a practical treatise on heat and its applications in the various branches of engineering, and is quite unique in the character and scope of its contents. It is not a text-book, neither is it a manual to aid students in preparing for any particular examination. The subjects dealt with are of an essentially practical nature, but in all cases the fundamental principles are clearly explained in order that a thorough grasp of the subject may be obtained. The author has been for some years lecturer in heat at the City and Guilds Technical College, Finsbury, and a number of original experimental methods and commercial tests are included in the book. A brief and lucid treatment of the nature of heat and the relation between heat and other energy units is followed by a useful chapter on the calorific value of fuels, which includes a description of the author's calorimeter for routine tests in central stations. Practical hints on combustion and smoke-prevention are given, and the chapter closes with some very brief references to electric resistance and arc furnaces and the "Thermit" welding process. A clear treatment of the phenomena of specific heat and expansion is followed by brief descriptions of the practical effects and applications of expansion. The precautions that have to be taken on account of the expansion of girders, rails, boiler plates, steam-pipes, and pistons, and the utilisation of expansion as exampled by thermo-regulators, fire alarms, compensated balance-wheels, steam-traps, &c., are described. Following this are chapters dealing with the more elementary side of the subject, including thermometric scales and the general properties of gases. But the next is a thoroughly practical and up-to-date chapter on pyrometry, and includes descriptions of various forms of platinum resistance and thermo-couple pyrometers, and recording instruments. The principles and construction of heat-radiation and optical pyrometers are also described. The laws of fusion are then explained, and the applications described include the Grinnell and other "sprinklers" for fire protection, boiler safety-plugs, freezing mixtures, &c. An interesting chapter on the liquefaction of gases is followed by illustrated descriptions of representative refrigerating plants on various systems, with worked numerical examples to illustrate the thermodynamic principles involved. In a useful section on heat-insulating materials are given particulars of an electrical method of testing steam-pipe lagging; and the remaining sections cover ventilation, draught of chimneys, and the efficiency of heat-engines, although only the first two laws of thermo-dynamics are discussed. In the chapter on radiation there is an interesting paragraph on the relation between temperature and luminosity, in which the cause of the high efficiency of tantalum and tungsten filaments as against carbon filaments is discussed. The book is illustrated with helpful diagrams and drawings, and should prove a useful work of reference for engineers of all classes.

LOCAL NOTES

ABERDEEN: *Supply to Tramway Co.*—The Council are still unable to come to an agreement with the Aberdeen Suburban Tramways Co. as to the price which the latter shall pay for electrical energy. The company have now made the following alternative offers:—(1) They will agree to pay 1.4d. per Board of Trade unit supplied to them for the period of three years from June, 1909, or (2) they are willing to pay for such longer period as the Corporation and they may agree on, a price calculated at 0·35 of a penny (over a third of a penny) per Board of Trade unit above the price per unit which the Corporation Tramways may be paying to the electricity department for their supply from time to time. Assuming that the Corporation Tramways are getting their supply at cost price, the latter offer would give the Corporation a clear annual profit of over £200 per annum on this company's account. This letter has been remitted to the Electricity Committee for consideration and report.

ARGENTINE: *Buenos Ayres: Tramways.*—At present, the Anglo-Argentine Tramways Co. have 1,200 electric cars in service, in addition to 600 trailers, but in order to meet the ever-increasing demand, they have on order, says the *Review of the River Plate*, a further 125 cars and 80 trailers. The returns for the first ten months of 1909 show that 231,000,000 passengers were carried, compared with 208,000,000 passengers in the corresponding period of the previous year.

Subway Tramways.—H.M. Consul at Buenos Aires reports that an *ad referendum* agreement has been made between the Mayor of that city and the Anglo-Argentine Tramway Company for the construction of a series of underground tramways, to run in various directions under the city of Buenos Aires, in connection with the present above-ground system. The following lines may be constructed, viz.:—(1) Between Plaza Mayo and Plaza Once de Septiembre, running underneath the Avenida de Mayo; (2) between Retiro and Plaza Constitución, running under Calle Maipú or Calle Florida and the continuations of these on the south side of the Avenida de Mayo; (3) between Plaza Mayo and Plaza Italia, Palermo. Each of these is to have a double line, and is to have direct connection with the above-ground lines. The first line is to be completed before June 1st, 1913; the second before December 31st, 1914; the construction of the third line depends upon whether the municipality finally carry out the project of making a diagonal avenue. A newspaper extract containing the text (in Spanish) of the most important clauses of the contract may be seen by British firms interested on application at the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

BERLIN: *Transport Facilities.*—Particulars have been published of the receipts of the public transport companies in Berlin during 1909. These are as follows:—Berlin tramways, £1,888,500; Electric Railways (elevated and underground), £3,567,700; Berlin Omnibus Co., £459,300. The tramway receipts are slightly less than in the previous year, owing to competition by a new section of electric railway opened in 1908.

BOURNEMOUTH: *Tramway Accident Claims.*—The Tramways and Parliamentary Committee have presented a report upon the settlement of the claims in connection with the tramway accident in May, 1908. The total claims amounted to £26,450. The sum paid in compensation and costs in respect of those killed was £3,619, and in the other cases £7,705. After the amount payable by the insurance companies has been received, the net liability falling upon the Corporation is £8,508. In the accident in question seven persons were killed and 26 injured.

CHELTENHAM: *Electricity Accounts.*—The gross receipts from the electricity undertaking for the past year were £22.609 against £23,700 in the previous year. This decrease is attributed entirely to the use of metal filament lamps. The number of consumers increased during the year from 967 to 1,126.

DUBLIN: *Tramway Wayleaves Dispute.*—The Estates and Finance Committee recommend that the dispute between the Corporation and the Dublin United Tramways Co. as to wayleaves for the use of the streets should be taken to court, as the parties were unable to come to an agreement. Up to the year 1900, no question arose as to the amount of the annual payment, as the mileage being under twenty miles, the company were liable for the minimum of £10,000 as fixed in the agreement. By the construction in that year of the Ballybough extension, the mileage became in excess of twenty miles, and wayleave became chargeable thereon at £500 per street mile. Since then it appears that no additional payment has been made by the company, in consequence of a difference of opinion as to the meaning of the words "per street mile" in the agreement. The company states that the Corporation wish to charge double the mile rate in the case of crossings where there are four tracks, for instance, and argue that if this is the true construction of the agreement, then where there is

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only single track half rate should be charged, and that therefore they have paid at too high a rate in the past. The Council claim a balance of £4,209 as due to them. The report of the Estates and Finance Committee was rejected, it being the general opinion that an amicable settlement should be possible, and so avoid law costs.

DUNDEE: *The New Electricity Works.*—Councillor Payton has given notice that at the next meeting of the Council he will move that a full report be prepared showing estimates and actual costs of the new electricity works, buildings, and equipment; the cause of the delay in the completion of the works, and what parties are responsible for the loss involved in claims, and otherwise.

EASTBOURNE: *Electricity Reserve Fund.*—At the last meeting of the Town Council it was stated that the Electricity Reserve Fund now amounts to £10,737, in addition to a contingency fund of £4,000.

FAREHAM: *The New Electricity Works.*—Messrs. May & Hawes, the Council's consulting electrical engineers, have reported that part of the town is now being supplied from the new works. The second portion of the new plant is practically ready for the change-over, which will be made very shortly. The arc-lamp posts are being erected, and the lamps will in all probability be ready in a few days. The report states that the running of the plant has been exceedingly satisfactory, and that the fuel-consumption tests are better than had been expected.

GRIMSBY: *Supply to Docks.*—Twelve months' notice has been received by the Town Clerk of the intention of the Grimsby Dock Company to terminate the agreement under which they receive electrical supply.

HENDON: *The Trolley Omnibus.*—The North Metropolitan Electric Power Supply Co. have asked the Council's permission to erect posts and wires in connection with the railless cars which the Metropolitan Electric Tramways, Ltd., propose to run between the Borroughs and Golders Green Tube Station. The consideration of the matter has been postponed in order that further particulars may be obtained.

IRELAND: *Monaghan: Electric Lighting.*—An offer has been made to the Council to provide public electric lighting, and at the next meeting a resolution is to be moved that the question of obtaining a loan for the purpose be considered.

LIVERPOOL: *Tramway Traffic.*—The receipts from the Corporation tramways from January 1st to December 31st, 1909, were £560,218, against £562,029 in 1908. The passengers carried in 1909 numbered 121,532,939, against 121,927,883 in 1908. The mileage in 1909 was 11,952,373, against 12,244,353. The decrease in receipts for 1909 would have amounted to only £253 but for the fact that 1908 was a leap year, and included an extra day's receipts.

LLANELLY: *Electric Lighting.*—As almost a year has expired since the Llanelly District Electric Light & Traction Co. entered into an agreement for the electric lighting of the town, the Town Clerk recently asked the company what steps they were taking to put this agrement into force. He has been assured by the company that they are proceeding with the matter, and will have the installation complete within the period agreed upon.

MERTHYR TYDVIL: *Overhead Wires.*—The Dowlais Chamber of Trade has passed a resolution against the use of overhead mains by the Merthyr Tydvil Corporation for the electric lighting of this district.

PARIS: *Underground Railway.*—The *Times* Paris correspondent states that an important new section of the underground railway was opened on Saturday. The line has a total length of 11½ km., and runs from the Porte de Clignan-court by the Gare du Nord to the Paris Central Markets, and crosses the Seine at the Châtelet, whence it turns westwards under the Place St. Michel, and runs by the Odéon and St. Sulpice under the Rue de Vaugirard to the Gare Montparnasse and to the Boulevard Raspail, passing thence in a fairly straight line to the Porte d'Orleans.

READING: *Political Meeting in Car-sheds.*—The recent meeting in the car-sheds of the Corporation, when Mr. Lloyd George spoke on behalf of the local candidate, Mr. Rufus Isaacs, K.C., was, we believe, the first occasion on which car-sheds have been used for large political meetings. Special arc lamps were installed for illumination purposes. Photographs were taken during the meeting, the flashlights being fired by electricity. The temporary flooring laid over the car-pits was removed a few minutes after the meeting closed, and the cars ran into the sheds as usual the same evening. The tramways undertaking benefited by a substantial sum paid as rent, and also by conveying several thousand persons to the meeting.

ST. HELENS: *Street Electric Lighting.*—Two metal filament lamps of 200 c.p. each, and two of 100 c.p. each are to be erected on tramway posts as an experiment.

SWEDEN: *Water-power Utilisation.*—The Stockholm correspondent of the *Financial News* states that the numerous waterfalls in Sweden are to be investigated and reported upon by a special Commission with a view to their utilisation for the generation of electricity. A proposal has been made to construct an electric power station on the Porjus Falls on the Lulea River at an estimated cost of 12,000,000 kroner.

WEST BROMWICH: *The "Fair" Fare System.*—A public meeting was held on Tuesday, at which protests were made against the introduction by the British Electric Traction Co. of the "fair" fare system, it being alleged that this has resulted in an increase of fares in many cases. A resolution was passed pledging the meeting to endeavour to compel the tramway company to revert to the old fares. A committee was appointed to deal with the matter.

WEST HAM: *Reversible Turbine Experiments.*—For some time past experiments have been carried out at the generating station with a patent reversible turbine. A syndicate has been formed to exploit the patents, and the Electrical Engineer had been asked to grant the necessary facilities and to supply steam, &c., for the experiments. The Committee have authorised the Engineer to enter into negotiations with the syndicate as suggested.

Electric Supply.—The Woolwich Council have been asked to receive a deputation to discuss the possibility of arriving at an arrangement in the matter of supplying North Woolwich, and so obviating an appeal to the Board of Trade.

WIMBLEDON: *The 1,000-kw. Howden Set.*—At the last meeting of the Town Council, the Electrical Engineer reported on a test of the 1,000 kw. turbo-alternator recently installed by Messrs. J. Howden & Co., Ltd. The actual steam consumptions were slightly in excess of the guarantees, but as they were very low he recommended that the set be finally accepted from the contractors, providing a few outstanding details are attended to by them. The set ran continuously from December 8th to December 14th, *i.e.*, 137 hours, and the temperature rise of the alternator was practically inappreciable. The recommendation was agreed to, and the balance of the 80 per cent. of the contract price, due to the contractors on completion, is to be paid.

WINCHESTER: *Purchase of Electric Supply Co.*—The Special Committee recently appointed to report as to the advisability of purchasing the undertaking of the Winchester Electric Light & Power Co., recommend the Council to immediately give the necessary twelvemonth's notice, under the agreement. The recommendation will be discussed at a special meeting of the Council.

YORK: *Tramways.*—Trial runs have been made over the reconstructed horse tramways.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BELFAST.—The Tramways and Electricity Committee invite tenders for two water-tube boilers, superheaters, mechanical stokers, economisers, &c., and pipe work. Tenders to the Town Clerk by January 31st. (See advertisement last week.)

A Local Government Board inquiry was held last week into an application by the Corporation for a loan of £62,200 for electrical extensions. The present capacity of the electricity station is 4,000 kw., and the loan asked for has in view the increase of this to 5,500 kw. This latter is the estimated output at the end of the next two years. During the past year the number of units sold increased by 17½ per cent.

HARRISON, AINSLIE & CO.—The directors propose to create £200,000 of 6 per cent. preference shares, of which £18,000 are required to defray the cost of extending the use of electrical power throughout the very wide area which the company controls. In the working of one grinding mill alone it is estimated that a saving of £7,000 per annum would be made if it were driven electrically instead of by steam.

LONDON: *Stepney.*—The Electricity Supply Committee require (*a*) boilers and accessories: (*b*) turbo-generator and accessories, converting plant, switchgear, &c. Particulars from the Borough Electrical Engineer, and tenders by January 24th. (See advertisement last week.)

MANCHESTER.—The Electricity Committee invite tenders for a 300-kw. motor or rotary converter, or motor generator, and high- and low-tension switchgear. Particulars from the Secretary, Town Hall, and tenders to the Town Clerk, by January 19th.

RHYL.—The Local Government Board have sanctioned a loan of £3,000, and a supplementary loan of £1,000, for electrical extensions.

SOUTH AFRICA.—According to the *South African Mining Journal*, it is intended to equip electrically the Wankie mine, on the surface as well as underground, for both power and light. The present boilers and engines will be utilised, but electrical generators are to be installed.

SUTTON COLDFIELD.—A loan of £3,500 is to be applied for, in connection with extensions of mains.

TAVISTOCK.—It is proposed that a consulting engineer be appointed to advise the Council as to an electric lighting scheme. A capital expenditure of about £10,000 is contemplated.

TORQUAY.—The scheme for extending electrical mains to Chelston at an estimated cost of £1,335 is to be enlarged so as to include three other roads at an additional cost of £735.

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WORKSOP.—An application has been made to the Local Government Board for sanction to a loan of £1,500 for electric lighting purposes.

Miscellaneous

ACTON.—The Electricity Committee invite tenders for one year's supply of cables, steel tubing, meter boards, and fuse boxes. Particulars from the Borough Electrical Engineer, and tenders by January 18th.

BIRMINGHAM.—The Tramways Committee invite tenders for stores during the year to March 31st, including electrical sundries, and insulating materials. Particulars from the General Manager, to whom tenders by February 1st.

CHELTENHAM.—Tenders are invited for the supply of general stores, including electric light fittings. Particulars from the Borough Surveyor, to whom tenders by January 29th.

HALIFAX.—The Highways and Tramways Departments require electrical accessories. Particulars from the Borough Engineer, and tenders by February 17th.

MEXICO.—A contract has been sealed between the Mexican Legislature and the Mexican Tramways Co. authorising the latter to construct a double line of tramway along the extension of Calle Gante, and also to double some of the existing lines.

PLYMOUTH.—The Corporation invite tenders for the supply of the following during the twelve months to March 31st, 1911:—Arc-lamp carbons, electricity meters, transformers, paper-insulated cables, oil, and waste. Particulars from Borough Electrical Engineer, to whom tenders by January 25th.

ROCHDALE.—The Tramways Committee invite tenders for (1) Poles, bracket arms, and accessories; (2) overhead line materials, trolley wire, section boxes, and accessories; (3) points and crossings. Particulars from the tramway manager, and tenders to the Town Clerk by January 17th.

STONE (Staffs).—An electric light and telephone installation is required at the new Isolation Hospital, Yarnfield, for the Stone Joint Hospital Board. Particulars from the Clerk, 21 High Street, Stone, and tenders by January 19th.

SWITZERLAND.—The *Board of Trade Journal* states that Mr. Arthur Bider, of Langenbruck, and Mr. E. Jenny, of Waldenbourg, have been granted concessions for eighty years, for the construction and working of an electric railway from Waldenbourg to Balsthal, with a branch from St. Wolfgang (Palsthal) to Mümliswil, the total length being 9½ miles. Messrs. Scharer and F. Luder, of Koppigen, have also been granted a concession for eighty years, for the construction and working of an electric railway from Herzogenbuchsee to Kirchberg *via* Koppigen, and from Koppigen to Lyss by way of Utzenstorf.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

N.—Alterations to Eastern Hospital, Homerton Grove. Builders, F. & G. Foster, South Norwood.

E.—School, Gainsborough Road, West Ham. Architect, Education Committee.

N.W.—Church Hall, Mill Hill (£2,300). Architect, J. S. Alder, Arundel Street, W.C.

Church, Central Square, Hampstead Garden Suburb, N.W. Architect, E. L. Lutyens, 29 Bloomsbury Square, W.C.

PROVINCES.

BIRMINGHAM.—Factory, Hockley Hill, for Messrs. Canning. Builders, Eloins & Sons, Maden Road, Soho, Birmingham.

Factory, Soho. Builder, E. Crowther, Farm Street, Birmingham.

BOLTON.—Labour Hall, St. George's Road (£5,000). Secs., Bolton Operative Spinners Association.

JARROW.—School (£15,700). Architect, F. Renoldson, 37 King Street, South Shields.

MANCHESTER.—Additions to works, Trafford Park, for Redpath, Brown & Co., Ltd.

Extension, Technical Institute. Architect, D. Bowden, c/o E. Warrall, surveyor, Stretford U.D.C.

NEWCASTLE-ON-TYNE.—Bakery and confectionery works. Architect, C. S. Errington, 21 Grainger Street West, Newcastle-on-Tyne.

Exhibition of Australian Telephone Apparatus.—In connection with the tenders that are from time to time invited by the Australian Postmaster-General's department for telephone and postal apparatus, it has been decided to have patterns of every class exhibited at the office of the Commonwealth in London, 72 Victoria Street, London. The specimens may be inspected by British manufacturers wishing to tender.

Paris-Vienna Telephone.—A Dalziel wire from Vienna states that direct telephonic communication will shortly be available between Vienna and Paris. The line, over which successful experiments have been made, will pass via Frankfort. Hitherto it has been necessary to telephone from Vienna to Berlin, and thence on to Paris.

TENDERS RECEIVED AND ACCEPTED

AUSTRALIA.—The Australian Postmaster-General's Department has accepted the tender of the Western Electric Co. (Australia), Ltd., for telephone cable, silk and cotton insulated and light lead-covered, in 440-yard lengths at £399 per mile.

BRISTOL.—The tender of Messrs. W. T. Henley's Telegraph Works Co., Ltd., for the supply of joint and junction boxes during 1909-10 has been accepted at £233.

CARLISLE.—The tender of the British Insulated & Helsby Cables, Ltd., has been accepted for overhead cable at £799.

CHATHAM.—The tender of Messrs. Rayfield & Jenner, Chatham, has been accepted for the supply of "Osram" electric lamps at £17 2s. per gross.

ECCLES.—The tender of the British Westinghouse Co. has been accepted for the supply of meters during the coming year.

LONDON: *St. Pancras.*—The following tenders have been received for a new switchboard at the King's Road station:—British Thomson-Houston Co., Ltd., £87 15s.; Northcote, Heaver & Co. (accepted), £90 19s.; Bertram Thomas, £95 5s.; E. F. Moy, Ltd., £109; A. Seage & Co., £115.

WALSALL.—The Council have placed an order with the Electric Ordnance & Accessories Co., Ltd., for four arc lamps at £2 3s. 6d. each.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £63 5s. to £63 15s. per ton (last week, £63 to £63 10s.).

DISSOLUTION OF PARTNERSHIP.—The partnership between A. Bagshaw and W. J. Fox, electrical engineers, Bradford Road, Batley, Yorks, has been dissolved.

CANADIAN AGENCIES WANTED.—A Toronto firm reports that there is a very good market in Canada for aluminium wires, &c., and desires to obtain the agency of a United Kingdom manufacturer. Further particulars of this inquiry may be obtained at the office of the High Commissioner for Canada, 17 Victoria Street, London.

LIQUIDATIONS, BANKRUPTCIES, WINDINGS UP, &c.—At the adjourned public examination on Thursday of E. Smith, electrical engineer, Lincoln, a complaint was made by the Official Receiver that the debtor had not complied with an order to render a cash account, and to hand over a certain pocket-book. The matter has been reported to the Board of Trade. The examination was again adjourned to enable the debtor to comply with the order of the Court.

A meeting of Messrs. Easton & Anderson, Ltd., will be held at 25 Victoria Street, Westminster, London, on Tuesday, February 15th, at 11.30 a.m., to hear the liquidator's account of the winding up.

ELECTROMOTORS' NEW OFFICES.—Messrs. Electromotors, Ltd., have found it necessary to remove their London office to more commodious premises, and all communications for this office should be addressed to 49 Queen Victoria Street, E.C. The telegraphic address and telephone numbers remain as before.

ROBERTSON & OSRAM SOCIAL CLUB.—The first annual fancy dress ball was held at Hammersmith on Saturday last, when there was an attendance of 400.

Slight Interruption to Supply in East Ham.—Some exaggerated reports have appeared in the daily Press with regard to a slight disturbance to the electric supply in East Ham on Monday last. We understand from official sources that owing to a slight cable fault or some similar disturbance, both feeder and machine circuit-breakers at the generating station came out. They were replaced and came out again, but on replacing a second time the fault apparently healed itself, and the supply was maintained. The interruption lasted only a minute or two in each case.

The late Mr. F. H. Medhurst.—Creditors of the late Mr. F. H. Medhurst are requested to send particulars of their claims to Messrs. Bennett & Ferris, 68 Coleman Street, London, E.C., not later than February 18th.

Glare: Its Causes and Effects.—At a meeting of the Illuminating Engineering Society on Tuesday, a discussion took place upon "Glare: its Causes and Effects." Dr. S. P. Thompson, President of the Socicy, was in the chair. In order to encourage discussion, a series of eleven questions was sent around to members. Of these five were purely physiological questions, and it was decided to restrict the discussion to this side of the question. The engineering side will be discussed at the next meeting of the Society, which will be held on February 15th.

London-Madrid Telephone.—The question of communication between Paris and Madrid is occupying the attention of the French postal authorities, and an agreement has been signed for the laying of a line between these two cities. When this is completed, it is hoped to be able to telephone from London to Madrid.

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MISCELLANEOUS CITY NOTES

R. WAYGOOD & CO.—The full dividend on the 6 per cent. preference shares has been announced for the six months to January 16th.

PRIMITIVA GAS & ELECTRIC LIGHTING CO.—Extraordinary general meetings of this company, the River Plate Gas Co., and the Buenos Aires (New) Gas Co. were held on Thursday to confirm resolutions providing for the amalgamation of the three undertakings.

DUBLIN UNITED TRAMWAYS CO.—The directors recommend the full dividend on the 6 per cent. preference shares for the half-year to December 31st, and 6 per cent. on the ordinary shares for the same period, after setting aside £15,000 to renewals of permanent way, and carrying forward £9,267. The amount at credit of net revenue account includes the sum of £8,150 in respect of income tax over-assessed during the past six years.

RIO DE JANEIRO TRAMWAY, LIGHT, & POWER CO.—A dividend of one per cent. has been declared upon the ordinary shares.

MEXICAN LIGHT & POWER CO.—A dividend of one per cent. has been declared upon the ordinary shares.

MADRAS ELECTRIC SUPPLY CORPORATION.—In accordance with the terms of the trust deed for the 5 per cent. construction debenture stock, the company give notice that it will require holders to accept forthwith one fully-paid £5 share for every £5 of construction stock.

CHILI TELEPHONE CO.—An interim dividend of 3s. per share, free of tax, has been declared for the past half-year.

DIRECT UNITED STATES CABLE CO.—An interim dividend of 4s. per share is declared for the December quarter. The sum of £7,500 has been added to reserve fund, and £6,859 carried forward.

COMPANIES' MEETINGS AND REPORTS

SUNDERLAND DISTRICT ELECTRIC TRAMWAYS CO.—At the meeting last week the report and accounts given in our last issue were adopted. The Chairman pointed out that but for the serious drop in the traffic receipts they would have shown a profit for the past year. The Board still considered that it would be a good thing for the public if they were allowed running powers into Sunderland, but although they continued to make efforts in this direction they had not been successful. The reorganisation of the company's capital would have to be dealt with soon, and had the past year been a normal one the Board would have brought forward a proposal at that meeting.

HARRISON, AINSLIE & CO.—At the annual meeting on Tuesday the question of installing new electrically-driven pumps, referred to in our "Tenders Invited" columns, was mentioned. It was stated that at the present moment an arbitration was pending between the makers of the original electrical plant and the syndicate with whom Messrs. Harrison, Ainslie & Co. contracted for the erection of the plant. The syndicate has, however, agreed that the result of the arbitration shall be binding as between the syndicate and the company, thus preventing the latter being involved in any litigation. The proposal to increase the capital by £200,000 preference shares of £1 each was adjourned until next Wednesday in order to give the shareholders time to thoroughly consider the matter.

APPOINTMENTS AND PERSONAL NOTES

Mr. F. A. Cortez-Leigh, of Messrs. Lacey, Sillar & Leigh, has been appointed chief electrical engineer to the London & North-Western Railway Co.

Bailie Maclay has resigned from the Glasgow Town Council, owing to pressure of business. Bailie Maclay was Convener of the Corporation Electricity Committee from November, 1896, to November, 1902.

Mr. Uffleman, having resigned his position in the Sales Department of West Ham undertaking, Mr. T. O. Wilton (formerly canvasser) has been appointed to fill the vacancy at £2 10s. per week and commission.

NEW COMPANIES

R. PAIN & SONS, High Street, Woking. Capital, £6,000. Electricians and engineers.

ALDOUS & CAMPBELL, 21 Lower Bland Street, Southwark, London. Capital £2,500 in £10 shares (50 preference shares). Electrical and general engineers.

SHEFFIELD ELECTRIC POWER CO., Chippinghouse Works, Lowfields, Sheffield. Capital, £2,000. To acquire the business of W. E. Burnand at above address. W. E. Burnand is managing director.

FRAME LIGHT.—Registerd by Messrs. Waterlow Bros. & Layton, Ltd., Birchin Lane, London. Capital, £1,500. Dealers in electric and other lamps.

C. S. CASELLA & CO., 11-15 Rochester Row, Westminster, London. Capital, £10,000. To acquire the busines of C. F. Casella & Co., scientific instrument makers, &c.

LONDON ELECTRIC TREATMENT INSTITUTE, 43-44 New Bond Street, London. Capital, £5,000. Electric light cure and Electro-therapeutic Institute.

ALPHABETICAL LIST OF ADVERTISERS IN "ELECTRICAL ENGINEERING."

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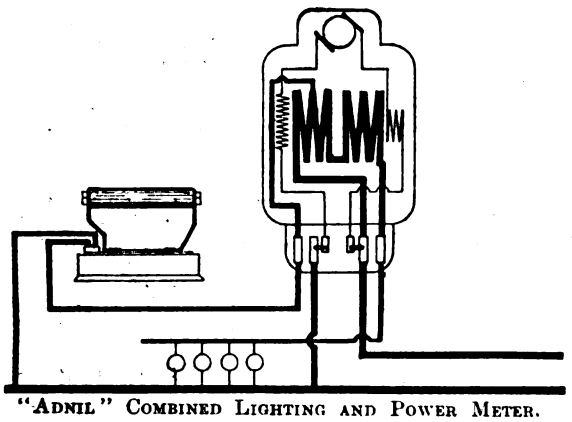
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United Flexible Metallic Tubing Co., Ltd.	—
Vickers, Sons & Maxim, Ltd.	—
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Wilson Wolf Engineering Co., Ltd.	—
Wolf, R.	—
Wright & Wood, Ltd.	—
"Z" Electric Lamp Manfg. Co., Ltd.	—

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COMBINED LIGHTING AND POWER METER

STATION engineers are all busy canvassing consumers with a view to their adopting appliances for heating and power in order that the loss of revenue caused by the extended use of metal filament lamps shall be counteracted by an increased consumption for power. A new meter, which should do much to encourage the use of electrical domestic appliances, has been introduced by the Adnil Electric Co., Ltd. (Adnil Building, Artillery Lane, London, E.C.). This comprises a standard lighting meter fitted with an additional terminal, which is connected inside the meter to the main current coils. The connection is made in such a manner that the current taken by the heating, cooking, or other appliance does not flow through all the turns of the main current coils, but only through a portion of them, dependent on the ratio of the power tariff to the lighting tariff. The current taken by the lamps in the installation flows through the meter coils in the ordinary way. The meter thus registers the units consumed for lighting, and, in addition, that proportion of the power consumption which, charged for at the lighting rate, equals the total power consumption charged for at the power rate. To deduce the total bill for lighting and power, the total units registered by the meter must therefore be multiplied by the lighting rate.

The method of connection for a D.-C. meter is illustrated diagrammatically in the accompanying figure, in which the



"ADNIL" COMBINED LIGHTING AND POWER METER.

special power terminal is shown connected to one-half of the series windings. In this case the ratio of the power and lighting rates is assumed to be 1 : 2—*e.g.*, threepence for power and sixpence for lighting; it will also be seen that it is only necessary to run one extra main back to the meter from the heating apparatus, &c., and connect it to the power terminal. Should the power rate be only one-third of the lighting rate, the power terminal is joined to a tapping on the main current coil, so that only one-third of the total number of turns is in series with the power circuit. Both A.-C. and D.-C. meters of this type can be obtained, and for any ratio of lighting and power rates, and as the prices are only slightly in excess of those for ordinary meters, they should be of considerable use where flat rates for both lighting and power are in vogue.

NEW PUBLICATIONS

Science Abstracts. December. Section A : Physics. Section B : Electrical Engineering. (London : E. and F. N. Spon.) 1s. 6d. each.

The Ideal Code Condenser, with instructions in English, French, and German. By A. Kolkenbeck. (London : Central Translations Institute.) £1 1s.

Fowler's Electrical Engineer's Pocket Book for 1910. Edited by W. H. Fowler. (Manchester : Scientific Publishing Co., Ltd.) 1s. 6d.

Fowler's Mechanical Engineer's Pocket Book for 1910. Edited by W. H. Fowler. (Manchester : Scientific Publishing Co., Ltd.) 1s. 6d.

Automatic Train Stops on a Berlin Electric Railway.—A recent issue of *Elektrische Kraftbetriebe und Bahnen* contains a description of an automatic arrangement for the purpose of stopping trains in the event of their passing a danger signal. An arm projecting over the track from the signal post swings in a vertical plane, and is so connected with the signal that when this is set to danger the arm is in the horizontal position, and when "clear," in the vertical position. On the roof of the motor-coach of the train is a device comprising a switch with a lever arm which tends to descend under the influence of a strong spring, but is prevented from so doing by a wooden support. The latter is knocked to one side by the arm on the signal post if the train passes it when it is in the horizontal position. The switch then opens the main circuit through a relay, and causes the brakes to be applied automatically. The fact that the device has operated is indicated in the driver's cabin, and a lever attached to the switch enables it to be used in cases of emergency.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."]

CALENDARS, &c.—Messrs. A. E. Mallandain, manufacturers of drawing instruments and drawing-office supplies (51 Cheapside) are sending out a convenient office wall calendar with a tear-off sheet for each month.

Messrs. Everett, Edgecumbe & Co. (87 Victoria Street, Westminster) are issuing a calendar for 1910, which consists of twelve monthly tear-off sheets, each having an original sketch by the well-known artist, Mr. John Hassall. These sketches give one an idea of how the various well-known names in common use, so far as electrical measuring instruments are concerned, appeal to the artist.

Premier Electric Control, Ltd. (Red Lion Street, Clerkenwell), have embodied a most ingenious idea in their calendar for 1910. Above the monthly tear-off sheet is a small window, through which appears a rotatable disc bearing the days of week. Above this window is a larger one, through which can be seen, under the leading resolution for 1910, the words, "Wipe out all inferior electrical controlling apparatus of every description." The rotation of the disc causes a hand holding a sponge to pass across the space and apparently to effect the wiping out advised. The firm will be pleased to forward a copy to any of their friends who have not yet received one.

A Christmas card from the Lea Recorder Co. (28 Deansgate, Manchester) is embellished with a border forming a diagrammatic representation of their well-known system of feed-water measurement.

A most useful combined blotting pad calendar and engagement book is being sent out by Messrs. Alfred Graham & Co. (St. Andrew's Works, Crofton Park, S.E.), makers of loud-speaking telephones.

TEXTILE MACHINERY DRIVING.—A pamphlet from the British Department of the Maschinenfabrik Oerlikon (Oswaldestre House, Norfolk Street, Strand) contains a reprint of an article on the use of variable-speed three-phase motors for the driving of machines for printing textiles.

TECHNICAL BOOKS.—A comprehensive catalogue of technical and scientific books, including a number of works on electricity and electrical engineering are to hand from Messrs. W. & G. Foyle, educational and other booksellers (135 Charing Cross Road, W.C.). Prices are given for new copies, but the firm are able to supply nearly all those mentioned second-hand at about half the published price.

TELEPHONES.—A new list from the Western Electric Co. devoted to telephone instruments describes a number of patterns of apparatus, including battery intercommunication instruments and accessories, and central battery sets in considerable variety. Particulars are given of a new automatic intercommunication system with a series of key buttons for calling. An automatic replacement intercommunication system is also described. Table and wall magneto sets are listed in numerous patterns, as well as magneto military portable telephone sets.

LANTERN SLIDES.—Messrs. Siemens Brothers' Dynamo Works, Ltd. (Caxton House, Westminster), have sent us a revised list of the large stock of lantern slides illustrating electrical plant and apparatus of every description which they are at all times willing to lend to lecturers, &c., free of charge. Many interesting additions have been made since last year's list.

METAL FILAMENT LAMPS.—A miniature list from the Brush Electrical Engineering Co. (108-112 Belvedere Road, S.E.) gives prices of "Metallum" lamps which they are putting on the market for voltages from 100 to 250, and in candle powers from 16 to 100.

ELECTRIC IGNITION FOR LARGE GAS ENGINES.—A pamphlet from the Lahmeyer Electrical Co. (109-111 New Oxford Street) contains a reprint of an article describing a low-tension electric ignition system for large gas engines. The break inside the cylinder is produced electromagnetically, and the commutator, which is a substantial piece of apparatus, is arranged to prevent all possibility of an accidental early spark by keeping the contacts short-circuited until the moment of ignition. The apparatus is made for pressures from 65 to 220 volts.

ELECTRIC SIGNS.—A striking post-card from Messrs. Venner & Co. (6 Old Queen Street, Westminster) gives a good idea of the effectiveness of their well-known signs, which are particularly recommended for electric supply advertising.

ELECTRIC IGNITION OF ACETYLENE LAMPS.—A leaflet from Messrs. Cox-Walkers, Ltd. (Darlington), describes an attachment for acetylene motor-car headlights for lighting them from the seat by a spark over the burner from the ordinary ignition apparatus on the car.

The Electrical Trades' Benevolent Institution.—The second festival dinner of this Institution will be held on February 23rd next. Dr. Gisbert Kapp has consented to preside.

The Electrical Standardising, Testing, and Training Institution.—Arrangements for the following special lectures to be delivered at Faraday House have been made :—"Electrical Measurements, by Mr. J. Rennie (of the Board of Trade Electrical Standards Laboratory), and "Accumulators," by Mr. W. R. Cooper.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Jan. 6th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

27,832/08. **Trolley-wheel Guard.** T. HOLDSWORTH (Birmingham). This comprises a curved metal arm pivoted just in front of the wheel at the top of the pole, and pointing downwards in the direction of movement. Should the wheel leave the trolley wire and a cross-wire be encountered, the latter comes under the metal arm and turns it about its pivot so that it reaches over the wheel. The wire thus slides over the underside of the arm and cannot catch in the wheel. After the cross-wire is passed, the arm is returned to its original position by a spring. Three claims, eight figures.

27,967/08. **Automatic Control of Single-phase Motors.** H. C. JACOBY (London). These are improvements in the method of control of an A.C. commutator motor, in which the brushes are rocked to vary the speed and to reverse. (See ELECTRICAL ENGINEERING, September 10th, 1908, Vol. IV., p. 383.) A V-shaped cam transmits the motion of the governor to the brush rocker, which moves into a position of less torque as the speed increases. Three claims, five figures.

133/09. **Single-phase Motor.** F. PUNGA (Liege). In series commutator motors, in which the compensating winding is in series with the auxiliary pole windings, and the compensating current is generated by induction, an auxiliary pressure is applied to this circuit from tappings off the main transformer in order to displace the current in phase, and thus completely neutralise the pressures induced in the short-circuited armature coils. Four claims, one figure.

1,327/09. **Continuous-current Generator.** A. BOECKEL, O. GRÜNBERG, J. K. KRUKOVSKI, and E. LUXEMBOURG (St. Petersburg). This is an improvement on the machine described in specification No. 72/09, abstracted in ELECTRICAL ENGINEERING, October 21st, 1909, Vol. V., p. 924. The armature and field rotate in opposite directions, while the brushes are stationary. A rotary field is produced by a stationary field system supplied with three-phase current from the armature. The latter has two commutators, one of usual construction, and one with twice the number of segments as there are turns in the armature. On the first are three brushes supplying the field current, and on the second are brushes for collecting continuous current. One claim, two figures.

2,052/09. **Apparatus for Grooving Trolley-wires.** B. KAY (Haslingden). Trolley-wires are grooved at intervals for securing to ears by a device comprising a longitudinally grooved bar with a reciprocating frame containing two horizontal cutting discs pressed inwards on each side of the wire by slide-pieces adjustable by means of hand screws. The bar is clamped to the wire, and the frame worked by hand or power. Five claims, four figures.

2,464/09. **Motor Starter.** SIEMENS BROS. DYNAMO WORKS, LTD., and E. SCHUPP (Stafford). Though this switch has only one operating arm, a double-pole break is secured, by connecting an automatic switch in the overload release circuit to one pole and the starter arm to the other. The overload release is independent of the short-circuiting of the no-voltage release magnet, and both devices can operate during the switch-in period. If either release operates, the starter-arm must be returned to the off position before switching on. The armatures of the two coils are mechanically interlocked. Four claims, one figure.

3,352/09. **Dynamo Brushes.** F. W. CARTER (B. T.-H. Co., Rugby). Brushes for high-speed machines are shaped at the trailing edge, so that the area of contact between brush and segment during the last moments of commutation decreases at a faster rate than that due to the movement of the segment when brushes with parallel sides are used. The brushes are fluted or corrugated on the trailing edge, so as to provide teeth with rounded edges, or rectangular brushes may be staggered with respect to the commutator to give the same effect. Two claims, six figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Names in italics indicate communicators of inventions from abroad.

Arc Lamps: BENKÖ [Securing contacts to electrodes], 15,737/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MERZ and PRICE [A.-C. distributing system] 28,186/08.

Dynamos, Motors, and Transformers: FERGUSON [Machines] 28,040/08; BRITISH THOMSON-HOUSTON Co. and CLOUGH [Bearings] 7,334/09; SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*) [Speed-regulation of machines] 18,802/09; and [Regulation of A.-C. commutator machines] 20,005/09; AKT-GES. BROWN, BOVERI, ET CIE. [Excitation of commutator generators] 20,899/09; JACOBY [Control of motors] 23,619/09.

Electric Ignition: KEITH [Ignition of gas lamps] 7,827/09; MILTON [Magneto-ignition] 24,602/09.

Electrometallurgy and Electrochemistry: GREENWOOD [Electrolytic decomposition of alkaline salts] 25,208/08; COMPAGNIE GÉNÉRALE D'ELECTRO-CHIMIE DE BOZEL [Manufacture of silicides] 5,799/09;

Incandescent Lamps: HADDAN (*Bruno-Patente-Verwertungs-Ges.*) [Incandescent bodies] 12,467/09.

Switchgear, Fuses, and Fittings: VESSEY [Wall plugs] 9,402/09; JOHNSON [Switch for railway points, signals, &c.] 18,500/09.

Telephony and Telegraphy: MUIRHEAD [Telegraphy] 27,867/08; SHARMAN [Telegraphy and telephony by earth conduction] 2,169/09; CONNER [Party-line ringing key] 10,247/09; GRAHAM [Telephonic receivers] 25,112/09; CLOUGH [Telephone mouthpieces] 26,461/09; SIEMENS & HALSKE AKT.-GES. [Signalling apparatus] 26,465/09.

Traction: ARMSTRONG and RUSSELL [Automatic brakes] 27,941/08 and 27,447/09; DUDGEON and CROSS [Trolley head] 5,235/09; MUNRO and RAILLESS TRACTION Co. [Trolley head] 5,249/09; THOMPSON [Trolley head] 8,649/09; TETLOW [Trolley] 9,365/09; BLUHM [Trolley] 12,253/09; DICK, KERR & Co. [Electro-magnetic brakes] 19,098/09; S.P. (Suchostawer Patents) SYNDICATE, LTD., and SAYERS [Collectors] 20,115/09.

Miscellaneous: STOCKALL [Electric clocks and counters] 13,679/08; WALTON and BELL [Temperature alarm] 27,626/08; RUBINER [Therapeutic apparatus] 27,796/08; BOYD [Therapeutic apparatus] 1,987/09; STEINWEG [Soldering aluminium] 6,138/09; DUNOYER [Mariners' compasses] 18,615/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: SENFTNER [Manufacture of electrodes] 8,151/09.

Electric Ignition: WEISS [Ignition systems] 29,255/09; DAIMLER MOTOREN-GES. [Distributor] 29,615/09.

Incandescent Lamps: KUZEL [Metal filaments] 25,889/09.

Traction: AKT.-GES. BROWN, BOVERI ET CIE. [Electric driving of vehicles] 24,843/09.

Amended Specifications Published

The following amended Specifications can now be obtained.

25,175/08. **Fan.** ELECTRIC & ORDNANCE ACCESSORIES Co. and JACOBSEN. This specification was amended as the result of opposition, and describes a blade construction for centrifugal fans.

8,263/09. **Fuses.** SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens & Halske Akt.-Ges.*) A disclaiming note has been added to this specification, which describes non-interchangeable cartridge fuses. See ELECTRICAL ENGINEERING, December 23rd, 1909, Vol. V., p. 1086.

Opposition to Grant of Patent

14,615/08. **Dry Cell.** H. HUNTE. This patent has been granted in spite of opposition. The specification describes a dry cell with vertical air passages through the depolariser open at top and bottom. Further particulars were given in an abstract in ELECTRICAL ENGINEERING, September 30th, 1909, Vol. V., p. 859.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, &c.: C. HESS [Insulating composition] 19,111/05.

Electrometallurgy and Electrochemistry: K. BIRKELAND and S. EYDE [Furnace with electromagnet to spread arc] 20,003/04; C. RUZICKA [Primary cell] 18,931/05.

Incandescent Lamps: A. W. HILL and SIR HIRAM MAXIM ELECTRICAL Co. [Straight-filament lamps] 19,259/05; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Vanadium-carbide filaments] 19,264/05.

Instruments and Meters: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Multiple-rate A.-C. meters] 19,036/05.

Switchgear, &c.: C. L. MENGES [Lamp-holder] 21,623/97; A. D. SMITH [Switch] 18,691/01; G. SMITH [Lamp-holder switch] 18,904/05.

Telephony and Telegraphy: J. E. BLANC [Ships' wireless course indicator] 12,994/04; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Vapour lamps in wireless systems] 19,034/05.

Traction: BRITISH THOMSON-HOUSTON Co. (*C. E. Barry, U.S.A.*) [Multiple-unit control] 16,705/00; A. J. BOULT (*N. A. Christensen, U.S.A.*) [Automatic switch for air-brakes] 19,028/01; R. HERMAN [Signalling] 19,086/01; R. SHEEHY [Signalling] 20,887/02; M. B. MOUNTAIN, G. M. GIBSON, and A. F. HEAD [Tramcar obstruction remover] 19,158/05; O. BÖHM [Train-lighting system] 19,201/05.

Miscellaneous: R. WAYGOOD & Co. and H. C. WALKER [Lift control] 20,613/04.

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ELECTRICAL ENGINEERING

No. 160 [Vol. VI., No. 3] THURSDAY, JANUARY 20, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.

Canada. 8s. 8d. per Annum.

Other Colonies and Abroad. 13s. per Annum.

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

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SUMMARY

A new pattern of explosion-proof motor, designed by the General Electric Co. to suit the special requirements of a gunpowder factory, is described. The carcase is gas-tight, and there are no means for ventilating but the heavy cast-iron covers are provided with corrugated iron centres, which, besides offering a large cooling surface, give a certain amount of elasticity. The flanges of the covers are recessed to take a packing of hemp rope dipped in tar. (Page 37.)

It seems highly improbable that the large fire in a retail shop in Kilburn last week was electrically caused, although in the first instance it was ascribed to the electrical installation. (Page 37.)

The 1910 edition of the Phœnix Wiring Rules, just issued, includes a stretching test for the rubber insulation of conductors, and also some very definite conditions with regard to the use of flexible and the wiring of shop-windows. (Page 38.)

Under Electrometallurgy and Electrochemistry, we give some notes on the electro-deposition of alloys of silver and copper. An electric furnace for the production of pig-iron is described; this is an arc furnace in which the electrodes are prevented from coming in contact with the incoming charge. (Page 38.)

A note about the London Electrobus Co. appears on page 38.

The "Fixed Price Light Co., Ltd." has been established to provide electric light for small houses at a fixed price of a few pence per lamp per week, which includes the hire of the wiring and fittings, as well as the supply of current. The company is affiliated to Messrs. Siemens Bros. & Co., Ltd., and the "Stannos" system of wiring is employed. (Page 39.)

A Paper read by Mr. R. M. Neilson last week before the Glasgow Local Section of the Institution of Electrical Engineers, contained an investigation of the most economical vacuum for making steam turbines. Assuming certain data for a hypothetical station, curves were given for different load factors, showing how capital and other costs were affected by the degree of vacuum for which the plant was designed. (Page 39.)

At last Thursday's meeting of the Institution of Electrical Engineers, the second "Kelvin" Lecture was delivered by Prof. J. A. Ewing, F.R.S., who chose as his subject the work of Lord Kelvin in telegraphy and navigation, and dwelt particularly on his connection with the early Atlantic cables and his improvements in the mariner's compass. (Page 41.)

We publish a description of the common battery exchange recently put into operation at Fremantle (Western Australia). An intermediate distributing frame of the vertical type is employed; alternate verticals are used for local and multiple connections. The line and cut-off relays are mounted on a frame forming part of the I.D.F. On the cord circuits repeating coils are dispensed with, and a similar arrangement is employed to that on the new Cardiff Exchange. Some of the subscribers' sets are fitted with a special party-line lock out device. (Page 43.)

Some particulars are given of four recent designs of heavy electric locomotives. The single-phase locomotive for the New York, New Haven & Hartford Railway has four pairs of driving wheels, coupled to four 350-h.p. motors through flexible gearing, and two pairs of guiding wheels. The motors are mounted rigid on the frame directly over the axles. Two three-phase locomotives are described. The first is one of those working in a tunnel of the American Great Northern Railway, and has four independent pairs of driving wheels only, each geared direct to a 375-h.p. motor. Speed variation is obtained by resistances in the rotor circuits. In the new Simplon Tunnel locomotives, the

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four pairs of driving wheels are geared together and to two 700-h.p. motors with short-circuited rotors. Four economical running speeds are obtained by changing the effective number of poles. The last described is a new 4,000-h.p. continuous-current locomotive, one of 24 ordered for the New York terminus lines of the Pennsylvania Railway. This comprises two independent units each with two pairs of driving wheels coupled together and driven through coupling rods by a 2,000-h.p. interpole motor. (Page 44.)

SOME motor-boats with combined petrol and electric drive have been constructed in Germany. An accumulator battery is charged at low speeds by a dynamo which is driven as a motor to assist the engine at high speeds. A 17-ft. cruising boat of this type, displacing over nine tons, carries a 20-h.p. engine and motor-dynamo and an 80-cell battery with a capacity of 213 ampere-hours on the one-hour discharge rate. (Page 45.)

A PAPER on the testing of rubber was read by Prof. A. Schwartz before the Manchester Section of the Institution of Electrical Engineers on Tuesday, January 11th. The author pointed out how important a bearing the results of mechanical tests had on estimating the suitability of rubber for electrical purposes, and described methods by which these could be applied. He also made certain suggestions as to tests that might be specified by the Cable Makers' Association. (Page 46.)

SOME figures of the output of an electrically driven cogging mill at Middlesborough are given on page 47.

A RETURN has been issued, under the Census of Production Act, 1906, dealing with the electrical industry in 1907. The total value of the electrical machinery, apparatus, cables, &c., produced was £13,782,000. The imports were 14 per cent. of the electrical machinery, 26 per cent. of electrical goods and apparatus, 11 per cent. of telegraph and telephone cables, and 5 per cent. of wires and cables. (Page 48.)

THE Board of Trade Report by Major Pringle on the buffer stop collision in November last on the Metropolitan District Railway at Ealing attributes the accident to absence of pressure in the brake air-reservoir due to the valve connecting the main reservoir with the train pipe having been accidentally left closed, and makes certain recommendations to avoid recurrence of such an accident. (Page 48.)

A SHORT article gives a *résumé* of some of the most important work accomplished by the Electrical Manufacturers' Association during the past year. (Page 48.)

A PAPER on factory organisation was read by Mr. James Rider at a recent meeting of the Rugby Engineering Society. (Page 49.)

THE Gravesend & Northfleet Electric Tramways, Ltd., are taking action against the Gravesend Corporation in respect of the metering of the electrical energy supplied for the tramways. The allegation is that the meters are reading fast, and that the company have had registered against them since August, 1908, about 47,000 units in excess of the actual consumption. (Page 49.)

AMONG the specifications published by the Patent Office on Thursday last is one by T. Ferguson for a train-lighting dynamo with automatic shunt regulation. The increase in the driving torque as the speed and output increase is caused to displace a sleeve on the shaft, and this in turn works a rheostat arm.—C. H. Merz and B. Price describe a system of protection for simple A.C. circuits, in which any difference in the currents in the different conductors causes a core to be magnetised and a current to be generated in a winding connected to the tripping coil of the main switch.—A specification by Dick, Kerr & Co. describes a magnetic track brake consisting of several independent electromagnets linked together.—The S.P. Syndicate has covered a construction of skate or collector for traction systems; this comprises a length of metallic woven fabric drawn edgewise across the studs.—The decision of the Comptroller to grant a patent to H. Hunte for a dry cell with open-air passages through the depolariser has been appealed against.—The opposition to the patent by C. E. Gilbert for an arc lamp mechanism has been withdrawn.—A patent by R. Pearson for a device for indicating in a signal box when a semaphore arm moves expires on Saturday after the full life of fourteen years. (Page 50.)

WE have received a letter from Messrs. Simplex Conduits, Ltd., with reference to the combined lighting and power meter described in our issue of last week, stating that there is no reason why existing meters should not be utilised for the double rate purpose by suitable reconnection, and that no special type of meter is essential. (Page 51.)

THE Cardiff Finance Committee have reported that the tramway system is being maintained in such an efficient condition that the provision of a depreciation fund is unnecessary.—The New Carolina Port Electricity Works of the Dundee Corporation will shortly be formally opened.—Sir Alexander Kennedy is to report with regard to large extensions at Hampstead.—A power tariff of 1d. per unit, on the restricted hour system, has been adopted at Marylebone.—Mr. Peter Fisher, General Manager of the Dundee Tramways, has reported upon the unsatisfactory position of the Perth Tramways, which, he says, is overstaffed, in some departments, to the extent of 50 per cent.—Local authorities in the Potteries are to hold a conference regarding the new system of fares introduced by the British Electric Traction Co.—The first section of the reconstructed tramways at York has been officially inspected. (Page 52.)

AN expenditure of £54,000 is contemplated at Coventry. Loans have been sanctioned at Wolverhampton (£15,000) and Lowestoft (£2,500). Southampton Corporation propose to borrow £9,600 for new cars and meters. The Ashton-under-Lyne Corporation require generating plant and condensing plant. A system of electrically operated clocks is required at the new Institution of Electrical Engineers' building. Electrical stores are required at Newport, Islington, and by the Asylums Committee of the London County Council. (Page 52.)

THE Victoria Falls Power Co. are issuing £900,000 debentures in Berlin. (Page 54.)

ARRANGEMENTS FOR THE WEEK

FRIDAY, JANUARY 21ST.

Physical Society.

5 p.m. At Imperial College of Science. (1) "The Polarisation of Dielectrics in a Steady Field of Force." by Prof. W. M. Thornton; (2) "On the Use of Mutual Inductometers," by A. Campbell.

Northampton Institute Engineering Society.

5.45 p.m. At the Institute. "The Choice of Prime Movers for Power Stations," by E. T. Driver.

SATURDAY, JANUARY 22ND.

Junior Institution of Engineers.

3 p.m. Visit to the new generating station of the Westminster Electric Supply Corporation, Horseferry Road, Westminster.

MONDAY, JANUARY 24TH.

Institution of Electrical Engineers: Newcastle Section.

8 p.m. At Armstrong College. "On the Safety Devices in Coal-Cutters," by H. J. Fisher.

TUESDAY, JANUARY 25TH.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "Equitable Charges for Tramway Supply," by H. E. Yerbury.

WEDNESDAY, JANUARY 26TH.

Institution of Electrical Engineers: Leeds Section.

7.15 p.m. At the University. "Equitable Charges for Tramway Supply," by H. E. Yerbury.

Institution of Electrical Engineers: Students' Section.

7.30 p.m. Annual Dinner at the Trocadero.

THURSDAY, JANUARY 27TH.

Institution of Electrical Engineers.

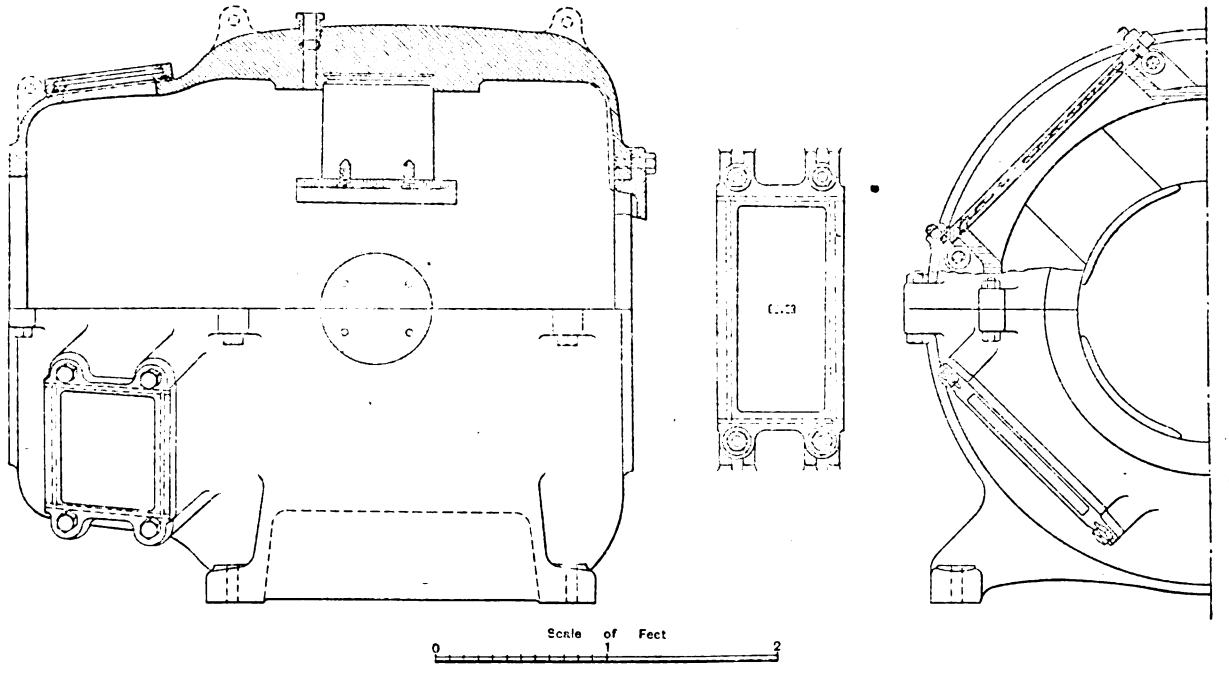
8 p.m. At 25 Great George Street, London. "Equitable Charges for Tramway Supply," by H. E. Yerbury.

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NEW DESIGN OF FLAME-PROOF MOTOR

THE accompanying illustration shows the mechanical details of a new pattern of flame- and explosion-proof motor designed by the General Electric Co. to suit the special requirements of a gunpowder factory where the presence of a certain amount of explosive dust in the air is unavoidable. For such work, the motor carcase must be capable of withstanding an explosion inside the motor, and there must be no possibility of hot gases escaping into the surrounding air. It will be noticed that all the openings are also machined, are recessed to take a packing of hemp rope dipped in tar. This packing is considered to be more efficient and much more durable than rubber, which would deteriorate at a temperature of 150° Fahr.

As the motors have to be gas-tight and explosion-proof, all the cables are brought into the casing through strong glands. One of these is shown in the drawing. Special packing has also been applied to all the bearings to prevent any hot gas produced by explosion inside the motor from escaping through the bearings. This has



G.E.C. FLAME- AND EXPLOSION-PROOF MOTOR FOR POWDER FACTORY.

provided with heavy covers consisting of cast-iron frames with galvanised corrugated iron centres cast in. This construction gives stiffness combined with a certain amount of elasticity. The corrugated iron offers a large cooling surface, and, being comparatively thin, is most effective in keeping the temperature of the inside of the machine within a low limit. There is no provision whatever for ventilating the inside of the motors, but they have been designed to withstand a 20-hours continuous run without exceeding the guaranteed maximum temperature rise of 80° Fahr. The edges of the openings are machined, and the flanges of the covers, also the advantage of preventing the blowing-off of the oil, which may take place if this protection is not applied, and bring with it as a consequence the overheating of the bearings. This would be most dangerous in the circumstances in which these motors are running.

The particular powder factory in question has been supplied with two 75-h.p., seven 30-h.p., four 10-h.p., and two 5-h.p. motors of this pattern. The pressure of the supply is 220 volts, D.C., and the motors are provided with slow-movement, totally enclosed, gas-proof starters. These have cast-iron boxes, and are fitted with glass doors.

ELECTRIC LIGHT AND FIRE RISK

FOLLOWING so shortly on the terrible fire at Clapham just before Christmas, a serious fire at Kilburn on Thursday last has attracted much attention and comment, owing to the fact that it was alleged to have been due to the electric light installation. Mr. B. B. Evans, the head of the firm B. B. Evans & Co., in whose drapery and furnishing shop the fire occurred, has suggested to an interviewer that the fire was electrically caused.

To ascertain the real facts, we have made a thorough investigation of the matter, and in the meantime Mr. G. H. Cottam, electrical engineer to the Hampstead Borough Council, has written to the *Times* to say that he can produce several witnesses—amongst whom is the man who rang the fire alarm—who noticed the fire at one of the first-floor windows, on which floor electric light was not installed, and that the interior of the building in which the fire originated was lighted with gas. Our investigations have revealed that there is a discrepancy in the statements of witnesses as to the part of the building in which the fire broke out. While an eye-witness states that before any alarm of fire had been called, he saw smoke and afterwards flames above an arc lamp in a shop window filled with blouses and underclothing, the man who rang the fire alarm states that the outbreak occurred in a different part of the building to this, several yards away. We need not consider the likelihood of the fire having originated in more than one place simultaneously, and it would appear most probable that the actual outbreak was in the position indicated by the latter witness, as it is this part of the building that has been wholly destroyed, whereas the front of the building and the floors above the shop window referred to are still standing, and the

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window adjacent to it has practically only been damaged by water. Moreover, the condition of the wires which led current to the arc lamp in question would not lead one to infer that there had been any serious short-circuit or arc between them. A considerable length of these wires above the arc lamp had not been consumed, and although the insulation was, of course, burnt off, the wire itself had not been destroyed. It must be admitted that the management of the shop showed great carelessness in placing inflammable materials in a shop window within close distance of an arc lamp inside the window; yet there is certainly no proof that the fire was originated by the lamp or the wires connecting it.

A number of fires whose cause is unascertainable are constantly being put down to the "fusion of electric wires," and there is no doubt that the large majority of these, as in the present case, have not been caused by any defect in the electrical installation. The electric light is undoubtedly by far the safest of all methods of artificial illumination, and even with the worst-designed electrical installation the fire risk is probably considerably less than with the best gas lighting system.

NEW PHOENIX WIRING RULES

MR. S. G. CASTLE RUSSELL, Electrical Adviser to the Phœnix Assurance Co., Ltd., has sent us a copy of the 1910 edition of the Phœnix Fire Office Rules for electric light and power installations which are just being issued.

Among the alterations is the inclusion of a stretching test for the rubber insulation of conductors. Conductors must be insulated with pure and vulcanised rubber, or with other material that has been specially approved by the Fire Office, and the rubber insulation must comply with the following test:—The dielectric, after being stretched to three times its own length for twenty-four hours at normal temperature, shall return to within 15 per cent. of its original length within one hour.

If the rules with regard to flexible conductors and shop-window lighting are carefully followed in installations, such accidents as the one that produced the Clapham fire will be absolutely guarded against.

Flexible cords, except when used in connection with pendant lamps hung clear of material, must not be used in shop windows containing inflammable goods. In a rule relating to show-windows, which are included among "special risks," this regulation as to flexible cord is repeated. It is also laid down that all wiring must be fixed and of permanent character, and that all lamps must be fixed in positions well clear of goods, and so placed that there would be no possibility of inflammable material being set on fire through breaking of lamps.

In the rules for temporary installations, which have been amplified, it is stated that flexible cord must not be used, that all changes of section in wires must be protected with double fuses, and here again it is repeated that lamps must be kept at a safe distance from inflammable material.

Incorporated Municipal Electrical Association.—The 1910 conference of the I.M.E.A. will be held at Glasgow from June 13th to 17th next. Mr. W. W. Lackie, City Electrical Engineer at Glasgow, is President.

A Middlesex Tramway Rail Contract.—A case was down for hearing in the King's Bench Division, on Monday, before Mr. Justice Ridley, in which the North-Eastern Steel Co., Ltd. sued Messrs. R. W. Blackwell & Co., Ltd., on a contract for rails supplied in connection with the Middlesex County Council tramways. It was announced, however, that an arrangement had been come to whereby Messrs. Blackwell consented to judgment against them for the sum of £2,910 17s. 6d., to be reduced by £7 12s. 6d. for every ton of rails returned by Messrs. Blackwell up to 67 tons. In this way the judgment might be reduced by £510 17s. 6d. The details of the action, therefore, were discussed.

ELECTROMETALLURGY AND ELECTROCHEMISTRY

A MEETING of the Faraday Society was held on Tuesday, January 18th, when a Paper on the conditions which determine the composition of electrodeposited alloys was read by Mr. Samuel Field. The author had previously discussed the deposition of zinc and copper in the form of an alloy, and in this Paper he describes the simultaneous deposition of silver and copper from various solutions. It would appear that while copper and silver are apparently so close together on the electrochemical scale, yet the difference between them is very distinct. This fact is well known in the case of solutions of sulphates and nitrates of these metals, where even when there is a large excess of copper in the solution, it is possible to deposit out the silver, with moderate current densities, almost entirely free from copper. Similar conditions also obtain with copper and zinc sulphate or nitrate solutions. But while copper and zinc are most readily deposited together, *i.e.*, as an alloy, from solutions of their double cyanides, there are apparently very narrow limits in which the same laws apply to silver and copper. The simultaneous deposition in both cases, however, is much more difficult when an excess of cyanide is present.

The second Paper contained the results of studies made on the electrodeposition of metals by Dr. F. Mollwo Perkin and William E. Hughes. The authors describe various forms of anodes and cathodes which they have found satisfactory for depositing metals in rapid electrochemical analysis. Also the arrangements of the apparatus for potential measurements.

The electric production of pig iron in the electric furnace is dealt with by B. Neumann in *Stahl und Eisen*, 1909, **29**, 18 1. The furnace described was started in operation towards the end of 1908. It consists in the main of two parts, the lower or electric smelting region and an upper shaft, which is very similar in shape to the blast furnaces, and it is by means of this that the charge is supplied to the hearth. The smelting zone is made of a circular magnesite hearth which is enclosed or bound together by means of iron bands. It has a diameter of 11·5 ft., and is 7·9 ft. high. An arch which covers it serves for the introduction of the electrodes. The usual cup and cone surmount the shaft and serve for carrying away the furnace gases. This particular form of shaft has two advantages; in the first place the weight of it is taken by six pillars which support it, and not by the arch, and secondly any necessary repairs are more readily carried out.

The wide form of the hearth and the size of the arch opening enables the charge to be delivered to the hearth in the form of a conical heap, thus leaving a circular air space around it, and into this the waste gases are blown after passing through a dust chamber. The smelting area is thus cooled, and the charge descending the shaft is warmed. There are inspection holes through which the temperature of the arch can be watched and the circulation of the gas regulated accordingly. Double electrodes are used, and are fixed into position by means of wedges, which also make contact with copper plates. The arc is struck through the air space so that the electrodes do not directly go into the charge, and there is thus no electrode contamination. Four men and a foreman are required to work the furnace, which requires emptying every six hours. From figures given it would appear that very good results have been obtained.

The American Electrochemical Society have appointed a committee to deal with the standardisation of dry cells. The annual output in the United States is about 40,000,000 cells, and is continually increasing. The present usual methods for rating the cells by short-circuiting or by taking the dimensions, are to be replaced by some more sensible method of obtaining the energy output.

THE ELECTROBUS

IT is announced that the assets of the London Electrobus Co. have been sold to "The Reorganisation and Control Syndicate," with the debenture-holders' authority. Until further details are forthcoming, it is, of course, difficult to say exactly how this will affect the shareholders' interests, but in the meantime we should recommend all those who have a holding in the Electrobus Co. to bestir themselves, and to insist on an early general meeting of the company, and a full explanation of the manner in which the company's business is being carried on and has been conducted in the past. It would, in fact, be desirable for the company to go into liquidation forthwith, while there are still a few of the electric omnibuses running in London, so that there may be an impartial investigation as to whether the continuity of the service should be maintained. Although there may be further revelations of the methods of some of the individuals connected with the company when the action of Gould *v.* Lehwess comes up for re-trial, there is no reason to wait for this, and although this action is revealing Dr. Lehwess' peculiar activities in one direction, it will doubtless not disclose all that has been done during his direct or indirect connection with the London Electrobus Co.

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CHEAP ELECTRIC LIGHT FOR THE SMALL CONSUMER

NOW that, thanks to metal filament lamps, electric light can be as cheap as or cheaper than gas, the only impediments in the way of its use being extended to the very smallest consumers are the capital expenditure on services and meters, the cost of wiring, and the objection of the small householder to meters and quarterly payments. The man who pays a small weekly or monthly rental for his house does not wish to run up a quarterly bill for his lighting; on the other hand, the management of the electricity works do not find it very remunerative to put in slot meters and separate services and fuses for 3- or 6-light consumers. Ever since the introduction of the metal filament lamp, we have advocated a simple contract system for small consumers—a fixed charge at the rate of so much per light per annum; this, combined with a rental for the wiring, and a system of employing one service for a group of terrace houses, meets most of the difficulties. It is evident, however, that for such an arrangement to be a success, it is necessary for the canvassing, the supply, the wiring, and the collection of accounts all to be under one control, and, as a rule, the companies and local authorities who have attempted the organisation and detailed work of such a business have either not found it a financial success, or have fallen foul of local prejudices. The operations of the "Fixed Price Light Co., Ltd." (Caxton House, Westminster, London, S.W.), which has been established for the supply of electric light to the tenants of small houses on the basis indicated above, will therefore be watched with considerable interest. For such a business to be a success, a cheap and at the same time reliable method of surface wiring is essential, and the company (which is intimately connected with Messrs. Siemens Bros. & Co., Ltd., and whose scheme of operations was suggested by Messrs. Handcock & Dykes) are employing the "Stannos" system in conjunction with low-voltage tantalum lamps. The company will have the consumer's house wired and fitted for him, and will charge a fixed price per lamp per week, which will include both the rent of the installation and the supply of electricity. The current is metered to the company by the supply authority, who are therefore relieved of all risk and of all the detailed work in connection with the scheme, their duty being simply to lay a service and to supply a meter for the company for each group of about three houses.

By arrangement with the London Electric Supply Corporation, Ltd., the Fixed Price Light Co. is starting operations in this supply company's district. Branch offices have been opened at 141 Rotherhithe New Road, and 19, Waterloo Road, S.E., and we were invited last week to inspect the former offices, which are in a small terrace house fitted as a specimen.

Current is taken from the supply company's low-tension A.-C. network, and is led into one of the houses of each group of two or three in the ordinary way through a meter and main fuses to a transformer. The transformer, meter, and fuses will be placed either in a suitable place in the house or in a watertight case on the outside wall. From the L.-T. terminals of the transformer, the pressure at which is 60 volts, current is led to the fuse in each house by a wire on the face of the building. As the number of lamps in each house is small, no other fuses or distributing boards are necessary. The wiring has been absolutely standardised on the "Stannos" system throughout, and the work will be let to wiring contractors. The "Stannos" system will be well known to the majority of our readers (see ELECTRICAL ENGINEERING, Vol. V., pp. 337 and 934), and need not be described here again in detail. The wire used is insulated with vulcanised rubber and protected with a tinned copper sheath which, in the case of these installations through transformers, will be used as the return conductor. Plain batten lamp-holders with "Langham" shades are fixed on wood blocks on the ceilings, and plain tumbler switches are employed. The wires are led into the switches and lamp-holders by means of the standard "continuity" back-plates and clamps. The size of lamp employed is chosen in accordance with the dimensions of the room; a rough test is that a woman should be able to see well enough to darn a black stocking. Twelve candle-power appears to be the ruling size.

An inclusive charge is made of 2½d. per light per week from April 1st to September 30th, and 3½d. per light per week from October 1st to March 30th. This includes the first supply of lamps, but the tenant has to buy his own renewals—an arrangement which will to some extent check waste of current. In order to prevent the tenant from replacing his lamps with lamps of higher candle-power, we understand that a system of special holders is to be employed, the details of which are not yet available for publication. It should be explained that the prices mentioned above are for ordinary dwelling-houses. In the case of shops and business premises, where the hours of lighting are longer, a higher rate per lamp is necessarily charged.

From the above notes, it will be seen that the whole scheme has been well thought out, and it should prove a source of satisfaction and profit to the supply authority, the small householder and the wiring contractor, and let us hope also to Messrs. Siemens Bros. & Co. and the Fixed Price Light Co.

THE MOST ECONOMICAL VACUUM FOR WORKING STEAM TURBINES

A PAPER entitled "An Investigation as to the Most Economical Vacuum in Electric Power Stations employing Steam Turbines and Cooling-Towers" was read by Mr. R. M. Neilson before the Glasgow Local Section of the Institution of Electrical Engineers on Tuesday, January 11th.

The effect of different degrees of vacuum on the capital cost of the boiler and condensing plant was considered, and also the annual charges due to the capital expenditure together with the cost of coal. Taking as an example a 9,000-kw. turbo-alternator station with three units working with a 10 per cent. load-factor, the curves in Fig. 1 for the boiler and condensing plant separately and together were given. Curves were also worked out showing the expenditure on coal for different vacua for four prices of coal per ton. The costs themselves were not given, but the curves show only the difference between the cost at any vacuum and a 27-in. vacuum (referred to a 30-in. barometer). Fig. 2 is obtained by combining these curves, and shows the aggregate variation in the items which vary with the vacuum. The most economical vacuum is seen to be at about 26¼ in. for coal at 6s. a ton, and at between 27 in. and 27¼ in. for coal at 18s., intermediate prices of coal giving intermediate best vacua.

Similar curves were worked out for a load-factor of 20 per cent. (Fig 3). The relative importance of low first cost is much less in this case than in the previous. The coal controls the final result to a greater extent in this case than in the other, and the best vacuum is seen to vary from about 26¾ in. with coal at 6s., to between 27¼ in. and 27½ in. with coal at 18s.

The Paper passes on to give curves for a 30 per cent. load-factor, but the final result is only slightly different from that for 20 per cent. In fact, each successive increase of 10 per cent. in load-factor makes a continually less difference. For very low load-factors new curves would have to be made. The best vacuum for a plant load-factor of 5 per cent. would lie between 25½ in. and 27 in., according to the price of coal. It may be said that, unless in very exceptional cases, the most economical vacuum for any plant load-factor and any price of coal will never fall below 25 in., and never rise as high as 27¾ in.

As regards the method adopted to obtain data for his curves, the plan involved assuming an initial cost for boiler plant and condensing plant, in both cases for 27-in. vacuum. An assumption was then made as to the variation in the steam consumption of the turbo-generators with varying vacuum, and thus, allowing for the varying power consumption of the condenser auxiliaries, and the varying hot-well temperature, the increase or decrease in the boiler-plant cost consistent with the varying aggregate of B.Th.U. required to be given to the water per B.T.U. of electricity delivered was obtained. The depreciation, repairs, and maintenance on the boiler plant have been taken at 10 per cent., and the same figure has been assumed as a mean on the condensing plant, including the cooling-tower. Seven per cent. additional has been added in each case for interest, rates, &c.,

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so that the total annual charge on boiler and condensing plant is 17 per cent. of the initial cost, which includes cost of erection. Different coal consumptions per B.T.U. delivered have been assumed for the three plant load-factors, in each case for 27-in. vacuum, and the variation in the coal consumption with variation in vacuum has been worked out. Then, taking four different prices for coal, the difference in cost of coal per 1,000

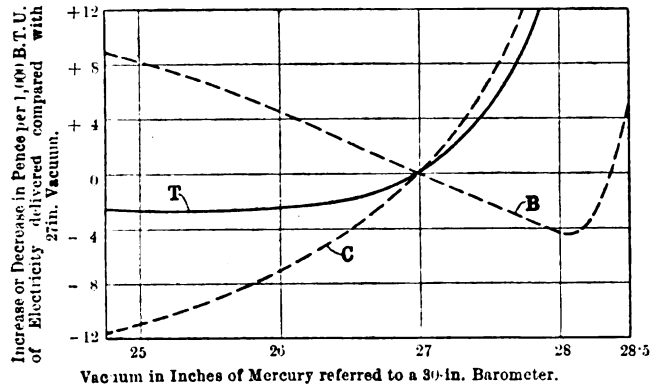


FIG. 1.—EFFECT OF VACUUM AS REGARDS INTEREST, DEPRECIATION, MAINTENANCE, RATES, TAXES, AND INSURANCE ON BOILER AND CONDENSING PLANT. PLANT LOAD FACTOR, 10 PER CENT.

B.T.U. of electricity delivered has been calculated. The coal has been reckoned as of a uniform calorific value of 13,000 B.Th.U., so that for coal of a greater or less calorific value a correction must be made. The cost of boiler plant was taken at £3·5 per kw. for a 27-in. vacuum, and that of the condensing plant at £1·4. per kw. Tables of other data upon which the curves were based are given in the Paper.

A few other items of cost are influenced to some extent by the vacuum. The oil consumption should be greater with high

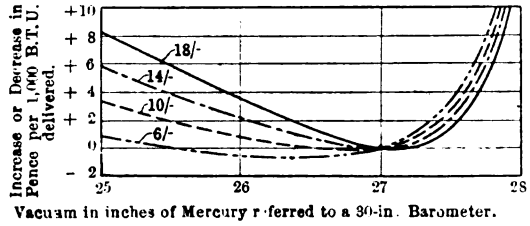


FIG. 2.—CURVES FOR A 10 PER CENT. LOAD FACTOR.

vacuum, owing to the greater size of the condenser auxiliaries. The annual amount of make-up condensing water required to balance the continual loss through evaporation and leakage, and for periodic discharge and renewal of the water, will be affected by the amount of water passed through the cooling-tower per hour—which is greater the higher the vacuum—but will also be affected by the condensing water discharge temperature—which is lower the higher the vacuum—these effects will partly counterbalance each other. Again, the higher the vacuum, the greater the aggregate size of the cooling-towers, and, therefore,

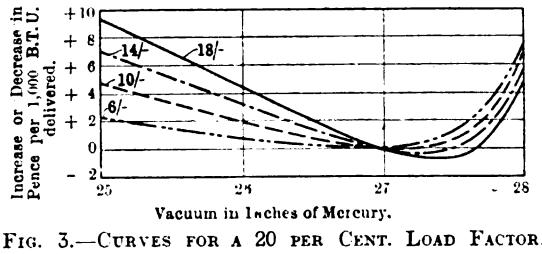


FIG. 3.—CURVES FOR A 20 PER CENT. LOAD FACTOR.

the greater the ground area required by them. On the other hand, high vacuum slightly reduces the ground area of the boiler house, and also reduces the cost of the house.

The present investigation is based, concludes the author, on a station containing three turbo-generators each of 5,000 kw., but a considerable variation could, the author considers, be made in the aggregate power of the station and in the number of units installed without greatly affecting the locality of the most economical vacuum for the different plant load-factors and prices of coal. The results may, however, be considerably different for stations not dependent on cooling-towers, but obtaining cold condensing water from a river, lake, canal, or from the sea.

DISCUSSION.

At the commencement of the discussion two communications were read. In one Mr. M. G. SWALLOW (Richardson, Westgarth & Co., Hartlepool), said that the steam economy resulting from high vacua was so tempting, that the high costs of obtaining the said vacua were often overlooked. He also asked several questions as to the assumptions made in preparing the Paper, drawing particular attention to the probability that in the case of low load-factor, the cost of "banking" losses would be so high as to have to be recognised.

The second communication from Mr. R. J. KAULA (London) was principally devoted to inquiries, which were dealt with by Mr. Neilson in his reply.

Mr. J. ROBERTSON (Burgh Electrical Engineer, Greenock), said that with turbine plants the condensing arrangements necessarily played a great part in the process of design, whereas in the old days, with reciprocating engines, it was often only a question of whether condensing or non-condensing was the more efficient. Mr. Robertson proceeded to give several figures illustrating the effect which the increase referred to would have on the total works costs under ordinary conditions, which had led him to the conclusion that the increased cost of obtaining the high vacua referred to was enormously in excess of the saving in steam consumption obtained. He thought that the standing charges allowed by the author were much too high. If these standing charges were corrected to, say, 4 per cent. for depreciation, 3 per cent. for interest, and 1 per cent. for repairs, and the curves revised accordingly, he thought the author would find that the most economical vacuum was in the region of 28-28¼ in. He did not agree with the author's method of arriving at the load-factor. Referring to the author's figures for price of condensing plant, he found that it was assumed that an increase of vacuum from 27 in. to 28·5 in. meant 157 per cent. increase in the cost of the plant. In an actual case which Mr. Robertson had in mind, the actual increase on the whole plant was only of the order of 15 per cent.

Mr. G. L. BLACK (Glasgow Corporation Electricity Department), took up the question of load-factor, referring to Mr. Lackie's address of last session on the subject. He apparently did not agree with all the result given as being probable in actual practice.

Mr. S. A. SIMON (Consulting Engineer to the A.E.G. Co., Glasgow), took up the cooling-tower side of the question. He drew attention to the fact that cooling-tower makers usually guaranteed to deal satisfactorily with a certain quantity of steam, giving certain definite results, with a certain hygroscopic state of the air at certain temperatures. The net result was that it was almost impossible to get a suitable test for cooling-towers, or the conditions specified may possibly be only obtained once in a year, or in several years; and there is no method of correcting the results for the other conditions obtaining in practice. It was obviously going to be uneconomical to strive for a high vacuum with a turbine which was designed to give its best results on a moderate vacuum, and *vice versâ*. He thought it was now generally accepted that the impulse type of turbine is better adapted for high vacua than the reaction type.

Mr. W. B. SAYERS (Consulting Engineer, Glasgow), made some inquiries *re* assumptions made by author.

Mr. NEILSON, in his reply to Mr. Swallow's remarks, said that jet condensers had not been considered. The jet condenser would cost less, but the working expenses would be higher, as more work is absorbed in removing the large quantity of air taken in with injection water. In reply to several queries, Mr. Neilson said he had not assumed the use of a Parson's vacuum augmentor. The application was a very interesting one, but he was not aware as to how the steam consumption varied between full load and fractional loads. The "banking" losses were allowed for. The figures were assumed on the basis of water-tube boilers, and were taken from test data supplied to him. Mr. Neilson did not think it would be possible to improve cooling-tower results very much in this country, but if it could be done, and the temperature of the outlet water reduced to, say, 72° instead of 82°, the increased margin would allow one to reduce the weight of circulating water to, say, 30 times the weight of steam dealt with, instead of 40 times, as in the normal case. Replying to Mr. J. Robertson, Mr. Neilson said that turbines were specially designed to take advantage of high vacua. The efficiency increased with the increase of vacua. Mr. Neilson did not quite follow Mr. Robertson's argument with regard to the standing charges. He claimed, however, that the standing charges of interest and depreciation on a cooling-tower were much in excess of those on any other part of a station plant. With regard to Mr. Robertson's contention that the condensing and vacuum plant should be arranged to suit the load-factor of the set instead of the whole station, Mr. Neilson pointed out that all the sets in his assumed station were of equal size, and were supposed to be run for equal periods. With regard to Mr. Simon's remarks, Mr. Neilson thought that the users of cooling-towers to blame in that they accepted any guarantees given. The manufacturers naturally prefer to give conditions which can hardly ever be obtainable. He hardly agreed with Mr. Simon that the makers of cooling towers usually allowed a good margin; he was afraid that the reverse was the case.

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THE WORK OF LORD KELVIN IN TELEGRAPHY AND NAVIGATION

THE second Kelvin lecture was given at last Thursday's meeting of the Institution of Electrical Engineers by Prof. J. A. Ewing, F.R.S., who chose for his subject an account of the work of Lord Kelvin in telegraphy and navigation. At the commencement of his lecture he referred to several of the characteristics of the great man, and said that few who had only seen the venerable figure of his latter years could realise the tremendous force and the overwhelming vitality of mind and body that characterised him in his prime. "His nature," he said, "was one of transparent simplicity; he was one of the few great men whose greatness was not greater than their goodness." The lecturer then mentioned that it was just forty years ago since he himself first came under his spell, and related how in 1872 he was invited by Prof. Fleeming Jenkin, who, besides being Professor of Engineering at Edinburgh, was Sir William Thomson's partner in consulting work relating to submarine telegraphs, to become one of the firm's assistants, and how in this way began a personal connection with Kelvin, which lasted on that basis for several years, and continued on the wider basis of discipleship and friendship to the time of his death.

The first task of the Kelvin lecturer was, he said, one of selection. In his initial lecture, Prof. Silvanus P. Thompson gave an admirable general survey of Kelvin's life and work which he was glad to see would soon be followed by the publication of a biography in two volumes. To-night, however, he had selected two portions of Lord Kelvin's work as the most suitable to bring before his audience, namely, his work in submarine telegraphy and navigation, both practical matters which appealed to the members of the Institution of Electrical Engineers. There was an additional reason for this selection in the personal one that both in telegraphy and navigation it had been the lecturer's good fortune as one of his young assistants to see some of his inventions in the making.

Lord Kelvin's connection with telegraphy began when he was nearly thirty years of age, dating from 1854. To appreciate rightly the part he played then, it is necessary to go back as far as 1850, the year of the earliest submarine telegraph. It was in August, 1850, that a line consisting of a single copper wire, insulated with gutta percha, but with no sheath or protection of any sort, was laid from Dover to Calais. In a few hours it was cut by the anchor of a fisherman, but during its brief life it gave the operators much food for thought. Accustomed to the clear, sharp signals of land lines, they could make nothing of those got from the cables, and Mr. Willoughby Smith relates how at each end of the line it was regretfully concluded that the operator at the other end must have been lunching not wisely but too well. Prof. Ewing then passed on to explain the effects of the capacity of a submarine cable in causing the current which arrives at the distant end not to reach its full strength at once, and to die away slowly after the signal is sent, an effect previously unknown. A successful Dover-Calais cable properly covered with a protecting sheath was laid in 1851, and was soon followed by other short lines. The general character of the electrostatic charge in a cable was explained by Faraday, and it was experimented upon by Latimer Clark in a cable 110 miles long, laid to connect England with Holland, but no one knew then in what manner the retardation of signals to which it gave rise depended on the electrical characteristics. It was in 1854 that Thomson's attention was drawn to the subject by Stokes, and in this way began the connection with submarine telegraphy which was to prove of momentous import. Thomson attacked the problem with characteristic ardour, and in less than twelve days he sent a complete solution to Stokes, which was published by the Royal Society in May, 1855. In this Paper he formulated equations and drew up what is called the "curve of arrival," which shows in what manner the current gradually reaches its full value, and how it falls away when the cable is put to earth, and showed how the time constant varies practically as the product of the capacity of the cable and its resistance, and that the time taken by the current to reach any particular fraction of the full value varies as the square of the length. The result of the theory was of particular interest at the time, for the project was then beginning to be introduced of connecting England with America by wire. The "law of squares" which Thomson had formulated was challenged by Mr. Whitehouse, who was interested in the Atlantic project, and it appears to have been the controversial letters on this subject which led to Thomson taking a share in the earliest attempt to lay an Atlantic cable in 1857. In this connection he carried out investigations on the resistance of copper, which showed the importance of systematic testing, and insisting on the use of copper of the highest conductivity, and he took up the invention of a method of signalling adapted to the character of the curve of arrival. It was in December, 1856, that Thomson joined the Board of the Atlantic Telegraph Co., which had been formed in the October. Charles Bright was engineer-in-chief, and Whitehouse, who had misunderstood and disputed Thomson's electrical results, was electrician.

The lecturer then passed on to relate the story of the first attempts at laying an Atlantic cable, starting with the unsuccessful endeavours of 1857, and the further expedition of 1858, in which Thomson took part on board the *Agamemnon*. In the meantime he had been working out the theory of the forces concerned in the laying and lifting of deep sea cables, of which the lecturer gave an admirably clear *résumé*, showing how a cable paid out from a ship going at a uniform speed, takes the form as it sinks of a straight line at uniform slope on account of the resistance which the water opposes to its motion. In the early summer of 1858 the cable squadron was again ready to put to sea. New paying out brakes had been devised, and Thomson had succeeded with much difficulty in getting systematic tests of conductivity established during the manufacture of the additional 700 miles of cable. And, most important of all, he had invented a new signalling and testing instrument, which was to make Atlantic telegraphy commercially practicable. This is the mirror galvanometer, the first description of which is found in his patent of 1858. Prof. Ewing showed some examples of the instrument, and explained how in its simplest form it consists of a circular mirror no bigger than a threepenny piece, to the back of which are cemented two or three pieces of steel watch spring, flattened and hardened and permanently magnetised. Showing some lantern slides, giving the form of the current waves under various conditions, he showed the great advantages which this very sensitive instrument was able to attain in rapidity of signalling by working on the early part only of the curve of arrival.

Continuing the narrative of the laying of the cable, he described how, after further failures, success was at last obtained, and a cable completed on August 5th of that year. Scarcely, however, had the enthusiasm aroused by this great event begun to subside, when it was apparent that all was not well. The Irish end of the cable had been handed over to Mr. Whitehouse, who had attempted with little or no success to establish communication by means of his own signalling instruments. It was only when the galvanometer of Thomson was resorted to with a simple Daniell battery to send the current, that messages were transmitted. The Board, dissatisfied with Whitehouse's action, directed Thomson to take complete charge. Various important messages passed, but the tests showed that the insulation was breaking down, and in a few weeks the cable altogether ceased to speak. It was not until 1865 that an attempt was made to lay a new Atlantic cable, but by that time much had been accomplished. It was in the intervening years that the work of establishing standards for electrical measurement was undertaken by a Committee of the British Association. The Committee was appointed at the instance of Thomson, and he took a prominent part in this work. In 1865 the *Great Eastern* was available for laying the cable. Thomson along with Cromwell Varley, went as a consulting expert on behalf of the company. The first attempt was a failure, as the cable parted in deep water, but in 1866 the thing was done. An entirely new cable was laid with complete success, and later the lost end of the cable of 1865 was recovered in water over 2,000 fathoms deep. By this time it was generally recognised that the credit for Atlantic telegraphy regarded as an electrical achievement belonged to Thomson, although, in his characteristic manner, he would, in speaking of the subject, dwell on the parts played by others. Along with Mr. Canning, the engineer of the expedition, and Captain Anderson, he received the honour of knighthood.

For a time his mirror galvanometer remained the only instrument by which conversation could be carried on. He now proceeded to design a substitute for it in the well-known siphon recorder, which gives a permanent record of the successful electric impulses. Prof. Ewing explained that the action of this instrument, which is really the earliest example of the moving-coil type of galvanometer, is often called the D'Arsonval type by those who do not recognise its real origin. He was able to exhibit the second instrument of this kind which was made, owing to the kindness of the Eastern Telegraph Co., along with the modern form which the instrument now takes.

Thomson was now beginning to reap some reward for his

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inventions. He had formed in 1865 a partnership for telegraph patents with Cromwell Varley and Fleeming Jenkin. Varley's chief contribution was a highly important device of signalling through condensers, and Jenkin was associated with Thomson in the invention of what is known as "curb sending," which is the method of sharpening the signal through a cable by following up each signal current with a reverse current of somewhat shorter duration. Besides this treble partnership in patents, there was a separate partnership between Thomson and Jenkin which lasted until Jenkin's death. Among the cables for which they acted were the Western and Brazilian line, which was laid in 1873 by the ss. *Hooper* (now known as the *Silvertown*), a ship specially built for cable laying, with what was for those days a phenomenally large capacity. Prof. Ewing recalled how on one occasion when he himself was on board, the *Hooper*, when in mid-ocean, dropped one of the two blades of her single screw, and completed the round trip to Rio de Janeiro and back, including the laying of the cable on a single blade. Sir W. Thomson went out on the *Hooper* on her first trip, and it was at Madeira, where there was some delay, that he met the lady who afterwards became his wife.

In those days the testing room of the cable factory was a better school in which to learn electricity than any laboratory. Practice, which owes so much to science, was just then giving back in that department of knowledge as much as she received or more. The electricity of the workshop had outstripped the electricity of the schools. It had become more scientific than the electricity of the lecture room and of the text-book. Members of the Institution have no need to be ashamed of the heritage that has come to them from the earlier associations from which this one sprang, the Society of Telegraph Engineers. To the telegraph engineer of the '60's and '70's is due most of the exact measurements and much of the exact thinking which supplies the foundation of the electrical engineering of to-day. Prof. Ewing then delighted his audience with some anecdotes throwing much light on the personal character of Lord Kelvin, partly extracted from reminiscences of Mrs. Fleeming Jenkin.

The second part of the lecture dealt with Lord Kelvin's work in navigation. In all that concerned the art of the navigator he took a keen interest, and with him that meant an impulse to improve the art. Taking the older aids to navigation, the compass and the sounding line, he revolutionised them both. He found the compass full of serious defects. Everyone knew it was very unsteady, and was liable to be set swinging through a large angle when the ship rolled. Under a mistaken idea of what would lead to steadiness, the card was usually made heavy and the needles long, and the long needles made it impossible to correct the compass properly for the magnetism of the ship. He recognised that for this purpose the needles must be short. Further, that for steadiness, what was wanted was a long period of horizontal oscillation. But to keep the frictional error down, the weight of the card, including the needles, should be small. So he made the card as light as he could get it; a mere aluminium rim tied by silk threads to a small central boss, and from the silk thread spokes he hung short pieces of magnetised knitting needles, to serve as the magnet. Magnets and all the card only weighed 180 grains, for a 10 in. size, and yet its period of oscillation is much longer than that of the old standard compass. A story is related of Lord Kelvin once showing it to a committee of admirals, who were disposed to say: "Too flimsy. Sure to be fragile." His reply was to throw it across the room. Another admirable feature of Kelvin's invention is his method of keeping the compass always level. He hung the bowl as usual from gimballs, but used knife-edges for their support, and to damp the swinging motion he partly filled the lower part with oil. Prof. Ewing then explained how the problem of the correction for the magnetism of the ship is solved. This magnetism springs from two causes. First, there is the more or less permanent part which the ship takes up when she is first built; then there is the induced part which changes with every change of course, a transient effect due to the induction of the earth's magnetic field. The permanent magnetism produces an effect when the ship is "swung," as if the compass were disturbed by a bar magnet turned slowly round a vertical axis. This error reaches a maximum twice in a revolution, hence it is called the semi-circular error. This magnetism has, of course, components fore and aft, thwart-ships and vertical, and the semi-circular error produced by them is corrected by putting suitable permanent magnets under the compass in the binnacle. One group of the correcting magnets faces fore and aft, and another faces thwart-ships. If the ship remains always on even keel these two sets would be sufficient, but when the ship rolls another kind of error, called the "heeling error," comes in, which arises from the fact that the ship's magnetism has a vertical component, which becomes inclined, with the result that a new force comes into play, hence Kelvin corrected this by putting in his binnacle an upright bar or bars of permanently magnetised steel directly under the centre of the compass card. Considering next the effects of induced magnetism, he explained how the error due to this was a maximum when the ship was lying N.E., S.E., S.W., or N.W., and for this reason is called the quadrantal error. It is corrected by balancing the fore and aft iron in the ship by two iron balls near the compass and on either side of it. The possibility of correcting the quadrantal error in this way had been pointed out by Airy as early as 1840, but with the old form of compass card and needles it could not be done because of the excessive length and large magnetic moment of the needles. A further cause of error is produced by the induced magnetism due to the vertical component of the earth's field, and this is corrected by a bar of soft iron in a vertical position at the back of the binnacle arranged so that the magnetism induced in it will act as a counter balance. This is called the Flinders bar, so called because its use was pointed out by Captain Flinders as early as 1801. Kelvin also devised an attachment to his compass in the Azimuth mirror, an apparatus which, standing on the top of the bowl allows bearings of distant objects to be readily taken by sighting. He also invented the deflector, an instrument for testing the adjustment of the various correcting magnets with a view to determining whether the effect of an external field is the same on the compass for all positions of the ship. The evolution of the Kelvin compass took about five years, but it was not until twelve years after the date of his patent, or eleven years after he had laid the invention formally before the First Lord of the Admiralty, that it was adopted in the Navy.

In the navigational sounding machine we have another invention of first-rate importance. Prof. Ewing explained the principal features of this machine, of which he was able to show an example. Another of Kelvin's services to navigation was his advocacy of what is called the position line in working out of a navigator's sights, in connection with which he published a set of very useful tables.

The lecturer then said a few words on Kelvin's work in the investigation of the tides and method of harmonic analysis introduced by him in this connection, culminating in the design of the mechanical tide predictor now largely in use.

"I have said nothing to-night," concluded Prof. Ewing, "of the lofty flights of scientific imagination which are perhaps his highest title to fame, but I have said enough to show that Kelvin was no mere philosopher with head in the clouds. He was quick to recognise a real need: quick also to see how the need should be met. He found material for invention in the most commonplace appliances, because his mental habit was in everything to seek for the how and the why, and to ask himself in what way the thing might be done better, and he had an infinite faculty of taking pains and adhering to a purpose until he secured its full accomplishment, and going on from improvement to improvement in pursuit of the same perfect result, and, with all this, a courage and hopefulness that no opposition could damp, that never accepted defeat. We may apply to him the words which he himself used of Cyrus Field: he possessed an admirable and unapproachable quality, an attribute of heroes; he never knew when to give in."

A vote of thanks to the lecturer was proposed by Mr. Alexander Siemens, and seconded by Prof. Silvanus P. Thompson, F.R.S., who paid particular tribute to the clearness of Prof. Ewing's explanation of the corrections of the compass, and was carried by acclamation.

Tests of Metal Filament Lamps.—We are informed that a series of life tests on 15 of the principal makes of tungsten-filament lamps has just been completed at the Westminster Testing Laboratory (York Mansion, York Street, Westminster). The following lamps were tested:—Pope, Simplex, Metalite (Bryant), Sunbeam, Auriga (Westinghouse), Welsbach, Leuconium (Stearn), B.T.-H., E.M.F., Cryselco, Efesca (Falk, Stadelmann), Metfil (Ediswan), Wultun (British Tungsten Lamp Co.), Osram (G.E.C.), and Metalik (Boddy). Four lamps of each make were tested. They were obtained direct from the makers, and purported to be for 200 volts, and of either 32 British or 32 Hefner candle-power. The lamps were run at 200 volts for 1,000 hours, and were tested for mean horizontal candle-power, watts and watts per C.P. at start, and after 200, 400, 600, 800, and 1,000 hours. The voltage during the run was maintained constant within ½ per cent. by an automatic regulator. The results of the tests have been printed in full and bound in one volume. In addition to giving the results for each lamp individually, this also gives the average of all of each make at each period, and the average for each make throughout the whole run. The subscription for a copy of the complete report is £2 2s. Additional copies may be obtained at £1 1s. each.

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A NEW AUSTRALIAN TELEPHONE EXCHANGE

TO the order of the Commonwealth Post Office a complete telephone exchange equipment, manufactured and equipped by the British Insulated & Helsby Cables, Ltd. (of Prescot, Helsby, and Liverpool), has recently been put into operation at Fremantle, Western Australia. The new exchange is of the latest common battery type; the system, in fact, is very similar to that in use at the new exchange at Cardiff, described in ELECTRICAL ENGINEERING of December 3rd, 1908.

The Fremantle exchange has a main distributing frame with a capacity on the vertical side for 2,400 lines; the frame is fitted with carbon lightning arresters and heat coils, together with 5-ampere enclosed fuses for 1,200 lines. Its horizontal side has a capacity for 2, 880 lines, or 20 per cent. greater than that of the vertical side, in order to allow for spare wires in the street cables, and this side is equipped with tag connection strips for 1,400 lines.

In the same room an intermediate distributing frame is provided of the "vertical" type. Instead of there being horizontal and vertical sides, alternate verticals are used for multiple and local connections. The cables from the M.D.F., multiple jacks and line and cut-off relays, are joined to the multiple verticals, whilst the local jacks only are wired to the local verticals, the cross-connections being made by quadruple jumper wire. The scribers' multiple jacks, the outgoing junction jacks are also in strips of 20. Each strip has below it a designation strip, of similar dimensions to the jack strip, fitted with 20 removable labels, which are engraved with the names of the distant exchanges and the number of the lines thereto. The present equipment of subscribers' multiple jacks is 900, of the outgoing junctions 80, whilst the capacity of the jack panels is for 1,600 and 160 respectively per four panels.

The sections are constructed with iron frames, the woodwork visible from the front of the switchboard being polished mahogany, and at the rear ash and other suitable hard wood; all is lined with uralite. Electric light reflectors are fitted and provided with 16 c.p. lamps, whilst plug sockets are provided at the back of the sections for portable hand lamps. All apparatus used in connection with the subscribers' operators' cord circuits is mounted on the sections, but owing to the small size of the sections, part of the incoming junction apparatus is fitted on a special rack at the rear of the sections.

For traffic supervision a chief operator's desk is provided and equipped with observation circuits, in addition to other necessary circuits, and listening lines to the operators' telephone sets. The observation circuits have lamps which light and darken simultaneously with the line lamps of subscribers complaining of irregular service to whose lines the observation

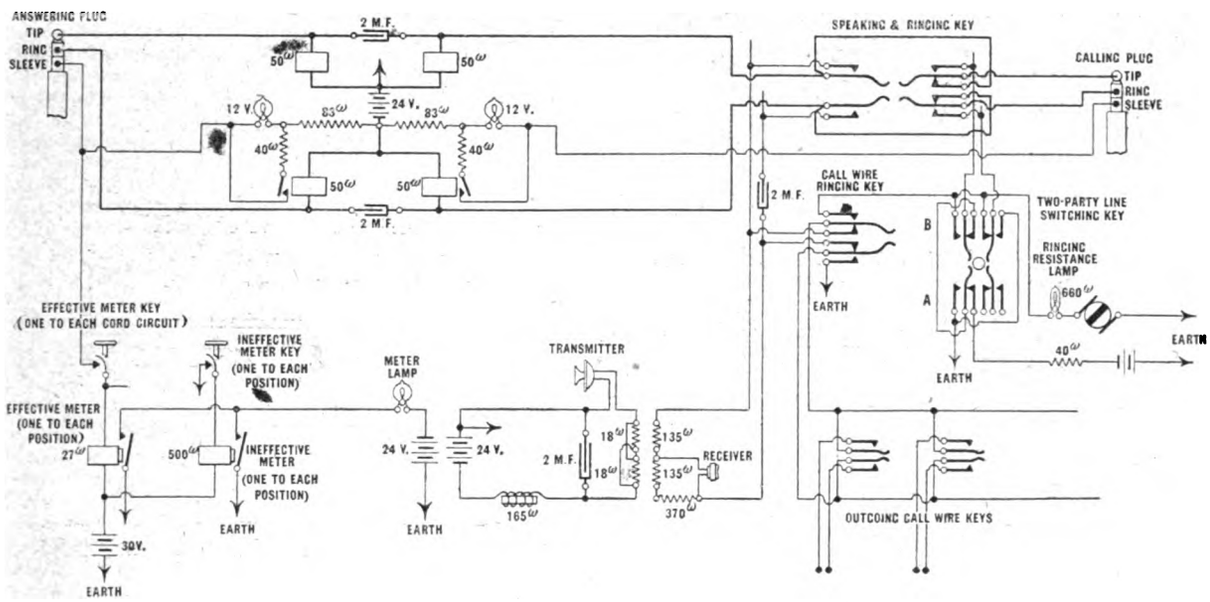


FIG. 1.—SUBSCRIBERS' OPERATORS' CORD CIRCUIT.

I.D.F. is single-sided, and is fixed to the wall of the apparatus room. Line and cut-off relays for 900 subscribers' lines, of 60 ohms and 30 ohms resistance respectively, are located in strips of 10 of each on a rack forming part of the same frame as the I.D.F., and in parallel with each cut-off relay is connected a subscriber's service meter. The meters are, of course, mounted on a separate rack.

The subscribers' sections, of which seven are supplied, are each arranged for one operator's position, and each section is equipped with 15 cord circuits similar to that in use at Cardiff and shown in Fig. 1, except that provision is made for party line ringing, suitable for the operation of selective and semi-selective lock-out 2- and 4-party lines. It will be noticed that the repeating coil is dispensed with, and that the battery is connected to the line through a supervisory relay and retardation coil on each side, each pair being separated by a condenser which allows the passage of the speaking currents. Each section has capacity for 200 calling lamps and answering jacks, whilst an equipment of from 100 to 180 subscribers' lines per operator is provided.

Two incoming junction sections, also for one operator's position, are provided, each fitted for 28 single-cord circuits. One section is wired for junction circuits incoming from other C.B. exchanges, and the other for circuits from magneto exchanges. Single lamp clearing is adopted for the former, and double lamp clearing and supervision for the latter.

The subscribers' multiple jacks are in strips of 20 at ½ in. centres; these strips are 11½ ins. in width and ½ in. in height. The multiple jacks are repeated every four panels, as are also the outgoing junction jacks. As in the case of the sub-circuits are connected; the chief operator can thus note the time taken to answer such subscribers' calls.

A testing officer's desk allows of the efficient testing and maintenance of the outside lines and plant. Special circuits are provided to facilitate testing from the multiple. These circuits end in plugs fitted on a dummy position on the switchboard, the ordinary engaged test click being supplemented by a "tone test," which intimates to operators requiring the lines into which these testing plugs have been inserted that such lines are out of order and under test.

The accumulators consist of two sets of 11 "J. 16" Tudor elements in type "J. 28" lead-lined wood boxes, and two sets of four "J. 2" Tudor elements in type "J. 4" glass boxes, the latter being put in series with the main batteries to raise the potential to 30 volts for the operation of the subscribers' meters in the ordinary manner.

A motor generator, consisting of a 12½ h.p. alternating-current motor coupled to a variable voltage generator, is provided for the charging of the above cells, and a choking coil is introduced into the charging circuit to enable the exchange to be run direct from the machine without the batteries, or to enable simultaneous charging and discharging. To obviate a breakdown, owing to only one charging machine being installed, a spare rotor and armature are supplied.

To supply the necessary ringing current, a 75-watt ringing motor generator and a 75-watt ringing dynamotor are provided, and each is fitted with the interrupter drums for giving the tone-test signals already mentioned, and for breaking up this tone into dots and dashes for the "busy-back" and "don't answer" signals, jacks for which are arranged on the switch sections.

A slate power board is equipped for the control of the power

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plant, and a slate fuse-board in an iron cabinet, fitted with the latest pattern patent alarm fuses, protects the power supply circuits to the switchboard and other apparatus. These fuses have a sleeve which rotates when the fuse wire is blown; this makes a contact, and lights a lamp to indicate on which bar a fuse has melted, and a bell is also rung to call the attendant's attention. At the same time the rotation of the sleeve discloses a coloured patch which indicates the individual fuse operated.

In addition to the foregoing exchange equipment over 800 subscribers' telephone sets were supplied, some being equipped with special lock-out party line apparatus. This lock-out device permits only one subscriber to speak on a party line at any one time unless another subscriber on the same line is required; in this latter event the second subscriber may be called by the operator, and the first subscriber, by depressing a key, cuts out of circuit a low resistance coil which normally prevents a second subscriber's mechanism from operating. The ordinary subscriber's telephones are wired up to the "bridge circuit," thus giving a very quiet line.

Sixty switchboards for private branch exchange working have been provided, the sizes varying from one exchange line and three extension lines, to four exchange and twenty extension lines. The smaller sizes are cordless, and all indicators fitted on these boards are of the drum type.

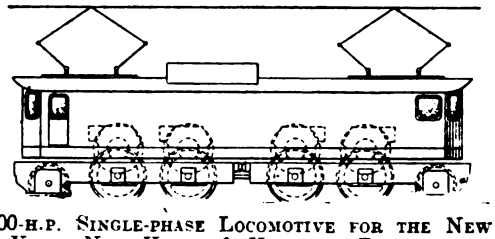
A large number of special extension switch sets for extension line working were included in the tender. These switches are operated by means of a key having four positions all operated by the same lever. A hand generator is fitted for calling the extension instrument, the main instrument being normally connected to the exchange, and a primary battery for energising the microphones when the main and extension instruments are connected. A drum indicator, only in circuit when the extension instrument is through to the exchange, is operated during the conversation, enabling the main instrument to know when to replace the key to its normal. By the addition of two short straps of bare wire the main instrument is enabled to come in parallel with the extension instrument when the latter is through to the exchange.

A porcelain base protector, fitted with carbon lightning arresters, heat coils, and fuses is provided for each instrument.

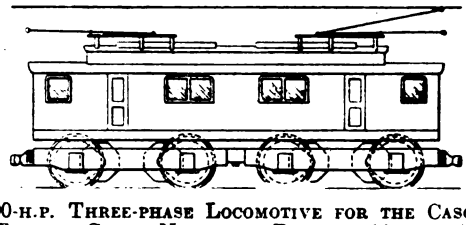
We are indebted to the British Insulated & Helsby Cables, Ltd., for the information given in this article.

A COMPARISON OF SOME RECENT ELECTRIC LOCOMOTIVES

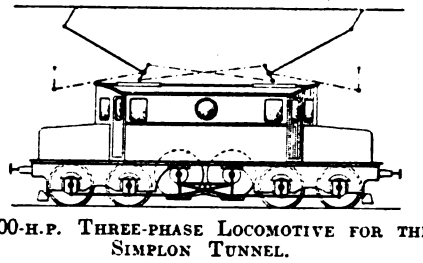
WE have collected together, for the sake of comparison, the following particulars of four heavy electric locomotives of recent design, which illustrate some new departures in the methods of driving and of mounting the motors, and indicate some of the directions in which developments are taking place. All three systems of electric traction, namely, single-phase, three-phase, and continuous-current, are represented, and an interesting comparison of the equipments and design can be made.



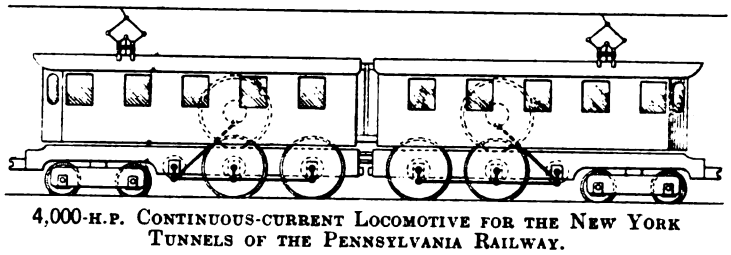
1,400-H.P. SINGLE-PHASE LOCOMOTIVE FOR THE NEW YORK, NEW HAVEN & HARTFORD RAILWAY.



1,900-H.P. THREE-PHASE LOCOMOTIVE FOR THE CASCADE TUNNEL, GREAT NORTHERN RAILWAY (AMERICA).



1,400-H.P. THREE-PHASE LOCOMOTIVE FOR THE SIMPLON TUNNEL.



4,000-H.P. CONTINUOUS-CURRENT LOCOMOTIVE FOR THE NEW YORK TUNNELS OF THE PENNSYLVANIA RAILWAY.

OUTLINE DRAWINGS TO THE SAME SCALE OF FOUR LARGE ELECTRIC LOCOMOTIVES, SHOWING METHODS OF DRIVING.
[One inch = 20 feet.]

The first is the single-phase goods locomotive built by the Westinghouse Electric & Manufacturing Co. (America) for the New York, New Haven, and Hartford Railroad, and was described in ELECTRICAL ENGINEERING, December 9th, 1909, page 1041. This was designed for handling fast goods trains, but will also be used for hauling heavy passenger trains. The 2-4-4-2 wheel arrangement has been adopted. Each truck has two pairs of driving wheels and a single pair of leading wheels. The electrical equipment comprises four 350-h.p. single-phase geared motors, for operation on either 11,000-volt alternating-current or 600-volt direct-current. The motors are placed directly over the axles, and are mounted rigid on the truck frames. A special form of flexible drive, described in detail in the above-mentioned article, is employed, and this smoothes out the torque pulsations and allows vertical movement of the axles. The centre of gravity of the motors, as well as that of the entire locomotive, is high, avoiding the transmission of strains and shocks from the track and roadbed to the motors. The locomotive is capable of hauling a 1,500-ton train at a speed of 35 miles per hour. When used in passenger service 800-ton trains are hauled at a maximum speed of 45 miles per hour.

The first three-phase locomotive illustrated is one of those working on the Cascade Mountain tunnel section of the Great Northern Railway in Washington, U.S.A. This locomotive has no guiding wheels, the whole weight of 103 tons being on the driving wheels. There are two trucks connected by a coupling, each truck having two driving axles; a motor is connected to each axle by twin gears with a gear-ratio of 4·26. The diameter

General Particulars of Locomotives.

Locomotive.	New York, New Haven, and Hartford Rly.	Great Northern Rly. Cascade Tunnel.	Simplon Tunnel.	Pennsylvania Rly. New York Tunnels.
Nature of Supply...	Continuous-current Single-phase 25 ~	Three-phase 25 ~	Three-phase	Continuous-current
Line Pressure ...	D.C. 600 v. A.C. 11,000 v.	6,000 v.	3,600 v.	600 v.
Motor Pressure ...	600 v.	600 v.	1,000 to 3,000 v.	600 v.
Number of Motors.	4	4	2	2
H.P. per motor (One Hour Ratg.)	350	475	700	2,000
Total H.P. on One Hour Ratg. ...	1,400	1,900	1,400	4,000
Total Weight (Tons)	116	103	68	148
Weight on Driving Wheels (Tons) ...	84	103	68	93
Total Length of Locomotive ...	48 ft.	44 ft.	38 ft.	70 ft.

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of the driving wheels is 5 ft., and the synchronous speed of the motors 375 r.p.m., corresponding to a speed of 15 miles per hour on the load corresponding to the one-hour rating of 475 h.p. per motor. The motors are completely enclosed and cooled by forced ventilation. Each locomotive has two 400-kw. transformers weighing 4·6 tons each. The motors weigh 5·45 tons each exclusive of gears. A single locomotive is capable of hauling an 885-ton train at the normal speed, and of accelerating such a train up a 2·2 per cent. gradient. The control system of each motor is separate, and speed variation is obtained by means of resistance control in the rotor circuits.

The Simplon three-phase locomotive illustrated is the latest design on this railway and is known as F.4/4. It was constructed by the A.-G. Brown, Boveri & Cie., of Baden, Switzerland, for operation in the Simplon tunnel, and presents some new features in three-phase design. There are two 700-h.p. motors, with short-circuited rotors, and four economical running speeds are obtained by changing the stator connections so as to vary the number of poles. There are two separate windings on each stator; one winding will give either 6 or 12 poles and the other 8 or 16, corresponding to speeds of 71, 35, 53, and 26 km. per hour respectively. As shown in the figure, the two motors are coupled together and to the four driving axles by means of eccentrics and coupling-rods without the interposition of gearing. The motors are operated by means of a controller worked by compressed air, and the transformer permits of the pressure at the terminals being raised from 1,000 to 3,000 volts in ten steps of 200 volts each. On the last step the motors are supplied at the full line pressure. On account of the great difference between the temperature in the tunnel and outside, it has been found necessary to enclose the stators totally to avoid condensation on the windings, and to do without forced ventilation, both of which factors considerably reduce the output of the motors for their size.

The large continuous-current locomotive illustrated is for handling the Pennsylvania Railroad trains into the New York station and through to the yards on Long Island. Twenty-four of these locomotives have been ordered from the Westinghouse Electric & Manufacturing Co. of America. The motors are mounted upon the frame and side-connected to the driving wheels by a system of cranks and parallel connecting rods, similar to steam practice. This permits the mounting of the motors upon the frame, secures their spring support, and brings the centre of gravity to 79 in. above the rail, or approximately the same as in high-speed steam locomotives. This locomotive can start a train of 550 tons trailing load upon the tunnel grades under the river, which are approximately 2 per cent. The guaranteed tractive effort is 60,000 lb. The normal speed with load upon a level track is 60 miles per hour, but during some of the trial runs a speed of 72 miles per hour was attained. The locomotive is an articulated machine. Each half carries its own motor and has four driving wheels 68 in. in diameter and one four-wheel truck with 36-in. wheels. The motors are 600-volt 10-pole interpole machines, designed for forced ventilation, with a capacity of 2,000 h.p. each. At this output each motor takes 2,900 amperes direct from the third rail. For the relief of the driving mechanism from excessive strains in the event of short-circuit in the motors, an adjustable friction clutch is provided between the armature spider and the motor shaft.

Manchester Engineering Exhibition.—At a representative meeting of engineers held at the Midland Hotel, Manchester, on Wednesday, 12th inst., it was resolved that a General Engineering and Allied Trades Exhibition be held in the spring of 1911, under the management of a committee of exhibitors, and to be organised by the International Trade Exhibitions, Ltd., London. The building is now in course of erection in Old Hall Lane, Rusholme, and will have a ground floor area of 100,000 square feet.

Commutation Pole Traction Motors.—In connection with the order from the Hull Corporation for twenty 33 h.p. tramway motors and controllers received by Messrs. Siemens Brothers Dynamo Works, Ltd., it is interesting to note that the motors are fitted with commutation poles, and the controllers are arranged according to the new system recently worked out by them, in which the ordinary series parallel system is combined with control by shunting the fields. Particulars of these commutation-pole motors were given in ELECTRICAL ENGINEERING, Vol. V., page 842, and the company claim that the employment of commutation poles in traction motors, and the system of control which is rendered possible by their use, marks a distinct advance in the direction of economy and satisfactory working of tramways. We are informed that this order was placed after exhaustive comparative tests on the first set of equipments of this type already supplied to the Hull Corporation Tramways against motors run with the ordinary series parallel control, and others working on the regenerative principle.

PETROL-ELECTRIC MOTOR BOATS

A NUMBER of motor boats with combined petrol engine and electric drive similar to the Pieper "Auto-mixte" system have been constructed by Messrs. Siemens-Schuckertwerke, of Berlin, and some examples are described in a recent issue of *Elektrische Kraftbetriebe und Bahnen*. The petrol engine is connected to a machine which can act as either motor or dynamo by an electro-magnetic coupling, and a second similar coupling is inserted between this machine and the propeller shaft. An accumulator battery is connected in parallel with the motor-dynamo in circuit with a controller for starting, varying the speed, and reversing, while a second switch is provided for obtaining different conditions of drive. When this latter switch is in the off position, all the circuits are broken, and both electro-magnetic couplings are released. In the charging position the engine is coupled to the machine, which is started as a motor from the battery by working the controller. The machine then begins to generate and charges the battery. The next is the normal running position in which both couplings are closed. When the controller is moved to "start," both engine and propeller are started by the machine acting as motor, but the engine immediately picks up and drives both machine and propeller, the speed being varied by the controller. At low speeds the machine generates and charges the battery, as only a portion of the engine power is required by the propeller, but at high speeds the conditions are automatically reversed, and the battery supplies current to the machine, which then acts as a motor assisting the engine. For reversing, the machine only is used and takes current from the battery, and the switch is placed in the fourth position, in which the coupling between the engine and the machine is released. In the fifth position the battery is disconnected, and the propeller is driven by the engine only, and no charging takes place. The speed in this case is regulated by hand levers, which vary the petrol supply and the ignition. Lastly, there is a sixth position of the switch for driving the boat forwards independent of the engine.

A 17-ft. cruising boat equipped on this system has a 20-h.p. petrol engine and a motor-dynamo of about the same output. The total weight of the electrical equipment is 4·3 tons, of which 2·8 tons is the weight of the battery. The latter comprises 80 cells, with a total capacity of 213 amp.-hours on the one-hour discharge rate. The total displacement of the boat is 9·37 tons. With purely electric drive, a speed of 5·7 miles per hour is attained with an expenditure of 3·5 h.p., and a four or five hours' run can be made with the accumulators alone at a speed of 7·5 miles per hour. The electrical equipment of this boat includes an arc search-light, glow-lamp lighting of the cabins, and electric ventilating and cooking apparatus. A boat for sea-going purposes has a 35-h.p. petrol engine, but a motor-dynamo of only about 6 h.p. The battery also is very small, weighing only half a ton. With purely electric drive a distance of about 18 miles can be covered on one charge at a speed of about 6·2 miles per hour.

Embezzlement.—At the Central Criminal Court on Friday, Vincent Edward Moir was sentenced to six months' imprisonment in the second division, for embezzling about £500 whilst acting as secretary of the National Society of Telephone Employees.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—Members: A. Anderson, Prof. L. A. Herdt, P. W. Sothman, R. E. Winkfield. Associate members: P. M. Baker, F. E. Bayley, W. Bent, W. H. D. Bostock, P. R. Boulton, G. Bowyer, W. C. Chappell, W. F. J. Cosser, W. S. Cunningham, D. S. Duff, T. M. Dutton, T. W. Ellis, R. F. Fry, W. A. Fullalove, G. G. Gale, H. Gobie, A. G. Grier, R. L. Griffin, A. B. Hart, A. H. Hull, J. H. Hull, H. H. Johnson, R. Johnson, C. G. Kirkus, H. Kitchen, S. C. Leggett, H. A. McInnes, D. McLennan, R. Murray, R. Nimmo, H. Ogilvie, P. J. Pybus, E. L. Ransome, J. W. Ray, O. L. Record, Major G. B. Roberts, R.E., J. W. Saaler, R. Sherley-Price, M. G. F. Temple, H. G. Townsend, P. W. Turner, W. T. Wardale, R. A Weaver, C. Whillis, J. H. Whiteley, B. Wood, H. G. Young. Students: Meer Laig Ali, G. D. Aspland, W. H. Padger, G P. Bailey, A. Barratt, H. E. Bellamy, B. S. Penning, J. E. Blair, J. W. P. Chalmers, W. H. Clarke, A. Coleman, R. H. Collier, J. L. H. Cooper, M. R. de Cordova, V. C. Dixon, G. W. Edward, F. F. Elliott, C. C. Elsworth, J. Gilbert, E. G. Grant, E. Grimshaw, R. W. Gunter, J. P. Guy, W. A. Hatch, F. Hayter, F. G. Heymerdinguer, G. Ingram, J. G. Jamieson, T. W. Jeffreys, R. S. Jull, C. H. Keith, J. M. Knight, F. P. S. Lacey, E. L. Lindquist, A. D. Mackinnon, A. Maclean, G. B. Manson, W. R. Millar, J. A. Nunn, L. H. Page, D. E. Parton, P. O. L. Pellowe, W. J. Pickersgill, W. H. Rean, C. Reid, R. E. Ricci, F. G. Ride, H. N. Ridgway, A. K. Roxburgh, A. Rushton, H. H. Scotland, H. G. Sharp, P. E. Stevens, R. E. Stradling, A. B. Stratford, S. H. Temple, A. C. Thompson, A. C. Timmis, H. S. Tisshaw, L. W. Tivy, A. H. Watson, A. P. Welch, C. W. Westwood, A. G. Wheeler, E. V. Winstanley, H. P. Young.

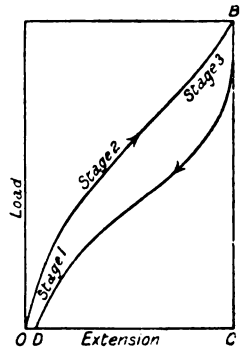
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THE TESTING OF RUBBER

A PAPER entitled "The Testing of Rubber for Electrical Work" was read by Prof. A. Schwartz on Jan. 11th, before the Manchester Section of the Institution of Electrical Engineers. The author pointed out that purely electrical tests did not afford satisfactory indications as to the permanence of those qualities of the rubber upon which its power of insulation depends. For information on this head we must turn, he said, to physical and chemical tests, and he considered in detail methods by which the various mechanical and other tests which he recommended might be carried out.

After a consideration of the various ways in which tensile tests may be applied, he discussed the best form for the test pieces, their preparation and mounting, and described the hysteresis machine he had devised.

The object of this machine is to effect the extension of the rubber by means of a load which is increased at a given rate until either a given load or a given extension is attained. When this point is reached the load is diminished at the given rate and the rubber is allowed to retract, the relation between load and elongation being recorded automatically throughout the test. The hysteresis loop furnishes a graphical record of extension of the rubber test-piece as the load is increased from zero to a given maximum and then decreased again to zero. The physical quantities which may be obtained from a hysteresis diagram drawn between limits of load or extension are set out as follows in connection with the accompanying figure. The



TYPICAL HYSTERESIS CURVE OF RUBBER.

rate of extension with load is given at any point on the extension curve *O B* by the inclination of the tangent at that point. The rate of retraction in a similar way may be obtained from the retraction curve *B D*; the work done in extension is given by the area *O B C' O*; the work done by the rubber in retracting is given by the area *D C' B D*; the work expended in the rubber itself is given by the area of the loop *O D B* O; and the sub-permanent set remaining after a given extension: this is measured by the length of the line *O D*.

With a normally vulcanised standard specimen of high-grade rubber stressed nearly to its breaking-point, the extension curve may be divided into three distinct portions in which the relation between load and extension differs considerably. Considering the extension curve *O B*, we see that in the first portion (stage 1) the increase in extension per unit of load is small, and that for the middle portion of the curve between (stage 2) it becomes much larger, and is practically constant, falling again on the last portion of the curve (stage 3). With high-grade rubbers which are correctly vulcanised and with rubbers which are under-vulcanised or contain a small proportion of substitute, stages 1 and 3 are small, while stage 2 is large. With hard rubbers which are over-vulcanised or contain a large proportion of mineral matters, stages 2 and 3 are small or suppressed, and stage 1 is large.

The following procedure is suggested for reducing the salient features of a number of hysteresis loops of various rubbers to a common basis for purposes of comparison:—(1) The designation of the form of extension curve as convex, linear, &c. (2) The determination by means of a planimeter or area scale of the areas representing the work done in extending the rubber. (3) The determination of the work done by the rubber retracting. (4) The reduction of the areas in (2) and (3) to their equivalent triangles on a given base.

With homogeneous material, the loops obtained with the hysteresis machine are identical for any number of standard specimens of a given material, and are, therefore, characteristic of the material. It must, however, be borne in mind in this connection that freshly vulcanised rubber improves with keeping, and takes some time to settle down to a constant state, so that if comparative tests are to be made on a number of samples which are newly manufacured care should be taken that they are all of the same age.

Experiments were made on the effects of variation of temperature, from the results of which it did not appear that variations in the test-room temperature were likely to present any serious difficulty. Variations in speed of working were also found not to be of great consequence in commercial testing.

The author's researches confirm Stevart's law that for a given extension the load is directly proportional to the cross-sectional area of the specimen, and show that the work done in extension, retraction, and in the rubber itself is also proportional to the cross-sectional area of the specimens. Further experiments showed that for a compound containing 88 per cent. Para and a 200 per cent. extension, the work done in extension, retraction, and in the rubber itself is directly proportional to the length of the specimen. A further series of experiments with 88 per cent. Para mixing rolled into sheets which were vulcanised for different times showed that the work done in extension, retraction, and in the rubber itself, was for a 200 per cent. extension approximately proportional to the length of the specimen multiplied by a coefficient which was proportional to the time of vulcanisation. On the completion of the first cycle of extension and retraction the specimen may be retained in the machine and subjected to a series of similar cycles, the limits of which may be set either by a given maximum extension or a given maximum load. This successive cycle test may be applied to discriminate between mixings containing various percentages of rubber. The proportion of rubber in the mixing exercises a considerable influence on the areas of the loops for the first cycles, and also on the increments of extension due to the subsequent cycles.

In another method of testing the specimens were given a constant elongation by being stretched between two fixed points, arrangements being made to measure the decrease in tension at definite time intervals with a view to ascertaining the relative durability of specimens made from the same compound, but vulcanised at a given temperature for different lengths of time. Tests of this nature were made at various temperatures, and it was found that the decrease in tension for the under-vulcanised and for the over-vulcanised specimens was in each case greater than that for the correctly vulcanised ones. Some of the observations made by this method, however, were inconclusive.

Further experiments were directed to the measurement of the slow stretch of rubber under constant load. This test may be used to discriminate between mixings, in which the rubber contents are varied, and also the degree of vulcanisation of a given mixing. Investigations were also made on the influence of small percentages of substitutes and on the various known qualities of rubber. The author has found, however, in cases in which he has known the actual order of merit of the samples from a knowledge of their composition, that the results of the maximum extensions per cycle have placed the specimens in their correct order, whereas the results for the sub-permanent set have not done so. Further, the maximum extensions are far easier to measure than the sub-permanent set, as the quantities are larger and the specimen is under a constant tension at the time the quantity is recorded.

In this country, continued the author, owing to the initiative of the Cable Makers' Association, we are fortunate in possessing a partial system of standardisation for rubber cable coverings. The standardisation, however, only extends to certain particulars, thus for each size of cable the minimum thickness of dielectric is fixed, and certain grades or quantities are established, the minimum insulation per mile being fixed for each of these grades. The individual manufacturers have a free hand as to the ingredients they employ in the compounds, provided that the finished article complies with the above conditions. It is suggested that a further standardisation, based on the physical properties of the rubber, may prove advantageous in discriminating between C.M.A. material and other material on the market which is sold as being "equal to C.M.A." Such a test would also enable the manufacturers to secure uniformity in the degree of vulcanisation, in the quality of the rubber employed, and in the amount of mineral filling used.

The author conducted a series of tests with samples of C.M.A. and non-Association cables. When first submitted to him, and therefore probably freshly manufactured, the 2,500-megohm grade samples all extended over 300 per cent. before breaking, while for the 600-megohm C.M.A. grade the extensions at break-

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ing lay between 200 per cent. and 300 per cent., with the exception of one sample, which extended 305 per cent. before rupture. The non-Association cables, with one exception, broke with extensions of from 80 per cent. to 200 per cent.

These samples were exposed to the air for three months, and as the rubber covering was stripped from the core, both the inside and outside were exposed, and the samples deteriorated to some extent; and to allow for this the extension limits decided upon for the tests were 200 per cent. for the 2,500-megohm grade, and 150 per cent. for the 600-megohm grade. All the 600-megohm C.M.A. coverings broke before reaching the 200 per cent. extension, with the exception of two, and the hysteresis loops for these two specimens were larger than those for the 2,500-megohm grade. It is evident, therefore, considers the author, that the existing C.M.A. conditions have already brought about results which allow of the two grades of cable coverings being broadly distinguished from one another by means of their physical properties.

The points which a satisfactory physical test should ensure would seem to be the following :—The employment in the mixing of a given percentage of rubber of a quality that shall not fall below a given standard; the restriction of the employment of recovered rubber and substitute within limits as to both quantity and quality; the degree of vulcanisation imparted; the character of the mineral filling used.

It would appear hopeless to expect any one test to fill all the above requirements, but the author thinks that possibly the necessary tests might be carried out with the hysteresis machine on the following lines :—(1) The hysteresis loop for a given grade of covering to lie within certain limits as to load, extension, and area. (2) The hysteresis loop after the specimen has been heated under specified conditions as to time and temperature should not vary from the loop under (1) by more than a specified amount. (3) The increments of extension for successive cycles to fall within specified limits.

DISCUSSION.

THE discussion was opened by Mr. A. WHALLEY, who pointed out that but little 88 per cent. mixture was employed in cable work. One reason that a lower percentage of rubber was necessary for uniformity of electrical results at a reasonable cost was that it was difficult on mixing rolls to get a really homogeneous mixture with much above 50 per cent. of rubber. To produce a more homogeneous mixture with the higher percentages, the two mixing-mills were driven at different speeds, but the increased friction caused partial vulcanisation on the rolls when the sulphur had been added. Even when the electrical results were better with the higher percentages of rubber—and in some directions they might be worse—they were not often proportional to the increased cost. He asked some questions as to the interpretation of the experiments, and was inclined to think that the constant load tests tended to imperfect results. The author's new testing-machine should be valuable in certain directions. The assumption, however, that it was a law that the smaller the area of the mechanical hysteresis loop the better is the cable, or the longer its life, needs most careful examination before acceptance.

Mr. C. BEAVER (Messrs. W. T. Glover & Co.) was not prepared to admit that physical tests could displace other usual cable tests, but thought that the author's development of the machine and researches in connection with it have rendered it quite ready for its application or dovetailing into existing tests used in connection with rubber cable work. From the cable-maker's point of view, therefore, the ideal conditions would be to standardise a hysteresis loop for a given grade of insulation, which would coincide with the maximum combined efficiency of electrical and vulcanisation results. He would then have his correct electrical standard, his corresponding maximum of chemical stability, and the corresponding physical test. When these were properly proportioned to one another for any given class of work, the author's machine would be applied to its greatest advantage, and would be of equal service to manufacturer and purchaser. He protested against the author's disparaging remarks as to 600 megohms grade C.M.A. cable, and said that the section of the Paper relating to substitute had practically no connection with cable work—at least, so far as cables made in this country were concerned. Even foreign cables did not often contain more than 10 per cent.

Mr. J. H. C. BROOKING (St. Helen Cable Co.) considered that tests of the effect of heat upon cable were important, and agreed that for ordinary purposes the stretch test, as shown by Prof. Schwartz, should be of considerable interest to those concerned.

Mr. W. CRAMP (Manchester Municipal School of Technology) did not understand why diagrams which were called hysteresis loops were plotted with the loads as ordinates. In electrical work they were accustomed to plot the magnetising force (which in this case corresponds to the load) horizontally, and, turning the curve round, gave it a curious and unfamiliar look. He failed to find in the Paper any experimental confirmation of Prof. Schwartz's law that with constant cross-section the area of the hysteresis loop for a given load was proportional to the length of the specimen. If confirmed, it would follow that two mechanical characteristics of rubber might be expressed in the form of ergs. per cubic centimetre per cycle, exactly as in the case with iron hysteresis. By testing a number of specimens, different hysteretic constants might be deduced to be adopted as standards in specifications. If a distinct connection could be shown between the hysteresis loop and the dielectric strength, the testing-machine would be of still greater use to electrical engineers.

Mr. T. URMSTON spoke from experience of the excellent working of the machine and

Mr. H. CAMPBELL CORMACK suggested that more consistent results might be obtained if, instead of a longitudinal section, an entire tubular length of the insulation of the cable or wire could be taken. Samples from different sizes of cables would be of varying lengths, but the ratio of length to diameter could be kept constant. Such samples would not be similar, inasmuch as the ratio of thickness of envelope to diameter would not be the same for all sizes.

Prof. E. W. MARCHANT (Liverpool University) asked Prof. Schwartz whether he had ever made any tests on the rate at which the electric current, through rubber, diminished when a steady P.D. is applied, and whether that has any relation with the hysteresis loops which we have seen. He was inclined to think that although these extension tests might be very useful, they were not adequate to determine the true quality of rubber for electrical purposes.

Mr. C. F. SMITH (Manchester Municipal School of Technology) thought that the great alteration in rubber on exposure to air would introduce difficulties. If the mechanical property could be taken as a sort of standard indication of the physical nature of the rubber, it would be of great value from the mechanical test alone to find the relation between this mechanical standard, and the various other properties of the rubber, such as its insulation, dielectric strength, and what ought to be closely analogous to it, the dielectric hysteresis constant when rubber is used in an alternating cable.

Mr. A. S. L. BARNES and Mr. C. C. ATCHISON (Borough Electrical Engineer, Rochdale) spoke briefly, and Mr. S. J. WATSON (Borough Electrical Engineer, Bury) made a few remarks from the chair, but the author, owing to the lateness of the hour, was only able to reply briefly.

ELECTRICAL EQUIPMENT OF ROLLING MILLS

THE electrically operated 28-in. cogging mill equipment recently installed by Messrs. Dorman Long & Co., Britannia Works, Middlesbrough, has fully justified the courage and enterprise of the firm in being one of the first to realise the advantages of the electrical operation of this class of machinery.

The mill is a 28-in. cogging mill, and on the 26th November last, during a night shift of 12 hours, it cogged 92 ingots 14 in. by 12 in. down to both 6-in. and 5-in. billets as required in 4 hours 41 minutes actual cogging time, the total weight cogged being 105 tons. The mill, which was built by Taylor & Farley, of West Bromwich, and the electrical equipment, which was designed and built by the British Thomson-Houston Co., Ltd., of Rugby, gave no indication that they were then at their limits.

The output for which the mill and equipment was originally designed was 15 tons per hour, with a possibility of dealing with 22½ tons per hour for two hours continuously if required. It will be noted that during the shift referred to the output of the mill was 22 tons per hour, for 4¾ hours continuously. In this mill an ingot of from 22 to 25 cwt. 14 in. by 12 in. can be cogged down to a 5-in. billet in 2¼ minutes.

We understand that this is the fastest running cogging plant in the North. It reflects great credit, not only on the users for the manner in which the mill is operated to obtain these results, but on the designers and builders of the mill and its equipment.

Glasgow Technical College Scientific Society.—The first part of Vol. VI. of the transactions of this society has just been issued and contains a short address by the President, Mr. A. G. Strathern, on the importance of thoroughness in engineering work. The paper by Mr. A. G. Collis, of Messrs. Ferranti, Ltd., on "High-tension Switchgear," and the discussions on it, are also included in this volume, together with a large number of plates and diagrams. An abstract of this paper appeared in ELECTRICAL ENGINEERING, Nov. 11th, 1909, Vol. V., p. 973.

Electric Traction on the Prussian State Railways.—According to the *A.E.G. Zeitung*, the Allgemeine Elektricitats Ges. of Berlin has received an order for a 3,000-kw. 900 r.p.m. turbo-alternator with turbine-driven auxiliaries for the new generating station which is to be erected to supply the Dessau-Bitterfeld section of the Prussian main-line railways. An order has also been received for a 62-ton single-phase locomotive for this line. This will have one 900-h.p. motor connected to the two driving axles by coupling rods. The contact-line pressure is to be 10,000 volts, and the frequency 15 cycles per second.

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PRODUCTION OF ELECTRICAL MACHINERY IN 1907

A BLUE-BOOK has been issued which summarises the results of the returns received under the Census of Production Act, 1906. This deals with a number of industries, including electrical engineering, and gives tables relating generally to the year 1907. The following particulars show, as far as can be at present determined, the value of the finished products of the electrical industry, the values returned being values at works, and not the selling prices :—

Electrical machinery and parts thereof :—Direct- and alternating-current generators, £851,000; direct- and alternating-current motors, £1,592,000; motor-generators, converters, and transformers, £494,000; switches, rheostats, £511,000; switchboards, £678,000; other descriptions, £30,000; making a total of £4,156,000.

Electrical instruments of all kinds, £484,000; primary batteries, £109,000; secondary batteries, £434,000.

Lamps and parts thereof (except carbons) :—Glow lamps, £235,000; arc lamps and search-lights, £226,000; making a total of £461,000.

Telegraph and telephone cables :—Submarine, £1,102,000; land, £809,000; making a total of £1,911,000.

Electric power and lighting cables :—Paper and bitumen insulation, £1,322,000; rubber insulation, £1,300,000; other and unclassified insulation, £729,000; making a total of £3,351,000.

Transmission apparatus and plant, £539,000; telegraph and telephone accessories, £307,000; electrical accessories, £392,000.

Contract work in the United Kingdom (exclusive of materials) :—Telegraphic or telephonic lines or works, £47,000; electric power or lighting works, £1,200,000; making a total of £1,247,000.

Repair and maintenance work for customers, £391,000.

The total for electrical engineering amounts to £13,782,000.

The exports during 1907 were as follows :—Electrical machinery and parts thereof, £996,000; electrical goods and apparatus, including telegraph and telegraph apparatus, £668,000; telegraph and telephone cables, £1,301,000; electric wires and cables, insulated, £501,000. The figures for the net imports under the above headings, *i.e.*, imports less re-exports, were as follows :—£570,000; £716,000; £207,000; £158,000.

The value of the imports of electrical machinery is nearly 14 per cent. of the value of the home manufacture as returned above; of electrical goods and apparatus, 26 per cent.; of telegraph and telephone cables, 11 per cent.; and of electrical wires and cables, 5 per cent.

In comparing these figures it must be borne in mind, as has already been pointed out, that the values returned to the Census of Production are values at works, while those declared by exporters are the values of goods free on board at port of shipment, and those declared by importers are the values of goods at port of landing.

Wireless Telegraphy.—The first of the Donaldson line steamers to be equipped with a wireless telegraph outfit is the *Athenia*, and it is stated that the *Cassandra*, of the same line, is also being fitted.

The Compagnie Générale Transatlantique have commissioned the Marconi International Marine Communication Co. to equip the s.s. *Guadeloupe* and *Perou*, which trade between Havre and Colon, with wireless telegraph apparatus.

It is stated that a Government Bill is to be introduced in Canada, having for its object the control of wireless telegraph companies doing business in the Dominion.

Telegraphic Traffic and Movements of Cable Ships.—The c.s. *Restorer* has been engaged in the laying of a telephone cable for the British Columbia Telephone Co. from Telegraph Bay to the island of San Juan, the old one having been broken during recent storms.—Telegraph cables have behaved fairly well during the past week. There were interruptions between Bagdad and Bassorah on the 11th and 13th insts, and on the 13th communication between Tangier and Mogador failed, but was repaired on the same day. Telegrams for the latter place were despatched from Casablanca at the same rates, and it was not necessary to give a fuller address.—On the same day also direct connection between Saigon and Bangkok failed, and telegrams are routed *via* Pakse Obome subject to delay.—The condition of communication in Central and South America is still far from satisfactory, owing to censorship and senders' risk. Telegrams to Novo Dondo and Bailundo in Angola are also subject to delay.—American telegraph companies have of recent years been rather active in West Indian waters, and it is known that the American Government also is desirous of extending telegraphs in that part. As soon as the concession of the International & Ocean Telegraph Co. expired, a direct cable was laid from New York to Havana, and as the concessions of the Cuba Submarine Telegraph Co. in Cuba, and of the West India & Panama Telegraph Co. in Puerto Rico, expire in 1910, it is quite possible an extension of American lines to these islands may take place. In fact, schemes considered by Congress included cable connection between Puerto Rico and the Isthmus of Panama.

THE BUFFER STOP COLLISION AT EALING

MAJOR PRINGLE'S Board of Trade Report on the fatal buffer stop collision which occurred at Ealing Broadway Station of the Metropolitan District Railway, in circumstances already reported in ELECTRICAL ENGINEERING (Vol. V., p. 1033), on November 18th, 1909, has now been issued. After briefly describing the accident, which happened to a train coming straight from the depôt in the morning, Major Pringle reviews the evidence, which, in his opinion, proves beyond dispute that the cause of the collision was failure of the brakes to act on account of there having been no air pressure in the train pipe or auxiliary reservoirs at the time of the accident. This appears to have been due to the isolating valve on the main reservoir pipe under the driver's brake valve having been left closed when the train started out, contrary to instructions. When this valve is closed, no air can pass from the main reservoir line into either the driver's brake valve, the auxiliary reservoirs and train pipe line, or the pressure gauge. The reading of both needles in the gauge will then be negative, and any application of the continuous brake either by the driver or conductor will have no effect.

It appears that ineffective attempts were made by the driver to pull the train up by putting over the reversing switch, with the result of causing the section circuit breaker to come out.

The report goes into the regulations for preparing a train for service, and investigates the irregularities which occurred in the procedure that morning. Finally, the attention of the company is called to the following points :—

1. The desirability of enforcing invariable obedience to the regulations for testing the continuous brake. Where trains stand for the night at a station and commence passenger service without any preliminary journey, the station inspector or other officer should be instructed personally to see the brake tested, and to sign the conductor's return that he has seen it tested, and that it was in working condition.

2. It is not clear that motormen and conductors are sufficiently exercised in the proper method of dealing with an emergency such as the failure of the continuous brake, more especially as regards the use of the reverse, and hand brakes. Some action to ensure that the men's practical knowledge is maintained in this respect seems to be desirable.

3. The conductor's test of the continuous brake, as now prescribed in the company's instructions, is insufficient. It is possible to make a full application by the emergency valve, and, even with so ineffective a pressure as 12 or 15 lb. in the train pipe, to be misled, by the rush of air escaping and by the sound of the blocks striking the wheels, into thinking that the brake is in working condition. It is necessary to observe on the gauge that the correct pressure (62 lb.) is available before making the test, and is recovered when the valve is closed.

THE NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION

WE have received from this association a short review of the results of their activity during the past year. In regard to railway and shipping rates, a conference with railway company officials has resulted in a new classification for metal filament lamps, which in practice amounts to a reduction of 15 per cent. off the former rates. The cost of carriage of recording ammeters by rail has also been reduced, owing to the efforts of the association, and a reduction in the freight of electric lamp shades to South Africa has been obtained. In Parliamentary matters the association was successful in influencing the retention of a clause in the Electric Lighting Acts Amendment Bill relating to hire apparatus whereby machinery which is now let out on hire by electric supply authorities to users cannot be distrained on.

The association has entered into an agreement with the British Traders' Association whereby, through its status bureau, members now receive information very definitely and promptly. In addition to this, members now have their debts collected free of cost in England and Wales, and can consult the solicitor of the British Traders' Association free of expense.

Useful help has been given in legal cases, and the association has established a trade custom regarding cash discount, of which cash discount can only be allowed subject to the following conditions : "All goods supplied during any calendar month are due for settlement on or before the last day of the following month, unless shorter terms have been arranged."

Meetings of different classes of manufacturers have been arranged for the discussion of various questions, and matters relating to exhibitions have been dealt with. The association has nominated members of the Engineering Standards Committee and of the Institution of Electrical Engineers Committee for the revision of the "Model Conditions of Contracts," and has also forwarded the interests of the Benevolent Trades Institution which was founded by it in 1906.

Extension of Central London Railway.—It is stated that the extension of the Central London Railway from the Bank to Liverpool Street will shortly be commenced. It is anticipated that the extension will be completed in twelve months.

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FACTORY ORGANISATION

A PAPER on the above subject by Mr. James Rider (Middlesbrough) was read on Thursday last before the Rugby Engineering Society. In discussing first of all the lay-out of works, the author emphasised the importance of each separate productive operation automatically bringing the article at each stage of manufacture to the point where it was most convenient to handle it, either for loading and despatch as a semi-finished product, or for the next succeeding process. He also spoke of the advisability of having plenty of margin of power in lifting and transport machinery, and adequate shop lighting. Again, the position of the stores had considerable influence on economy. Too often the store building is detached from the main factory, or is in one corner. It is desirable, if possible, to make this building run along the end of, and at right angles to the various shops of the main factory, making its internal arrangements correspond as far as practicable with each shop, and so secure that the needs of each section are served with a minimum cost of time and labour.

With regard to the administration of the factory, this should be divided into two distinct sections, the operating and the commercial. The whole attention of the operating staff, from the works manager down, should be devoted to production, and should not be taken up with details of stores and cost-keeping, which properly belong to the commercial department of the administration.

The author considered that the most important factor in works or factory organisation is that of cost of production, including the method of obtaining accurate information upon it. He favoured the cost office being part of the accountant's department. There are, he said, many systems of time recording, but few which surpass or equal that of the job card, with one card to each job done by the workman, and this worked well, with a certain number of shop clerks patrolling the shops, checking the men's cards, and changing them when required. The foreman appointed the man his work, giving him a ticket, which contained (as far as possible printed on a standard form) his instructions. The shop clerk saw that this corresponded with the work the man had in hand, and checked the time of commencement and completion.

The procedure with regard to material would be rather different. Assuming an order was given out for one or a group of standard machines, such order, emanating from the drawing office, should be accompanied with a complete list of all the parts required for each machine, the drawing or print showing the operations required to finish each part. This order would be sent to the works manager's office, from whence requisitions would be forwarded to the stores for all material required.

A careful organised store or stock-keeping system is essential. Just as in commercial book-keeping, he continued, it is necessary to have separate accounts for each individual customer, however small, so it is equally necessary to have separate records of each article which is of sufficient importance to require keeping in stock. By the judicious use of card ledgers, analysis sheets, and similar appliances for making up the accounts, it is possible to always keep the factory well and fully supplied without carrying an excessive stock, and to keep a constant check on stocks. Many directors and managers are frightened at the sight of black-coated clerks, and carelessly (and really ignorantly) class them as unproductive, and necessary evils, but the accountant's department of a factory, with its cost and stock records, if not a money making, is, or might and ought to be, a money saving department.

One of the weakest parts of factory organisation is that relating to fulfilment of delivery promises. One reason why there is so much default on this point is, that it is very rarely the business of any one department or person to follow up orders in each stage. There is frequently serious delay in getting drawings and instructions into the shops.

In conclusion, the Paper dealt shortly with indirect factory expenses which, if not carefully watched, are liable to become excessive; on the other hand, machinery requires attention, and in this connection it is much cheaper, whenever possible, to anticipate breakdown and prevent its occurrence.

Naval and General Engineering Exhibition.—A Naval, Mercantile, Marine, and Engineering Exhibition will be held at Olympia from August 31st to September 24th, 1910, inclusive. The organising manager is Mr. F. W. Bridges, 119 Finsbury Pavement, London, E.C. The patrons and Hon. Advisory Council include a number of persons well known in the electrical industry, including Dr. Gisbert Kapp, Sir John Gavey, C.B., Sir A. B. W. Kennedy, Sir W. H. Preece, K.C.B., Mr. G. K. B. Elphinstone, Mr. W. B. Esson, Dr. R. T. Glazebrook, Mr. W. H. Patchell, Mr. Charles Bright, Mr. H. V. Kramer, Mr. W. C. Mountain, Mr. J. H. Rosenthal, and Captain H. R. Sankey.

METER DISPUTE AT GRAVESEND

AN action is being heard in the King's Bench Division before Mr. Justice Hamilton, in which the Gravesend and Northfleet Electric Tramways, Ltd., ask for an injunction ordering the Gravesend Corporation to remove three meters from their power station, which are used for the purpose of measuring the electrical energy supplied to the tramways. The facts of the case are as follows:—Under an agreement dated February 11th, 1902, the Gravesend Corporation undertook to supply electrical energy to the company, and in clause 4 the amount of energy supplied was to be ascertained by the average reading of three wattmeters, which were supplied and calibrated by the Corporation and fitted in their power-house. In August, 1907, the company alleged that the meters were registering inaccurately, and that in consequence they had paid a larger sum to the Corporation than that represented by the amount of energy actually supplied. The difference to August, 1907, was settled, but without any admission on the part of the Corporation that the meters were inaccurate. As a consequence of this, the clause of the original agreement was altered so as to read that the amount of energy supplied should be ascertained by the average reading of three wattmeters to be supplied by and remain the property of the Corporation, but that such meters were to be calibrated and fixed in the Corporation's power-house and connected in a manner to be reasonably approved by the company.

The statement of claim is to the effect that from August 7th, 1907, to August 7th, 1908, the meters recorded a supply of about 40,627 units in excess of what the actual supply was, and that the meters are still recording wrongly, and that from August 7th, 1908, till the commencement of the action the meters recorded about 47,000 units too much. The company have refused to pay for the amount actually registered, and also allege that the Corporation have never asked for their reasonable approval of the connection of the meters provided for in the supplementary agreement. The Corporation deny all these allegations, and counterclaim for the sum of £233 16s. 4d., which has been deducted by the company from the account delivered for the year ending August 7th, 1908, for electrical energy supplied, and also 4 per cent. interest from that date till payment. The Corporation also claim that the company have approved the connection of the meters, inasmuch as they have not objected to such connection since it was made. The meters in question are of the B.T.-H. Co.'s motor type of integrating wattmeter.

The case for the company is that a complete investigation of their cars and equipment has not revealed any such defects as to account for the excessive consumption per car-mile, which is greater at Gravesend than upon any of the other lines of the British Electric Traction Co. Evidence was called to show that since September, 1907, the consumption per car-mile had continued to increase, and this was demonstrated by the following figures:—1907, 1·2 units per car-mile; 1908, 1·4 units per car-mile; 1909, 1·49 units per car-mile. In the opinion of the witnesses for the company, the variation in the number of cars in service, the fact that top-covered cars might be used, or the fact that chilled wheels or steel tyres were employed, did not account for the difference. They therefore came to the conclusion that the meters must be recording inaccurately. It was admitted, however, in cross-examination, that on one occasion when the meters were tested one was found to be correct and the other two were reading slow. One of the witnesses went so far as to assert that the B.T.-H. motor-meter was incapable of measuring accurately a fluctuating load such as a tramway load, and that the only meter likely to do this without fear of inaccuracy was the Aron meter. It was pointed out that the test mentioned above was made on a uniform load and not on a fluctuating load. It was further contended, on behalf of the company, that the meters had been installed in 1902, and that the weakening of the brake-magnets had made them read fast. Such meters, it was said, were also liable to be affected by stray fields, and it was suggested that they were not properly shielded.

On the point that this type of meter was regarded as unfit for the particular class of work, Mr. Justice Hamilton remarked that apparently the company had not held this view up to August, 1907, and that under the agreement there was nothing to compel the Corporation to install a different type of meter, even if an admittedly better one was known to exist. Both parties had apparently agreed that the meters installed were satisfactory up to a certain date, and now one of the company's witnesses alleged that this class of meter was not suitable for the work in question. What was the remedy of the company under the agreement if the Corporation did not put in a proper meter in a proper manner?

Mr. WALTER, K.C., who appears for the Company, said it seemed to him that there was no liability on the part of the company to pay.

Mr. Justice HAMILTON said that that was how the agreement struck him, and he did not understand why the company need have brought this action.

In the course of further discussion, Mr. Bousfield, K.C., who appears for the Corporation, said that two of the meters read within 2 per cent. of each other, and the third read within 5 per cent. of the other two.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Jan. 13th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

28,040/08. **Train-lighting Dynamo.** T. FERGUSON. In a previous patent, No. 17,311 of 1908, a train-lighting dynamo was described, in which the armature was caused to slide along its shaft away from the field system by the action of the increase in driving-torque due to the higher output at high speeds. According to this invention, the increase in torque is utilised to produce the displacement, not of the armature, but of a sleeve on the shaft which is connected to a pivoted arm. The latter cuts in resistance into the shunt field-circuit, and thus reduces the voltage and output. Five claims, six figures.

28,186/08. **Balanced Protection Systems.** C. H. MERZ and B. PRICE. A protective arrangement for simple A.-C. circuits comprises an iron ring surrounding the two- or three-core cable and a winding on the ring connected to the tripping gear of the main switch. Should there be leakage to earth, the currents in the cores will be unbalanced, the ring will be magnetised, and the current generated in the winding will trip the switch. Instead of placing the winding round the cable, three current transformers with the secondaries connected in parallel or series to the tripping coil may be used. Other similar arrangements are described. Six claims, eleven figures.

5,235/09. **Trolley Head.** H. DUDGEON and H. CROSS. This head is so constructed that it is free to swivel when in contact with the trolley wire, but is brought forcibly into alignment with the pole when the hand rope is pulled, to enable easy replacement on the wire. This is effected by attaching the rope to a short lever pivoted on the fixed part of the pole head in such a manner that it presses on projecting pieces on the swivelling part and brings it into alignment. Three claims, four figures.

6,138/09. **Aluminium Solder.** C. E. STEINWEG. A solder for aluminium comprises an alloy of aluminium and 5 per cent. cadmium. The sticks are tubular and are filled with a flux consisting of 60 per cent. chloride of lithium, 30 per cent. fluoride of potassium, and 10 per cent. cryolite. Five claims.

19,098/09. **Magnetic Track Brakes.** DICK, KERR & Co., LTD. (*R. Braun*). A number of electromagnets are connected together by links so that the brake takes the form of a chain which can adjust itself to irregularities in the rail. The units are excited separately, so that the failure of one does not affect the others. The units are interchangeable, and the number per brake can be varied to suit the conditions. Two claims, one figure.

20,005/09. **Single-phase Commutator Motor.** SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*). To improve the speed characteristic of a single-phase shunt or separately excited commutator motor, an auxiliary winding is provided on the stator. This winding replaces the ordinary compensation winding, and is supplied from an auto-transformer with an E.M.F. of such magnitude and phase that the E.M.F. of self-induction in the armature winding is neutralised by transformer action. Four claims, three figures.

20,115/09. **Collector for Surface-contact Traction System.** THE S.P. (SUCHOSTAWER PATENTS) SYNDICATE, LTD., and H. M. SAYERS. This is a collector or skate formed of one or more lengths of metallic woven fabric carried edgewise under the car, with the width of the strips of which the fabric is composed at right-angles to the direction of motion so that they scrape across the contact studs or third rail. Devices for keeping such a skate in tension and for magnetically drawing it down on to the studs are described. Six claims, four figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MORRIS and LISTER [Pressure regulation on A.-C. systems] 416/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Insulating material] 2,128/09; WITZENMANN [Method of armouring cables] 4,957/09.

Dynamos, Motors, and Transformers: SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*) [Polyphase commutator machines] 21,542/09; ALLGEMEINE ELEKTRICITÄTS GES. [Machines] 26,146/09.

Electric Ignition: BROWN and VANDERVELL [Commutator] 20,897/08; TROIKE [Magneto-generator] 14,153/09; GIBAUD [Ignition mechanism] 20,241/09.

Electrometallurgy and Electrochemistry: JOHNSON (*Badische Anilin und Soda Fabrik*) [Manufacture of calcium nitrite] 11,275/09.

Incandescent Lamps: COOLIDGE [Metal filaments] 282/09.

Instruments and Meters: FRICKER and MORDEY [A.C. meters] 129/09; PRALON, FRANÇON and FOURNIER [Meters] 10,456/09.

Storage Batteries: FENNELL and PERRY [Charging and discharging arrangements] 6,773/09.

Switchgear, Fuses, and Fittings: REASON MANUFACTURING CO. [Time-switches] 353/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Motor controllers] 551/09; TANNAHILL [Controllers] 3560/09; SIEMENS BROS. & Co., LAUCKERT and NEBEL (partly *Siemens & Halske Akt.-Ges.*) [Switch] 10,550/09.

Telephony and Telegraphy: SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) [Telephone exchanges] 13,749/09, and 25,882/09; STRAGIOTTI [Telephone systems] 17,473/09, and [Telephone relays] 17,542/09.

Traction: GROB [Lighting and heating of vehicles] 28,120/08; MUNRO and RAILLESS ELECTRIC TRACTION CO. [Trolley-arm] 764/09. and [Collector] 11,947/09; KOHLER [Collectors, 26,808/09; GROB [Control of vehicle lighting] 27,937/09.

Miscellaneous: FAGERLUND [Electrically operated valves] 2,740/09; SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) [Thermo-electric temperature indicator for steam locomotives] 24,389/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Telephony, &c.: VON LEPEL and BURSTYN [Oscillation generator] 30,030/09.

Traction: BOIRAULT [Automatic brakes] 30,088/09.

Miscellaneous: CLEIREN [Electro-mechanical power transmission] 29,995/09; ANDERSON [Transmitting pictures to a distance] 30,188/09; JONES [Alarms] 30,305/09.

Opposition to Grant of Patents

14,615/08. **Dry Cell.** H. HUNTE. An appeal has been lodged against the decision of the Comptroller to grant this patent. The specification describes a dry cell with vertical air passages through the depolariser open at top and bottom. Further particulars were given in ELECTRICAL ENGINEERING, Sept. 30th, 1909, Vol. V., p. 859.

27,303/08. **Arc Lamp Mechanism.** C. E. G. GILBERT. The opposition to this patent by H. P. Bleckley, of the Abbey Electric Co., has been withdrawn. Full particulars of the patent and of the grounds of opposition were given in ELECTRICAL ENGINEERING, December 30th, 1909, p. 1101.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

1,563 of Jan. 22nd, 1896. **Railway Signal.** R. PEARSON. To indicate that the signal has worked, the semaphore arm carries a curved glass tube containing a globule of mercury immersed in oil. There are two contacts at either end, and when the arm moves up or down, one circuit is momentarily closed by the mercury and an indicator in the signal box operated.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: A. BLONDEL [Supplying current through friction shoes to burning ends of flame carbons] 19,712/05; M. V. ELY and E. R. GROTE [Reflectors] 19,719/05.

Dynamos, &c.: H. CHITTY [Magnetic bridge-pieces for placing between pole-shoes] 20,820/03; E. A. CAROLAN (*General Electric Co., U.S.A.*) [Prevention of field distortion in single-phase rotary converters] 21,045/04.

Electric Ignition: D. B. ADAMS [Automatic stopping of overheated combustion engines] 21,354/02; J. PORTER [Switch for ignition circuit] 21,093/03; H. HILL [Ignition of acetylene carriage lamps] 19,570/05.

Electrometallurgy, &c.: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Vacuum resistance furnace] 20,809/04; A. F. BOSQUET [Electro-deposition] 20,896/04; G. SCHAULI [Primary cell] 19,616–6A/05.

Instruments and Meters: BRITISH THOMSON-HOUSTON CO. (*E. Thomson, U.S.A.*) [Dynamometer type voltmeter] 22,218/97.

Switchgear, &c.: R. W. H. HOFSTEDE-CRULL [Switchboard construction] 21,008/03; E. DU BOIS [Time switch] 19,551/05; CROMPTON & Co. and R. C. HARRIS [Automatic circuit-breaker] 19,603/05.

Telegraphy, &c.: E. OLDENBOURG [Multiple tube electro-capillary relay] 19,425/05; F. OPRENDEK [Telephone relay] 19,819/05.

Traction: H. BRAMHALL and J. B. PEAT [Station indicator] 21,069/03; W. PROKOV and M. RICHTER [Track signalling] 20,941/04; A. L. PRENTISS [Pneumatic control of trolley poles] 19,504/05; F. B. HOLT and A. WALLIS [Electrically worked signal] 19,568/05; F. HEWER [Trolley head and wheel] 19,746/05; J. HAYDOCK and T. S. JONES [Trolley wire supports] 19,753/05.

Miscellaneous: K. W. HEDGES [Joints and connections of lightning conductors] 19,678/99; E. A. CAROLAN (*General Electric Co., U.S.A.*) [Electromagnetic gearing] 21,142/04.

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Mr. WALTER pointed out that when tested against a Chamberlain & Hookham meter, the three B.T.-H. meters were fast to the following extent:—8·3 per cent., 14·1 per cent., and 13 per cent. Continuing, he said that the agreement provided for three meters to be fixed by the Corporation in their power-house, in a manner to be reasonably approved by the company. The Corporation had never asked for the approval of the company with regard to the mode of connection, and this raised the question of stray fields. It might be that all the meters were registering fast, and surely it could not be contended that the company should pay?

Mr. Justice HAMILTON replied that if it were true that the B.T.-H. meter was largely used for a similar purpose, this would be material evidence, and it was not for him to say how much they should register fast in order to condemn them as unsuitable meters, having in view the terms of the contract. The question of their construction in relation to meters of different types was another matter, and did not arise on this action, it seemed to him.

Mr. WALTER contended that with a 3 per cent. variation, it could reasonably be said that an instrument did not read accurately.

The hearing was adjourned. Among the witnesses yet to be heard in the case are Mr. A. P. Trotter, Mr. J. Rennie (who have been subpœnaed on opposite sides), Mr. H. M. Sayers, Mr. A. H. Preece, and Mr. S. H. Holden.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[READERS APPLYING TO ANY OF THE UNDER-MENTIONED FIRMS FOR COPIES OF THE CATALOGUES OR PAMPHLETS REFERRED TO ARE REQUESTED TO MENTION "ELECTRICAL ENGINEERING."]

CALENDARS.—One of the most artistic of the wall calendars that we have received is that of the British Westinghouse Electric and Manufacturing Co., which presents a striking example of effective colour printing, showing a damsel driving home a flock of geese, illumined by the rays of the setting sun.

Messrs. Evershed & Vignoles' desk blotting bad is combined with an abridged catalogue of their electrical instruments, a monthly calendar, and an engagement pad with weekly tear-off sheets.

STEAM PIPE COUPLING.—A pamphlet from the Westinghouse Brake Co. (82 York Road, N.), describes a flexible steam pipe coupling for railway steam heating pipes, which entirely does away with rubber packing.

ENAMEL INSULATION.—A booklet from Messrs. Connolly Brothers, Ltd. (Blackley, Manchester), deals with the properties of wires coated with the firm's patent enamel insulation, and gives various results of comparative tests to show its superiority over other classes of insulation for a great variety of electrical purposes. It is stated to be quite non-inflammable, to resist acids and electrolytic effects, to withstand high temperatures, and to possess high insulation resistance, combined with flexibility and durability.

THE ENGINEERING DIARY.—This is a publication which is being issued from the offices of the *Electric Journal*, at one penny monthly, and contains, besides a diary for the month of January, some useful curves and data on engineering matters.

HEATING AND COOKING APPLIANCES.—The newest catalogue of radiators and electric cooking apparatus of the Sun Electrical Co., Ltd. (118-120 Charing Cross Road, W.C.) contains a number of new and attractive designs of lamp radiators, connectors, and other heaters, and a considerable range of cooking and heating appliances on the Phœnix, Prometheus, and other systems.

ELECTRIC LOCKS.—A series of electric locks which the Sun Electric Co. have on the market is described in a leaflet just to hand. These locks are made in several forms, and are intended for unlocking a door electromagnetically from a distance by means of a push-button contact. The reclosing of the door automatically locks it, and resets the electrical release. They should be of considerable use to shopkeepers and others who desire to control their doors from behind the counter, and for garden gates and similar purposes.

TELEGRAPHIC APPARATUS.—An illustrated pamphlet from Messrs. Siemens Bros. & Co., Ltd. (Caxton House, Westminster, London, S.W.), describes the electric driving of telegraph instruments on the Mulligan system, in which both transmitting and receiving instruments are provided with motor drive. The system is applicable to any type of weight- or spring-driven apparatus, and the motors can be worked from a section of the battery supplying the telegraph circuit. By means of an ingenious device, the receiver starts and stops under the control of the transmitter at the distant end of the circuit. The system is in use by the G.P.O. at the Central Telegraph Office, London, where it is said to be giving every satisfaction. A number of photographs illustrating the comparative space taken up by weight and electric motor driven receivers are given.

ELECTRIC DRIVING OF PRINTING PRESSES.—We have received from Messrs. Kohler Bros. (56 Ludgate Hill, E.C.) an illustrated pamphlet describing briefly their well-known push-button system of driving printing presses, and containing a number of testimonials as well as a list of the newspaper and other printing offices using the system. The Kohler equipment at the *Times* London Offices was described in ELECTRICAL ENGINEERING, June 3rd, 1909, p. 506.

CORRESPONDENCE

To the Editor of ELECTRICAL ENGINEERING.

COMBINED LIGHTING AND POWER METER.

SIR,—We are much interested by a description that appeared in your last issue (January 13th, p. 33) of a combined lighting and power meter which has been put upon the market, with the purpose of encouraging the use of electrical domestic appliances without introducing two separate meters.

We would like to point out that the system described is somewhat of an old friend, and a glance at the connections which appear in diagram accompanying your description leaves no doubt whatsoever that the system described is nothing more or less than a very old friend, generally known as the three-wire connection, with split neutral, and in use for three-wire ampere-hour meters. (Fig. 1.) The principle can be applied

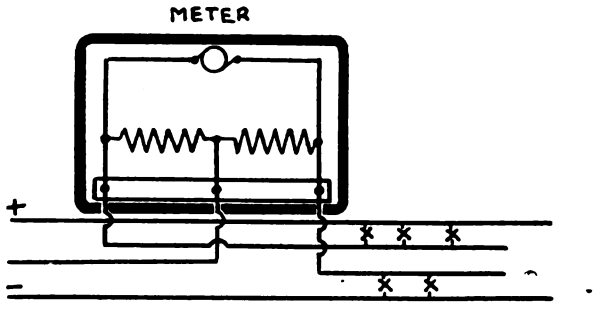


FIG. 1.

to any type of watt-hour meter, and does not call for any special instrument, such as your article leads us to believe to be the case. There are several drawbacks in connection with this method of obviating the use of double meters, principally the difficulty with which the meter can be adjusted should the ratio of the lighting and power rate differ from 2:1. Supposing, however, this latter condition to be the case, there is absolutely no reason why existing meters should not be utilised for the double rate purpose under consideration, and in this connection we may point out that shunted ampere-hour meters lend themselves most readily to the application of this system of connection. (Fig. 2.) In this case variation be-

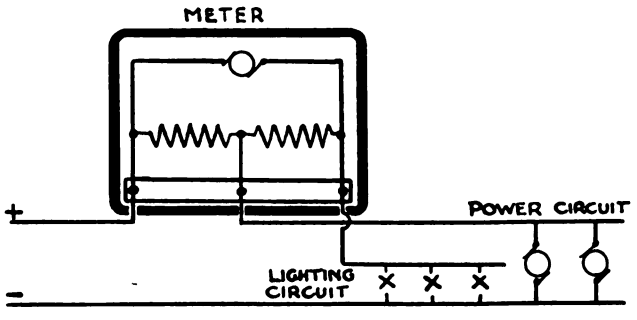


FIG. 2.

tween the ratio of lighting and power charges can be adjusted for by tapping the series shunt in the proper place.

As this type of meter is used to a very large extent, and has the additional advantage of being inexpensive, the principle might be adopted with advantage in the case of the smaller class of consumer, to whom it must be looked to make up for the decrease in revenue due to the widespread adoption of higher efficiency lamps. Our object in writing is to point out the fact that no special type of meter is essential, such as the notice we have referred to will lead central station engineers to believe to be the case.

Yours, &c.,
SIMPLEX CONDUITS, LTD.
London, January 18th, 1910. (Meter Dept.)

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LOCAL NOTES

ACTON: *Electricity Accounts.*—The report of the Assistant District Auditor says that the gross revenue of the electricity undertaking for the past financial year amounted to £9,004, and the expenditure to £9,175, leaving a deficiency of £171. After providing for repayment of loans, £2,377, and interest, £2,390, there was a total deficiency of £4,943 for the year's working.

BIRMINGHAM: *Concert.*—On Tuesday, January 11th, the Corporation Electrical Engineers and the leading manufacturers entertained the high-tension consumers and others, including their lady friends, to a Bohemian concert at the Grand Hotel. The chair was taken by Mr. Bertram Moore, and an excellent variety programme was enjoyed by all.

BURMAH: *Mandalay: Electricity Supply.*—Under the Indian Electricity Act a licence has been granted to the Burmah Electric Tramways & Lighting Co., Ltd., Mandalay, for general supply and for the supply of energy to particular consumers under special agreements, but not for traction, in respect of the area comprised within the limits of the Mandalay Cantonments.

CARDIFF: *Tramway Depreciation Fund.*—The Joint Finance and Electric Lighting and Tramways Committee report that they are of the opinion that the tramway system and its equipment is being maintained in a good and efficient condition, and that it is not, therefore, necessary at present to provide a depreciation fund other than the present sinking fund.

CLYDEBANK: *Tramways over Canals.*—At the last monthly meeting of the Town Council, Councillor Young asked if there was any further information to give as to the erection of the bridges over the Forth and Clyde Canal by the Glasgow Corporation. Were the Tramways Committee still pushing on these plans? The Provost pointed out that plans had recently been prepared and estimates taken, but they had been rejected by the railway company. He had information from an outside source that certain engineers of the Glasgow Corporation were at present preparing plans. They had made a request to the Corporation to have a meeting. Of course they were under an obligation to pay Glasgow £700 when the two bridges were built, but they would not pay a penny until then. They had still two years to go before the powers expired.

CROYDON: *Water Supply.*—At the last meeting of the Council, the provision of an artesian well at the generating station was proposed, at an estimated cost of £1,150. It was calculated that the Electricity Committee would save about £325 per annum. After some discussion it was decided to take the recommendation back in order that the matter might be considered by the Water Committee.

DUNDEE: *The New Electricity Works.*—A formal opening ceremony is to be held in connection with the new electricity works at Carolina Port. The Electricity Committee hope that they will be able to arrange with a well-known electrical engineer to perform the opening ceremony. The request of Councillor Paton for full information concerning the estimates of the new power-house, and the reasons for the delay in its completion, has been ruled out of order, as all this information has been given from time to time.

GILLINGHAM: *Electric Wiring.*—Mr. E. E. Hoadley, Borough Electrical Engineer, Maidstone, has communicated with the Council regarding a proposed Bill for conferring wiring powers on municipalities. Mr. Hoadley is to be asked to furnish a list of those boroughs which have promised financial support and the amounts promised.

ISLE OF WIGHT: *Newport: Street Lighting.*—The Council have complained to the Isle of Wight Electric Light & Power Co. that they are not fulfilling the terms of their contract, and supplying 1,000-candle-power lamps in the streets. At the last meeting of the Council it was stated that the candle-power given by the lamps was not more than 250.

LONDON: *Hampstead: Electricity Undertaking.*—At their meeting on January 13th, the Borough Council decided to engage Sir Alexander Kennedy to report, at a fee of 400 guineas, on the future working of the electricity undertaking. The report is required in consequence of the probability of large additions to the plant at the generating station being required in the near future.

Marylebone: Power Supply.—The General Manager's recommendation of a tariff for power at 1d. per unit on the restricted hour system has been adopted by the Electricity Committee.

PERTH: *Tramway Undertaking.*—Mr. Peter Fisher, General Manager of the Dundee Corporation tramways, was recently called in to investigate the Perth tramway system, and has now submitted his report. Mr. Fisher says that one reason for the unsatisfactory results at Perth can be attributed to overstaffing, in some respects to the extent of 50 per cent. He recommends running the cars on Sundays, but disapproves of half-penny fares and the granting of season tickets, except to heads of municipal departments and Corporation employees. The report also deals with certain extensions

POTTERIES: *Tramway Fares.*—A conference of local authorities in the Potteries District is to be held to consider the new system of fares recently inaugurated by the British Electric Traction Co., Ltd.

SIAM: *Electricity Supply.*—According to a Consular report, the electricity works at Bangkok are owned by the Siam Electricity Co. (Limited), a Danish company. Its equipment consists of Babcock & Wilcox boilers, Brush compound triple expansion engines, Curtis turbine, and others; Morley, G.E.C., Short, and other dynamos; Terrarie, Thompson, G.E.C., and other motors. The pressure at the consumers terminals is 100 volts, 100 cycle, single phase. The company began operations in September, 1890, and is the only electric-supply company in Siam. It furnishes the electric power and light for the city of Bangkok, both public and private, and also supplies the electric power for the 25-mile single-track overhead-trolley system of tramways.

Telephones.—The Government owns and operates the telephones. A new installation was finished this year. It is of the central-battery system, for 1,500 subscribers. The electric power, obtained from the Siam Electricity Co., is 100 volts, 100 cycle, single phase, and two sets of motor generators. The contractors for this work were a Stockholm firm.

WIDNES: *Electricity Supply.*—By the agreement with the Salt Union for the supply of electricity within the borough, the maximum charge for lighting to small consumers is to be 4d. per unit, to small consumers for power purposes, 2d. per unit; large consumers, primarily for power purposes, 1½d., where the consumption is not less than 300,000 units per annum; maximum price to be charged to the Corporation for traction purposes, 1d. per unit, and for all in excess of 500,000, ½d. Energy for public lighting will be supplied at 2d. per unit. A Provisional Electric Lighting Order is being applied for this session.

WIGAN: *Tramway Deficit.*—At the last meeting of the Corporation it was stated that the revenue for the tramway undertaking to date was £5,000 less than for the same period of the previous year. A long discussion took place, in which various suggestions were put forward for improving the position, but nothing definite was done.

WOKINGHAM: *Electric Supply.*—The Rural District Council have referred the Reading and District Electric Supply Bill to the Highways Committee for consideration and report. The Bill only affects Wokingham in relation to the roads, and the Rural Council wish to be certain that they are protected so far as reinstatement is concerned.

YORK: *Completion of Tramways.*—Lieut.-Col. von Donop made an official inspection, on Thursday, on behalf of the Board of Trade, of the tramways from Fulford to Nessgate.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ASHTON-UNDER-LYNE.—Tenders are invited for (1) a counter current jet condensing plant, (2) natural draught cooling-tower, (3) exhaust turbine and 400-kw. direct-current generator, and (4) balancer. Particulars from the electrical engineer, and tenders by February 19th. (See an advertisement on another page.)

COVENTRY.—In consequence of the increased demand for electrical energy, the Electricity Committee recommend an expenditure of £54,000.

INDIA. The Secretary of State for India invites tenders for electric power plants. Particulars from the Director-General of Stores, India Office, Whitehall, to whom tenders by January 27th.

LOWESTOFT.—The Local Government Board is to be asked sanction a loan of £1,500 for meters, and £1,000 for public lighting. A fresh set of air-pumps for the condensers are to be obtained, and the Local Government Board is to be asked to sanction the borrowing of £350 for same. The Local Government Board have sanctioned the borrowing of £1,822 for the provision of a new 250-kw. set and mechanical stokers.

MONAGHAN (IRELAND).—Messrs. Miller, Wilson & Pegg have submitted an electric lighting scheme to the Council. The estimated cost is £4,000. The matter is to be discussed at the next monthly meeting.

NETHERLANDS. The communal authorities of Leeuwarden, says the *Board of Trade Journal*, have decided on the erection of an electric generating station, the cost of which is estimated at £21,666. The burgomasters of Harmelen and Vleuten are endeavouring to arrange for the installation of electric lighting in all the communal districts to the south-west of the Province of Utrecht, the central station to be erected at Harmelen.

SHEFFIELD.—Mains are to be extended at an estimated cost of £528.

SOUTHAMPTON.—Application is to be made to the Local Government Board for sanction to borrow £660 for meters. Application is to be made to the Local Government Board for sanction to borrow £9,000, the estimated cost of fourteen new

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cars. The General Manager is to proceed with the preparation of the specifications, drawings, and bills of quantities in connection with the construction of tramways from the Clock Tower to the Northam Toll Bridge.

WOLVERHAMPTON.—The Local Government Board have sanctioned a loan of £15,000 for electricity mains, repayable in twenty-five years.

Miscellaneous

BRITISH COLUMBIA.—It is stated that the British Columbia Electric Railway Co. contemplate an expenditure of £100,000 upon new rolling stock, &c. Four electric locomotives, 100 passenger cars, and 100 freight cars are to be provided.

CANADA.—An application is to be made to the Parliament of Canada by a company for permission to construct an electric railway, about 50 miles long, from Niagara Falls Town to Dunnville. The company has a capital of about £102,750. The name of one of the directors of the company, to whom inquiries regarding the proposed railway might be addressed, may be obtained by British firms interested on application at the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

ECUADOR.—A Bill providing for the construction of an electric railway about 106 miles long, between Quito and Ibarra, has been presented to the National Congress. The maximum cost per kilom. is fixed at £2,000, and the maximum total cost of rolling stock, &c., £180,000. The line is to be completed within three years.

HELSINGFORS (FINLAND.)—Tenders are invited by the Administration Supérieure des Routes et Travaux Hydrauliques, Helsingfors, for the supply of an electric crane. Tenders by March 1st.

LONDON: *London County Council.*—Tenders are invited by the Asylums Committee for various stores for the year commencing April 1st, 1910, including electrical sundries and electric lamps. Particulars, &c., from the Asylums Committee Office, 6 Waterloo Place, London, S.W., and tenders by February 4th.

London County Council.—Tenders are invited for the roadwork and platelaying for the tramways from Brockley Station to Forest Hill. Particulars from the Chief Engineer, and tenders by February 1st.

Institution of Electrical Engineers.—The Council invite tenders for a complete system of electrically-operated clocks at their new premises on the Victoria Embankment. Particulars from the Consulting Engineers, Messrs. Handcock & Dykes, 1 Victoria Street, London, S.W., and tenders to the Secretary of the Institution, 92 Victoria Street, London, by February 4th.

Islington.—The Council invite tenders for electrical and engineers' stores for the year commencing on April 1st, including arc lamp carbons and globes, transformers and accessories, meters and prepayment meters, cables, electrical sundries, cable terminal, service, and network boxes and tapes. Tenders to the Town Clerk by February 4th.

NEWCASTLE-UPON-TYNE.—The Corporation invite tenders for an electric crane for the quayside. Particulars from the City Engineer, and tenders by January 29th.

NEWPORT (MON.).—Tenders are invited for stores, including electrical accessories, dry batteries, fuse wire, insulating tapes, and enamelled steel tubing. Particulars from the Borough Electrical Engineer, and tenders by January 24th.

OLDHAM.—The question of extending the tramways to Grains Bar at an estimated cost of £12,000 is under consideration.

SWANSEA.—A number of additional streets are to be lighted electrically, at an annual cost of £215.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

PROVINCES.

ALLOA, N.B.—Extensions to Ludgate School (£2,000). Architects, Wilson & Tait, Lumley Street, Grangemouth.

AYR.—House, St. Leonards Road (£15,000). Architect, J. Drinnan, 30 Wallace Street, Ayr.

House, Arran Terrace (£1,200). Architect, A. C. Thomson, Wellington Chambers, Ayr.

BARRY.—School, Weston Hill (£8,000). Architect, G. A. Birkenhead, 104 St. Mary Street, Cardiff.

BRISTOL.—Extensions to Casual Wards (£1,800). Builder, S. Lovell, Bristol.

BRISTOL.—The Docks Committee of the Corporation invite tenders for the electric lighting of the passenger station of the Royal Edward Dock, and the maintenance of the work for twelve months after completion. Particulars from W. W. Squire, Engineer's Office, Cumberland Road, Bristol, and tenders to the Secretary, Docks Office, 19 Queen Square, Bristol, by January 31st.

BRITON FERRY.—Public hall and institute (£5,000). Architect, H. A. Clarke, Briton Ferry.

EXETER.—Additions to St. John's Hospital School. Architects, C. E. Ware & Son, Bedford Circus, Exeter.

FIFE.—Additions to I.D. Hospital (£15,000). Architect, E. Simpson, 16 King Street, Stirling.

HALIFAX.—Business premises, Harrison Road (£1,800). Architects, J. T. Dalton, Victoria Street, Halifax.

Mackintosh's confectionery works (£2,500). Architect, Medley Hall, 1 Harrison Road, Halifax.

HORNSEY.—The Borough Electrical Engineer has been instructed to prepare a specification for the installation of electric light in Stroud Green School.

JARROW.—Secondary school (£15,000). Architect, F. Rennoldson, Union Chambers, South Shields. Builder, T. Lumsden, Albert Road, Jarrow.

LIVERPOOL.—St. James' Schools (Cathedral) (£7,000). Architects, G. Bradbury & Son, Cook Street, Liverpool.

OXFORD.—School, Thames Street, St. Aldates; also additions to buildings, Luther Street (£9,500). Architect, Wm. Henry Castle, Town Hall, Oxford. Builder, H. Flint, High Wycombe, Bucks.

POOLE.—Court Hill School (£5,000). Builders, Jones & Seward, Bournemouth.

READING.—Hall, St. Luke's Church (£1,500). Architect, S. S. Stallwood, Market Place, Reading.

SHEFFIELD.—Theatre, Bramall Lane, for Olympic Rink Co., Ltd.

Tenders are invited for an electrical installation at the Women's Hall, Ecclesall Road. Particulars from the architects, Messrs. Gibbs, Flockton & Tether, 15 St. James Road, Sheffield, and tenders to the Education Office, Leopold Street, Sheffield, by January 31st.

STIRLING.—Municipal buildings for the Town Council (£20,000). Architect, E. Simpson, 16 King Street, Stirling.

WREXHAM.—Corn exchange, Queen Street (£3,000). J. England, borough surveyor, Wrexham.

YARMOUTH.—Offices at Fish Market (£1,450). J. W. Cockrill, borough surveyor.

Presbyterian Church, junction of Trafalgar Road and Nelson Road. The Trustees.

TENDERS RECEIVED AND ACCEPTED

BELFAST.—The tender of Messrs. Gilmore & Co., of Fountain Street, Belfast, has been accepted for the maintenance of the fittings at the Ulster Hall.

GOVERNMENT CONTRACTS.—The following tenders have been accepted during the past month by the Government departments named :—Admiralty : Silk shades and incandescent lamps, Edison & Swan Co., Ltd.; extension of electric light and power station, Priddys Hard, Portsmouth, John Hunt, South Wharf, Cleveland Road, Gosport. General Post Office : Paper core cable, British Insulated & Helsby Cables, Ltd.; Western Electric Co., Ltd.; submarine cable, Telegraph Construction & Maintenance Co., Ltd.; insulators, Bullers, Ltd.; Doulton & Co., Ltd.; Taylor, Tunnicliffe & Co., Ltd.; table telephones, British L.M., Ericsson Manufacturing Co., Ltd.

LEEK.—An offer by the D.P. Battery Co. to increase the capacity of the battery from 300 to 400 ampere hours, and to maintain same for an additional payment of £39 12s. per annum, has been accepted.

LONDON: *Southwark.*—The Council have accepted the tender of the St. Pancras Iron Works Co., Ltd., for the supply of 100 ft. of floor lights at 3s. 11d. per foot super, for extending the present switchboard gallery at the generating station.

Westminster.—The following tenders have been received for providing and fixing eight 400-c.p. metal filament lamps in the 1st class swimming bath in Great Smith Street, in place of the existing arc lamps : L. White, £83; Leo. Sunderland & Co., £59; Coleby & Co., £55 10s.; Belshaw & Co., £49 12s.; Speedy Eynon & Co., £39 10s.; Drake & Gorham (accepted), £52.

Metropolitan Asylums Board.—An order has been placed with A. V. Gritkins & Co., at £27 15s., for re-wiring in the East Hospital block of the Children's Infirmary.

SHEFFIELD.—The Council have accepted the tender of Messrs. Ferranti, Ltd., at £274 for the supply of thirty-two oil-break switches, time-limit overload relays, current transformers, &c., to renew the existing fuses on the switchboard at the Sheaf Street Station. The tender of the British Insulated and Helsby Cables, Ltd., for the supply of six miles of Fig. 8 copper trolley wire for the tramway department has also been accepted.

SOUTHAMPTON.—An order has been placed with Messrs. Dick, Kerr & Co. for six car equipments at £240 per car.

WEST AFRICA.—*Commercial Intelligence* states it is reported that the contract for the supply of an electric crane to the port of Lourenço Marques has been awarded to Messrs. Nagel & Kamp, of Hamburg. A number of British crane-makers tendered, including Messrs. Dick, Kerr & Co., Messrs. Cowans, Sheldon & Co., and Messrs. Ransome & Rapier.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £62 10s. to £63 per ton (last week, £63 5s. to £63 15s.).

LIQUIDATIONS, BANKRUPTCIES, WINDINGS UP, &c.—The Silverlyte Electric Lamp Co., Ltd., is to be wound up voluntarily. This has no reference to Silverlyte (1909), Ltd.

Peter Smith, electrician, 18 Mill Street, Warrington, has been adjudicated bankrupt.

Before Mr. Justice Nevill last week a petition was down for the compulsory winding up of the London Electrobus Co. It was stated, however, that the petitioning creditor's debt had been satisfied, and the petition was dismissed, without costs.

It has been arranged that the petitions of Messrs. Dick, Kerr and Co. and A. Schonfield & Co. for the compulsory winding-up of the British Aluminium Co., Ltd., shall stand over until March. A scheme of reconstruction has been drafted, and will shortly be submitted to the debenture-holders and ordinary shareholders.

The Himalaya Electric Railway, Ltd., is to be wound up voluntarily. A meeting of creditors will be held at 28 Chapel Street, Liverpool, on January 25th at 11 a.m.

Joseph Platt and Richard Bleasdale, electrical engineers, Victoria Square, Bolton, have been adjudicated bankrupts. The first meeting of creditors will be on January 28th, at three p.m., at the Official Receiver's Offices, Byron Street, Manchester, and the public examination will be held on February 2nd, at three p.m., at the Court House, Maudsley Street, Bolton.

The Unity Motor Electrical & General Engineering Co., Ltd., is to be wound up voluntarily. Mr. J. G. Taylor, 28 Baldwin Street, Bristol, is liquidator. A meeting of creditors will be held at this address on January 25th, at three p.m.

CANADIAN AGENCY.—A firm in the Midlands manufacturing an electrical and magnetting machine wish to arrange for its introduction and sale in Canada. Further particulars may be obtained from the Board of Trade Branch for City Trade Inquiries, 73 Basinghall Street, London, E.C.

REYROLLE LANTERN SLIDES.—Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, have a large number of lantern slides illustrating their various manufactures, and they will be glad to send sets on loan for use in connection with lectures at Colleges, Engineering Society Meetings, &c.

WESTERN ELECTRIC CO., LTD.—With reference to our notice of the incorporation of the Western Electric Co., Ltd., on another page, we are informed that Mr. G. E. Pingree has been appointed managing director of the new company. Mr. J. E. Kingsbury, whose approaching retirement has been generally known, will continue until the end of February in an advisory capacity and to facilitate the transfer of the business.

CANADIAN CUSTOMS.—Amended certificates of origin on invoices for Canada have been issued to collectors of customs and others concerned, by the Canadian Department of Customs. Copies may be obtained from the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W.

ELECTRICAL FOOTBALL LEAGUE.—The league table corrected up to January 17th, shows that the Metropolitan Electric lead with eight points as the result of having played and won four matches. The City of London Electric, and St. James' Electric follow with six points each, and then comes the County of London Electric with two points for three matches. Robertson and General Electric are at the end of the table, both having played and lost two matches.

The Birmingham Discussion on the German Electrical Industry.—Our attention has been called to the fact that Mr. S. P. Smith, who in our report of the discussion on Messrs. Lepine and Stelling's Paper on the German Electrical Industry, at Birmingham, was described as being in the employ of Siemens Bros.' Dynamo Works, Ltd. (ELECTRICAL ENGINEERING, January 13th, page 28), has left this firm, and is now with the General Electric Co., at their Witton Works, Birmingham.

St. Helens Tramway Dispute.—At the Lancashire Chancery Court last week, an application was made on behalf of the new St. Helens Tramway Co., Ltd., for an injunction to restrain the St. Helens Corporation from carrying out a threat to disconnect the overhead electrical wire at both the Prescot and the Haydock ends of the tramway system. It was explained that the Tramways Company maintained through traffic between Liverpool, Prescot, St. Helens, Haydock, and Ashton, having by agreement running powers over the St. Helens Corporation tram lines. Last October, at their request, the Corporation connected the overhead electrical trolley wire at Haydock, as had been done at Prescot seven years ago. This obviated changing the trolley arm from one wire to the other. The Haydock to Ashton length belonged to the South Lancashire Tramways Co., and they lent three cars to the St. Helens Co. for the purpose of the through traffic. The Corporation had never authorised the South Lancashire Co. to use the town lines, and objected to their cars and threatened to disconnect the wires at both ends of the system. After some discussion, the Corporation undertook to make no alteration pending the trial of the action.

MISCELLANEOUS CITY NOTES

VICTORIA FALLS POWER CO.—The Victoria Falls Power Co. will shortly issue £900,000 of debentures, the balance of the authorised amount of £1,700,000, of which £800.000 was issued in November, 1908. The issue of any further amount was postponed until the placing of a further sum of £900,000 preference shares was carried through in London. This was successfully accomplished last April, and it has since been open to the company to make its remaining debenture issue in Berlin as soon as convenient. The *Financial Times* has it from a very good source that there can be hardly any doubt of the success of the issue, and that, in fact, it is as good as placed already.

APPOINTMENTS AND PERSONAL NOTES

Mr. W. B. Child, of Worcester, has been appointed Assistant Electrical Engineer at Leek, at a salary of £100 per annum.

Mr. E. J. Fussell, chief clerk of the Croydon Electricity Department, has resigned. A successor is to be appointed at a commencing salary of £180, rising by annual increments of £10 to a maximum of £230.

The salary of Mr. H. E. Yerbury, chief electrical engineer to the Sheffield Corporation tramways, has been increased from £450 to £500 per annum.

Mr. J. R. Salter has been appointed Consulting Electrical Engineer to the Heywood Town Council at a fee of £50 per annum.

NEW COMPANIES

WESTERN ELECTRIC CO., Norfolk House, Victoria Embankment, London. Capital, £500.000 in £5 shares. To acquire the business carried on in the United Kingdom by the Western Electric Co. of Chicago, Illinois, U.S.A., dealers in telephones, telephonic, telegraphic, and electric lighting apparatus, instruments, and machinery, electrical cables, wires and goods, electricians, &c. The subscribers are F. R. Welles, Norfolk House, Victoria Embankment, W.C., and G. E. Pingree, Norfolk House, Victoria Embankment, W.C. The number of directors is not to be less than three nor more than seven. The first are F. R. Welles, G. E. Pingree, and A. Williamson. We also refer to this new company in our Miscellaneous Business Notes.

London Tube Railway Bills.—There is no opposition at the Standing Order stage to any of the Bills relating to tube railways in London, which have been deposited for the next session of Parliament. We gave full details of these in our issue for January 6th, p. 13.

BOROUGH OF ASHTON-UNDER-LYNE.

ELECTRICITY DEPARTMENT.

THE ELECTRICITY COMMITTEE invite Tenders for the following works, viz. :—

Section A.—For one Counter Current Jet Condensing Plant.
,, B.—For one Natural Draught Cooling Tower.
,, C.—For one Exhaust Turbine and 400 KW. Direct Current Generator.
,, D.—For one Electric Balancer.

Copies of the Specification and Form of Tender can be obtained from the Borough Electrical Engineer, Wellington Road, Ashton-under-Lyne, on payment of a deposit of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Electricity Works," addressed to the undersigned, must be received not later than 12 noon, Wednesday, February 9th, 1910.

By order,
JOHN NEAL,
Borough Comptroller.

Town Hall,
Ashton-under-Lyne.
18th January, 1910.

H. PIEPER of Liege, Belgium, the Proprietor of British Patent No. 4501 of 1905 for means for Controlling Electric Motors for intermittently working machines, is desirous of entering into arrangements with British Manufacturers with a view to the sale or commercial exploitation of the invention protected by the above Letters Patent.

Interested parties are invited to communicate with the undersigned for further particulars.

HENRY SKERRETT,
Chartered Patent Agent.
24, Temple Row,
Birmingham.

TELEPHONE SWITCHBOARD WIREMEN wanted for London, Glasgow and Manchester. Only men accustomed to the work need apply to Mr. NELSON, Central Telephone Exchange, Waterloo Street Parcels Post Office, Glasgow.

For Other Small Advertisements, see p viii

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ELECTRICAL ENGINEERING

No. 161 [Vol. VI., No. 4] THURSDAY, JANUARY 27, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.

Canada. 8s. 8d. per Annum.

Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

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A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

An article by Mr. S. W. Cuttriss describes some of the conditions of electrical development in Russia and Siberia, and urges that the openings for the application of electrical power in those countries should not be lost sight of by British manufacturers. Some Russian electrical statistics are given, and a good idea is afforded of the extent to which electricity is used.. (Page 57.)

Some particulars are given of the turbo-alternators constructed by the Allgemeine Electricitäts-Ges., of Berlin. The shaft and the rotor body are forged solid, and slots are cut in the latter to receive the teeth, which consist of packets of laminations rivetted together. Coils of copper strip wound on edge are placed in the gaps between these teeth, and are held in by metal wedges. The machines are enclosed and are provided with elaborate ventilating arrangements. (Page 58.)

In view of the fact that the Departmental Committee to inquire into the working of the Special Rules for electrical installations in mines will shortly be hearing evidence, we publish the chief points raised in a discussion on the subject at the Institution of Mining Engineers last summer. (Page 59.)

Mr. A. G. Cooper (Borough Electrical Engineer, Colne) writes with reference to the combined lighting and power meter recently described in our columns, and calls attention to a patent of his own for a similar arrangement. (Page 61.)

Among the specifications published by the Patent Office on Thursday last was one by G. C. Fricker and W. M. Mordey for an induction motor-meter. The rotor disc rotates between the opposing faces of a unipolar shunt stator, and the series coils are arranged all on one side of the disc in between the shunt poles. An iron screen separates the stator field system from the permanent brake magnet, and there is a separate brake disc.—D. K. Morris and G. A. Lister have protected a method of improving the regulation of alternators by connecting highly saturated, closed magnetic circuit choking coils across the phases.—H. F. Reason and The Reason Manufacturing Co., Ltd., describe a clockwork time-switch, in which the work required of the device when operating is considerably reduced.—A patent by Messrs. Siemens Bros. & Co. covering the well-known horn lightning arrester, and two patents by H. Hirst for cut-outs in which the fuse wire takes an irregular path round an insulating bridge, expire during the week, after the full life of fourteen years. (Page 62.)

Some particulars are given of the new generating station which is being erected for the Westminster Electric Supply Corporation in Horseferry Road. This is designed to accommodate ultimately 6,600 kw. of steam turbine plant and 14,000 kw. of converting plant. (Page 63.)

Under "Electrometallurgy and Electrochemistry" are given some notes on the use of calcium carbide

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in Australia, and on the manufacture of nitrates from atmospheric nitrogen in Norway. (Page 63.)

IN a Paper read before the Manchester Section of the Institution of Electrical Engineers on Tuesday evening last, Mr. H. E. Yerbury criticised the usual methods of allocating the relative proportions of generating costs in combined lighting, power, and tramway stations, when determining the charge to be made for energy supplied to the tramways department. A detailed comparison was made between the total fixed costs of 0·865d. per unit assumed chargeable to the tramway department at Manchester, and a figure of 0·371d. obtained in the independent tramway station at Sheffield. The assumption that the difference is justified by the expense incurred in providing plant for the tramway peak load, and in conversion from A.-C. to D.-C. was characterised as incorrect. It was suggested that the charge should be based on capital and running costs in connection with the plant essential to the tramway supply only, with the addition of a profit of from 3 to 5 per cent. on the running costs. In the discussion Mr. Pearce justified the charges determined at Manchester; Mr. J. R. Salter asserted that many lighting stations actually owed their existence to the tramway departments; and Mr. Watson and other engineers also spoke. (Page 64.)

THE appeal of the British Westinghouse Co. against the judgment of Mr. Justice Joyce, in which the Bremer flame arc lamp patent was declared invalid, has been before the Appeal Court since Thursday. After hearing lengthy arguments on both sides, the Court on Tuesday reserved judgment. (Page 66.)

THE Dundee Corporation have settled, for £1,350, a claim with regard to failure to supply electrical energy.—The London County Council have decided to proceed with the construction of the Woolwich-Eltham tramways upon an overhead system with an insulated return (using two wires for each track).—The Winchester Corporation have served a notice upon the local supply company of its intention to purchase.—The first section of the electric tramways at York has been opened for traffic.—A report has been presented to the Australian Government to the effect that the measured rate system of charging in connection with the telephone service has proved unremunerative.—The Australian Postmaster-General has promised to give preference in departmental electrical contracts to wire made from local raw material. (Page 66.)

LOW-TENSION cable is required at Belfast; a Lancashire boiler and superheater at Bolton; and mains at Islington and Swansea. Particulars are given of the proposal of the Coventry Corporation to spend £54,000 upon new plant. Service-boxes, cut-outs, and meters are required at Beckenham, and mains at Worksop. (Page 69.)

IT is rumoured that the General Electric Co. of New York and the Westinghouse Co. of Pittsburg (and possibly a third undertaking) are to be amalgamated. (Page 69.)

A DIVIDEND of $1\frac{3}{4}$ per cent. per annum is declared upon the ordinary shares of the City & South London Railway Co., and 2 per cent. upon those of the Central London Railway Co. The report of the East London Railway Co. states that the lessee companies are still unable to agree upon a system of electric traction for this line. The Metropolitan Railway Co. declare a dividend of 1 per cent. for the past half-year. (Page 70.)

Wireless Telegraphy.—The Bill which has been introduced in the Canadian House of Commons with regard to cable and wireless telegraph companies provides that all such companies must file their tariffs with the Railway Board within four months of the passing of the Bill.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JANUARY 27TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. "Equitable Charges for Tramway Supply," by H. E. Yerbury.

FRIDAY, JANUARY 28TH.

Institution of Electrical Engineers: Leeds Section.

6.30 p.m. Annual Dinner at Hotel Metropole.

SATURDAY, JANUARY 29TH.

Institution of Mining Electrical Engineers.

4 p.m. At Park Hotel, Cardiff. Discussion on a Paper on "Shocks," by W. Maurice.

4 p.m. Grand Hotel, Whitehaven. Discussion on a Paper on "Shocks," by W. Maurice.

TUESDAY, FEBRUARY 1ST.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology. "Face-plate Type Starters and Control Apparatus," by J. G. Travis.

Institution of Engineers and Shipbuilders in Scotland.

8 p.m. At 29 Elmbank Crescent, Glasgow. "The Design of Surface Condensers," by R. M. Neilson.

WEDNESDAY, FEBRUARY 2ND.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At 92 Victoria Street, London. "Direct Current Railway Motors for High Voltages," by E. V. Pannell.

Royal Society of Arts.

8 p.m. At John Street, Adelphi. "An Improved Method of Electroplating," by A. Rosenberg.

FRIDAY, FEBRUARY 4TH.

Northampton Institute Engineering Society.

5.45 p.m. At the Institute. "History and Manufacture of Electric Glow Lamps," by L. Wallis.

Telegraph Traffic.—A fairly quiet week has passed in the telegraphic world, but the El Arich route was down between L'Attaqui and Beyreuth on the 17th inst., and the line between Bagdad and Bassorah failed on the following day. Direct communication between Saigon and Bangkok was restored on the 18th inst., and on the 19th inst. the telegraphs to Sitoebondo, Bandjermasin, Balikpapan, and *viâ* Makassar, ceased operating. Telegrams for Mevado, Kwandang, Gorontalo, Makassar, Balikpapan, Moearadjawa, and Samarida can only be sent *viâ* Yab, and those for other places in the Netherland Indies *viâ* Saigon, Singapore, or Cocos-Islands. The Government of Uruguay introduced censorship on the same day. On the 21st inst. the line between Sitoebondo and Balikpapan was restored to working order, and on the 22nd inst. the Bagdad and Bassorah line was once more added to the active list. The Commercial Cable Co. has also had to attend to a faulty line.

Accident at the Tareni Colliery.—At an inquiry into the circumstances attending the death of two men as the result of the flooding of the Tareni colliery, Ystalyfera, Wales, the jury returned a verdict of accidental death, and attributed the death of the men to electric shock, and in one case to drowning also. It appears that the men were up to their waists in water, and had grasped hold of a cable for support. The electrician gave evidence to the effect that he had examined the cables on the morning of the accident, and had found nothing wrong, but that he found the insulation bad in one spot after the flood. According to the *Colliery Guardian*, the doctors did not agree as to the cause of death, one asserting that they had only received minor shocks, and that their death was due to suffocation by drowning. No blame was attached to the colliery company.

Petrol-Electric Motor Boats.—An article in our contemporary, the *Motor Boat*, describes the application of Mr. W. P. Durtnall's patent "Paragon" system of three-phase variable-ratio transmission to the driving of petrol-engined motor boats. The variation of the system described provides for three speeds, which are obtained by supplying currents at three different frequencies to the induction motor which drives the propeller. The generating plant driven by the engine consists of two machines, one an ordinary three-phase alternator with a small exciter, and the other a machine with three-phase windings on both stator and rotor; this latter machine acts as a frequency transformer, and, by applying current from the main generator to the rotor slip-rings, current is delivered at the stator terminals at a frequency above or below that of the main generator, according to the direction of rotation of the field produced by the primary current in the rotor. Then three different frequencies are obtained by using (1) the main generator alone, (2) both machines coupled to add their frequencies, and (3) both machines coupled to subtract their frequencies. By altering the motor connections a reverse is obtained. It is stated that a barge on the lower Thames is being fitted on the system, and that a scheme is in hand for a cargo boat propelled by a 160 b.h.p. suction gas engine with this transmission.

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THE ELECTRICAL OUTLOOK IN RUSSIA AND SIBERIA

By S. W. Cutfriss

CAN any good come out of Russia or Siberia, the land of snow, wolves, and fettered convicts? Childhood's early training and the teaching of a sensational Press would answer, No! That such a reply is far removed from the truth, and that Russia is by no means so desolate as she is pictured, is a fact that is gradually dawning on the mind of Englishmen to-day, and instead of a country to be shunned, he finds it one of great commercial possibilities, encouraging the influx of outside capital and energy to develop its enormous natural resources.

Russia at present is not what might be called a manufacturing country, and therefore the demand for machinery and electrical goods is comparatively limited; but such a state of things is not likely to continue long, as the country is now passing through a period of industrial and commercial fermentation. The institution of the Duma, the cessation of transportation of criminals to Siberia, and guarantees which have been given for constitutional government, promise greater security for commercial ventures, and the country is already feeling the benefit. Since the natural resources of the country in agriculture, minerals, and forests are so great and practically undeveloped, and transport facilities are being rapidly improved, there is no apparent reason why in the near future the demand for machinery of all descriptions should not increase enormously. The Siberia of convicts and desolation is rapidly disappearing before the reaping machine, the gold dredge, the timber yard, and the booming towns. All this means openings for the application of electrical power, and British manufacturers will do well to keep their eyes open in that direction, which is already being keenly competed for by other nations. The growing friendly feeling between Great Britain and Russia is being evidenced by the formation of a Russo-British Chamber of Commerce in conjunction with the Russian Section of the London Chamber of Commerce, and already good results have accrued in smoothing the way for Anglo-Russian trade relations.

In an able article on the "Industrial and Commercial Resources of Siberia," by Mr. H. G. Read, which appeared in a recent number of *Cassier's Magazine*, it is stated that manufactories run on commercial lines are needed in all the large trading centres. At the present time there are hundreds of little works scattered about at long distances apart, many of them run by horse-power and others without any power at all. Practically all machinery is imported into Siberia from Russia and abroad.

The principal seat of the Russian electrical industry centres round St. Petersburg and Riga, but Moscow has developed considerably in that direction lately; the firms doing business there, however, are principally of foreign origin. In the Russian Empire there are thirty cities which possess an electrical tramway system, and among the 1,802 towns there are only 886 lighted at all. Of these seventy-four are provided with electric light and thirty-five with gas. In Central Asia electric light is unknown, and in Siberia one city only is lighted by gas and five by electric light. In the Caucasus and Vistula districts oil lighting is employed. Among the 224 towns in these districts this system is adopted by 172, while only eleven are provided with electricity and eleven with gas. In Eastern Russia there are 762 towns, of which fifty-seven are lighted by electricity, twenty-three by gas, 631 by petroleum, and 120 have no municipal lighting system at all.

The following figures taken from the *Anglo-Russian Gazette* show that electrical undertakings in Russian cities are very remunerative. The net profits of the works of the city of Vilna were £8,385, or 50 per cent.; Vologda £1,807, or 39 per cent.; Minsk £1,484, or 38 per cent.; Nicolaiev £3,455, or 33 per cent.; Orenburg £3,806, or 44 per cent.; Poltava £2,864, or 49 per cent. It is not stated whether capital charges have been included in arriving at the above results.

This article owes its inspiration to a journey which the author recently completed across Russia to the far north of Siberia, and which gave him the opportunity of making personal observations on the present position of the electrical industry in that part of the country through which he passed. Like others who have come in actual contact with the Russians and seen the country itself, it was very evident how little Englishmen understand the one, and what possibilities for profitable investment are present in the other.

Ekaterinbourg, one of the towns visited, is an important town of some 60,000 inhabitants, situated on the eastern slopes of the Ural Mountains. The electrical works are controlled by a French company, and the load is a purely lighting one. The engineer was most courteous in allowing an opportunity to inspect the generating station, but a want of familiarity with the language prevented the obtaining of many statistics which would have been of interest to engineers in this country. For the day load a vertical twin-cylinder gas-engine of apparently 60 to 70 h.p. is used. It is supplied with gas from a producer on the premises. The fuel is wood (silver birch being the timber universally used for firing purposes in the country), and the gas is stored in a large holder. The engine worked very steadily, and although it was not a recent installation, it had never given any serious trouble. The night load is taken care of by a steam plant consisting of three wood-fired Babcock & Wilcox boilers supplying steam to several direct-coupled generating sets, all of Continental manufacture. A large storage battery is installed, which was apparently charged from the gas-engine set. The plant throughout is well up to date, and includes a CO_2 apparatus. The distribution system is three-phase at 2000 volts 50 periods. The high-tension wires are carried overhead on poles, being supported from independent wires by small insulators placed every few yards apart. The roads are illuminated by enclosed arc lamps suspended over the centre; but they are by no means extravagant in the use of light, as a single lamp does duty where at least three would be used in England. The house wiring is on the usual Continental system at 110 volts, and metal filament lamps are freely used. The price charged is equivalent to 10d. per unit. How would our engineers like that?

Electric lighting has been adopted to a limited extent on the railways, some of the express trains being illuminated throughout by that means. In addition to the lamps on the roof each compartment is provided with a portable standard. The illumination of the ordinary trains is atrocious, a single candle generally having to do duty for two compartments.

On the river Ob there are some very fine passenger steamers, which are illuminated throughout by electricity in a thoroughly workmanlike manner. Few of the smaller boats, however, have yet adopted the system. Where such has been the case the work is of a very primitive nature, the fittings being apparently a scratch lot, quite unsuited for ship work. However, one is thankful for small mercies, even when the filament is nothing better than a red-hot wire, with an exasperating predilection to total extinction at times.

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The telephone is almost unknown in Russia, being adopted in only fifteen cities. What a contrast to a country like Norway, where telephonic communication is practically universal throughout the land.

In a report on the projected development of means of land and water communications in Russia, the Minister of Public Works states that during the next few years there will be built many steam and electric railways, canals, and roads for connecting up all the important places and opening up the interior. Among other important improvements which the Government has inaugurated is the installation of a chain of wireless telegraph stations, placing Eastern Russia in direct communication with the furthest part of Asiatic Russia. The intention of the War Department is to erect a number of intermediate stations extending from the Baltic seaboard to the Pacific Coast of Siberia, and it is calculated that three or four stations will be sufficient to permit of messages being transmitted direct from St. Petersburg to Vladivostock.

Germany at present holds the lion's share of all the electrical business in Russia, not merely through imports, but also in the number of electrical works, which are wholly or partly controlled by German firms. Belgian and German firms are usually represented by an engineer who has the advantage of being skilled in the commercial as well as the technical side of the business, and speaks both Russian and German.

Surely there are no insurmountable difficulties in the way of English manufacturers and exporters securing a fair share of the Russian business. Taking into account the vast possibilities of the field which Russia and Siberia present, there is bound to be a large import for many years to come, as the home industry is not large enough to supply the needs of the country. Those who are best informed believe that the next few years ought to see a trade boom in that country on an unparalleled scale.

The man who wants to do business there must be prepared for a state of affairs different from that obtaining in England. A commercial traveller ought to have a fair knowledge of the Russian language, and also of German, as the latter is rapidly replacing French in commercial circles. He ought to study the real needs of the trade before he attempts to begin his campaign, and it is absolutely necessary that manufacturers should be prepared to give extensive credits. The Russian monetary system is largely based on the well-being of the agricultural portion of the community. Since money is only turned over at times of sowing and reaping, it means that six monthly credits will be asked for, and even longer periods, and the Russian merchant is usually prepared to pay a good rate of interest for such accommodation. Practically everything in the electrical line is imported, and, although there is competition already, the prices paid are such as to leave a fair profit to the manufacturer. If English firms wish to secure a share of the trade it is no good adhering to British currency and measures. They must be prepared to spend considerable money in catalogues and attractive circulars printed in the vernacular, quoting prices in roubles, and adopting either the metric or Russian system of weights and measures. Commercial travellers require a special trading permit in addition to their passport, which will cost about £4, and this has to be renewed annually. This permit has to be shown to the tax inspector before the traveller is at liberty to call on any firm. Travelling expenses must be allowed on a liberal scale, as hotel life is much dearer than in England, and a good dinner is often the easiest road to securing a desirable bargain.

In conclusion, the writer would recommend all who wish to keep themselves *au fait* with the commercial movements of the Russian Empire to peruse the *Anglo-Russian Gazette*, a weekly paper which devotes itself entirely to that subject.

A.E.G. TURBO-ALTERNATORS

SOME weeks ago we gave particulars of the impulse type steam turbine developed by the Allgemeine Elektricitats Ges., of Berlin, and supplied in this country by the Electrical Co., Ltd. (See ELECTRICAL ENGINEERING, November 4th, 1909, Vol. V., page 951.) In this turbine all the drop in pressure takes place in the nozzles. The steam flows axially through radial blades, and, changing its direction in stationary vanes, traverses a second row of blades on the same wheel. The following information with regard to the turbo-alternators manufactured by the same firm is of interest.

The chief feature in which the A.E.G. generators differ from those of other manufacturers is in the construction of the rotor field system. The shaft is a solid steel forging, the centre thickened part of which is provided with dove-tail slots all round its periphery. In each of these slots is placed a series of packets of stampings to form the teeth. The stampings are riveted together under hydraulic pressure, and are widened at the base to fit into the slots, and also widen out at the top to hold in the wedges. By this means the windings and wedges are retained against the enormous centrifugal forces. The windings are of copper strip wound on edge, and these are pressed up into shape, and insulated before insertion into the slots. The slots in the centre of each set of coils are filled up with metal bars and wedges to balance the rotor dynamically. Wire is wound over the ends of the coils, and vanes are attached at each end of the rotor to force a current of air under the ends of the coils and through the axial ducts which are provided in the laminated teeth. There are also radial ducts between the separate packets of teeth stampings, and the air escapes through these to the air gap, and thence through the stator ducts to the main outlet under the frame. The wedges over the windings are of a non-magnetic metal, but those over the bars in the centre of the poles are of iron, as are also the bars themselves. After being inserted in the slots, the wedges are turned down at their projecting ends, and are electrically connected together by short-circuiting rings at each end. They thus act also as a damping winding to prevent sudden fluctuations in the main field. The wedges press the windings inwards on to the solid shaft body, and tend to draw the teeth outwards, thus fixing them in the slots in the shaft. A most rigid construction is thus obtained.

The field coils are wound by a special machine, and layers of an insulating material suitable for the high mechanical pressure are interposed between the strips. Each coil is then compressed, bent into shape, insulated, baked at a high temperature in a vacuum oven, and thoroughly tested before its insertion in the slots of the rotor. The slip-rings are of steel, and are shrunk on to the shaft from which they are insulated by a layer of micanite. Before leaving the works, every rotor is run at a speed 50 per cent. above the normal in a special testing room, but before this is done, a balancing test is made. The rotor is run in bearings supported between springs on steel balls free to move in a direction at right angles to the axis, and the balancing weights are adjusted until both bearings remain steady.

The stators are totally enclosed, and the cooling air is drawn in through cloth filters at both ends under the bed-plate from the outside of the station, passed through the machine, and sent out through a central exhaust aperture. Enclosing the machine not only enables the air to be passed through the various parts in an ordered sequence, but prevents dust, oil, and steam from being sucked in, and considerably lessens the noise. A 1,000 kw. machine takes some 200 cubic metres of air per minute, a 6,000 kw. machine some 750 cubic metres. The stator windings are caried out in the form of bar-windings or threaded coils, according to the output and generating pressure; even for such high pressures as 20,000 volts, the coil ends are turned back and clamped down to the stator end plates in the usual way.

Electrical Engineers' Ball.—The ball of this year is to be held, as on previous occasions, at the Hotel Cecil, on Friday, February 4th. The success is already well assured. The names of the following gentlemen appear on the committee for the year, and through them only can tickets (one guinea each) be obtained:—Messrs. H. Alabaster, O. H. Baldwin, J. Horace Bowden, E. G. Byng, Guy Burney, T. Browett, J. Carlton, E. A. Carolan, A. C. Cramb, F. W. Crawter, Sydney Dobson, P. W. D'Alton, R. S. Erskine, A. L. C. Fell, G. Flett, E. J. Fox, T. E. Gatehouse, Sir J. Gavey, W. Geipel, Jas. Gray, R. K. Gray, A. E. Hadley, R. Hammond, Harold E. Harrison, J. S. Highfield, H. Hirst, W. Judd, J. E. Kingsbury, E. M. Lacey, W. E. Lane, H. M. Leaf, W. L. Madgen, W. Lee Matthews, H. T. S. McKay, P. V. Mahon, W. M. Mordey, Lee Murray, F. H. Nalder, Major W. A. O'Meara, Messrs. G. W. Partridge, Hugh A. Pearson, J. Petersen, J. S. Raworth, J. H. Rider, Martin F. Roberts, Leslie S. Robertson, L. L. Robinson, P. F. Rowell, W. Rutherford, Sydney Sharp, Alex. Siemens, A. M. Sillar, Frederick Smith, J. Spagnoletti, C. P. Sparks, T. E. P. Stretche, G. Sutton, C. D. Taite, J. Taylor, R. J. Wallis Jones, and C. H. Wordingham. Executive Committee, Messrs. P. V. MacMahon, Martin F. Roberts, and R. J. Wallis Jones. Hon. Treasurer: Mr. J. E. Kingsbury. Hon. Secretaries: Messrs. A. M. Sillar and H. Alabaster.

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SAFETY PRECAUTIONS IN MINES

IN view of the fact that the Departmental Committee to inquire into the working of the Special Rules for electrical installations in mines will shortly be hearing evidence, it is as well to recall the discussion on the Paper read by Mr. Robert Nelson (H.M. Electrical Inspector of Mines) before the Institution of Mining Engineers last May, and we publish below the main points which were raised by the various speakers, so that our readers may have an indication of the various directions in which the revision of the Rules is probable. The Paper itself was published, in slightly abbreviated form, in our issue of June 10th, 1909 (Vol. V., page 527).

Mr. W. H. PATCHELL (Consulting Electrical Engineer, London), who, it will be remembered, was a member of the Home Office Committee which framed the special rules for the use of electricity in mines, said that surface work must not be overlooked, as there was some very bad work at the surface in connection with colliery undertakings, and just as much damage might be done by a fire at the top of the downcast shaft by the smoke and fumes being carried down as by a fire in the pit itself. Generally, the danger of fire was as real as danger from explosion or shock. It must be borne in mind that a shock, not dangerous in itself, might prove serious when the man's foothold was insecure. He did not share the author's antipathy to floor trenches; if the leads were brought in under the floor (whether the motor was above ground or underground), and then only brought up to the machine protected, they were safer than if they were brought up a wall and across the ceiling. Personally he had always preferred to have the neutral of a three-phase system earthed, but at the same time he had every sympathy with the man who did not want to earth his neutral. After a condemnation of "shoddy" temporary work, the speaker expressed disagreement with Mr. Nelson's advocacy of gas-tight joints, because every time an oil switch was broken there might be a slight evolution of gas, and he therefore preferred ventilated boxes. Instead of the narrow covers which were employed, and the gasket which was used so frequently, he preferred a good big flange with proper ventilation through the lid or side; a flame-tight case was wanted, and not a gas-tight case. He differed from Mr. Nelson where he said that a Home Office rule required that all motors, located in places where General Rule 8 applies, should be totally enclosed if they were not separately ventilated with intake air. The words used in the rule (No. 37) were, "completely enclosed in flame-tight enclosures." Mr. Nelson's interpretation of the rule should bar out plate protection, which he (Mr. Patchell) thought was the best thing. In support of the use of plate protection, he read some notes on a test of a motor protected in this manner made by the Lahmeyer Electrical Co. The motor was placed in a room containing an explosive mixture of firedamp and air, and the gas inside the motor was lighted by sparks from an induction coil, but the fire did not penetrate the cover of the motor, and the fumes were at all times sufficiently chilled so as not to ignite the surrounding gases. He submitted that a motor of that type was far safer than a totally enclosed gas-tight motor, because one could not absolutely enclose the motor. When the air inside expanded it must be driven out over the shaft or through the joints, and when the motor cooled again gas was sucked in. One could not stop the machine from "breathing." He agreed with the author's advocacy of switches with trip coils, instead of fuses. As a check on transformer heating, when he had had transformers in a difficult place, he had arranged a thermometer with contacts, one a little above the normal temperature, and another higher up which closed the circuits of an alarm-bell and a fire-bell respectively.

Mr. S. F. WALKER (Bath), while endorsing many of the author's opinions, expressed disagreement on certain points.

Mr. JOHN GERRARD, H.M. Inspector of Mines, Manchester District, agreed with Mr. Patchell's remarks with regard to fire. In his own district he had had three fires from electricity, but no explosion. He was not satisfied with electric coal cutters, and, after discussing the question with those who used them, he thought that greater safety was assured by the use of compressed air.

Mr. ROSLYN HOLIDAY (Ackton Hall Colliery) took exception to the author's recommendation that armoured cables should be used from end to end. Falls of roof or risings of floors were apt to break the armouring, and there was also corrosion from water, all of which was difficult to make good again in the pit. One could not solder or even make good surface contact on steel or iron armouring. If one's earthing were not perfect right through to the surface, one was putting danger into the pit: a fall might stab the armouring into the core and make the armouring alive throughout its whole length. He strongly supported the author in saying, "Have your cables in view." He admitted the risk of a fall and bringing the cable in two and producing an arc, but there was the same risk of a man knocking his lamp and breaking the glass. On the other hand, he thought there was less risk with unarmoured cables which were thoroughly inspected than with armoured cables.

Mr. G. G. L. PREECE (W. T. Glover & Co., Ltd.) said that the earthed outer system was not so safe in operation as it might seem. He had seen arcing on this type of cable through slight deterioration of the insulated inner conductor. It was almost impossible to avoid leakage at cable ends in colliery installations, and it was this leakage, combined with pit water, which as a rule was a good electrolyte, that caused the corrosion of the lead. This showed itself mostly at cleats and other points of contact with earth, and could be minimised by keeping such places dry and clear from wet dirt. Once the lead was attacked the paper or fibre insulation soon failed, and innumerable instances of the failure of lead-covered cables could be found. He considered them impossible for continuous current and inadvisable for alternating current. He had seen yards and yards of lead sheathing burnt away without giving any warning. Vulcanite bitumen cables had, without doubt, proved to be the most successful in mines, and 75 per cent. of inquiries and orders from collieries were for this type. The possession of a cable in which the ends could be left free, and which, when an accident occurred, left the fault fairly local in its damage, was surely an advantage. The cable could be wire-armoured throughout, with double-wire armouring in the shaft, and single-wire armouring in the workings, and just as good an earth could be got as with a paper lead-covered cable. Complete metallic sheathing by wire armouring was, however, not an unmixed blessing, as there had probably been more cases of shock with armoured cables than with unarmoured cables. The majority of managers preferred the latter. He quite agreed that an armoured system continuously earthed was safer, but there was always the difficulty of continuous earthing, and when repairs were made the armouring had been found to be not properly bonded. Unarmoured cables with heavy braiding, as a rule, came off much better than armoured cables in cases of fall, as they "gave," whilst the latter had the armouring forced into the insulation. Armoured cables required frequent inspections, and such frequent inspection would make unarmoured cables equally safe. The Merz-Price system was theoretically right, and acted well in the north of England for cutting out faulty feeders, but it would hardly prevent an arc from appearing externally; even steel tapes over cables would not. He agreed with the author's recommendation to use unarmoured cables with earth wires as trailing cables.

Mr. B. WELBOURN (British Insulated & Helsby Cables, Ltd., Prescot) said that there was a large body of men in the country who were at present thinking of electrifying their pits, and who got contractors to give them advice. They became hopelessly bewildered, but in the end they usually did the right thing and brought in a consulting engineer. He thought there were no less than 200 miles of cable and 70,000 h.p. of plant protected by the Merz-Price system. It had never failed to isolate a fault, and had isolated it within 1/20th of a second of its happening.

Mr. W. C. MOUNTAIN (Ernest Scott & Mountain) said in his opinion there was too much automatic gear about collieries. He believed that the bulk of breakdowns which had occurred, particularly upon the continuous-current system, had been due to badly erected installations going to earth, which put a heavy strain on the insulation of the machinery. Whatever theoretical advantages might exist in favour of an earthed system, the practical disadvantage was so great that he had always hesitated to adopt it. The trouble with automatic gear was that it gave out and cut off the supply at inconvenient moments, for instance, in starting up a heavy haulage plant or on a sudden overload arising. A time limit could be provided, of course, but this again meant additional complication. He thought a great deal of caution was necessary before adopting lead-covered cables. His experience during the past 20 years indicated that, in nine cases out of ten, lead-covered cables were so badly acted upon by the pit water that they had to be taken out. He preferred a waterproof insulation protected by a heavy serving of jute and thoroughly compounded, and if unarmoured the cable should be coated frequently with preservative paint. He had found that the soundest protection for shaft cables could be obtained by running the cables from the shaft top to the bottom in wooden troughs. The troughs must be very strong, and the cables should be put in coated with a mixture of pitch and tar or bitumen, and the covers screwed on whilst the composition was hot. His experience of rubber-covered cables in pits had been very disastrous, as the warm air and dampness acted upon the rubber. Some armoured bitumen cable used to replace rubber cables had been working for many years without giving trouble. Mr. Mountain also mentioned the heavy starting current required by squirrel-cage motors. In one case of a 50-h.p. motor, the starting current was so heavy that it lowered the voltage sufficiently to stop practically all the motors in the pit. Another

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50-h.p. squirrel-cage motor connected to a 200-kw. dynamo, and used to work an endless haulage gear, caused the volts to drop from 440 to 270 at starting, and took five or six times its full-load current. He thought the size of earth connection mentioned by Mr. Nelson was unnecessarily large. For earthing ordinary armour and motor casing, he considered a solid copper wire of from 3/16 to ¼ in. diameter sufficient, but, of course, with an earthed neutral, larger earth connections were necessary. He had a strong objection to totally enclosed motors, for they were "out of sight and out of mind," and received practically no attention. Except for coal cutters, where it was necessary to have enclosed motors as a protection against falls of roof, he did not think there were many places in a pit where electricity need be introduced when gas was present. There was, however, no difficulty in making a motor which could be rendered proof against firedamp and at the same time would admit of ventilation

Mr. J. W. FRYAR (Eastwood Collieries) said that the majority of colliery installations were small, and did not warrant the employment of skilled electrical engineers. The ordinary men in charge would not be able to use delicate instruments, and it was better for the colliery manager to get a sound practical job rather than have a number of refinements. On the question of cables he pointed out two disadvantages of lead-covered cable: one was that it had to be made in shorter lengths than plain insulated cable in order to manipulate it in the pit, and another, that one could not wipe the joints, as General Rule 8 would not allow this.

Mr. H. W. CLOTHIER (Reyrolle & Co.) said that insufficient attention was paid to technical considerations in mining switchgear, and in the majority of instances, price had more influence than efficient protection and other technical details. Collieries would run less risks if qualified men were allowed more scope in the selection of electrical apparatus. Speaking of the Merz-Price system of protection, he said that his company would be prepared to demonstrate the possibility of isolating a faulty cable before the flashing occasioned by the fault could have time to create an explosion. The question of earthing the neutral on low-tension systems was open to discussion, as the first consideration was to prevent the possibility of a serious sparking to earth. He agreed that it was advisable, whenever possible, to use automatic oil-break switches in preference to fuses, but on the other hand, for small capacities this meant an increase in expense, and the switches also require more attention to keep them working efficiently, and were likely to be tied out of commission. A good form of plug fuse, if enclosed in a strong explosion-proof box having metal to metal joints, could be used with safety. He did not agree with the author's recommendation of cartridge fuses, but preferred a small form of porcelain handle tubular fuse, as replacements were easier, and cartridge fuses were not always properly replaced. He did not think there was much practical value in the suggestion of packing a fuse box with slack wood. The risks of wiring for lighting inbye could be reduced by using low-voltage metal filament lamps. His firm supplied enclosed motor switch panels which contained small potential transformers, and this arrangement could be used for such purposes.

Mr. HENRY HALL (His Majesty's Inspector of Mines, Lancashire) said that accidents appeared to be somewhat on the increase, but perhaps it was because the number of installations were increasing: still, in 1908, he believed that 13 lives had been lost through electric shock. From listening to the Paper he had come to the conclusion that the difficulties in the way of installing electricity with absolute safety was such as to tax the ingenuity of even mining engineers.

Mr. M. H. HABERSHON (Sheffield) said that the danger of armoured cable came out prominently in the discussions at the time of the drafting of the Home Office Rules. The great development in the use of electricity for power purposes underground during the last twelve years, he continued, had been chiefly with continuous current. There was now a tendency to put down three-phase plant for pumping and hauling on a large scale; but there were probably more miles of cable in collieries underground used for the purpose of coal-cutting than for any other purpose, and the bulk of that was done with continuous current. Armoured cable was a source of danger, in consequence of the necessity of making the earthing continuous. Cables for coal-cutting were put down in numerous gates and cross-gates, which were only temporary, and had to be removed sometimes after only a few months. If the comparatively few accidents with electric cables in pits were analysed it would be found that the bulk of them had occurred with some type of armoured or concentric cables, and not with unarmoured cables. In coal-cutting, with machines running on sledges, and with continuous current, one could perhaps get quite sufficiently good earth from the sledge. After using coal-cutting machines for the last eleven years, and a considerable number of them entirely with the unarmoured cable, he could state that he had had no case of serious accident due to shock. The safest method of cabling for electric power underground was to have continuous current with two separate single-conductor cables placed on either side of the roadways, unarmoured. He would avoid, whenever possible, the use of an armoured cable in a roadway underground. The proper sphere for armouring was in shafts. In the evidence given before the Departmental Committee on the Use of Electricity in Mines, those who had had the greatest experience with electricity for coal-cutting were unanimous in the condemnation of armoured cables. In wet pits compulsory use of armoured cables would certainly stop electric coal-cutting. Personally, he would prefer to put up with any trouble in connection with the commutator rather than endure the necessity of using armoured cables. He believed that the three-phase system was cheap, but he strongly objected to the statement that it was safer than the continuous-current system.

MR. C. C. LEACH (Seghill) said that the people who had to work the apparatus had not been trained in electrical work, but they were men who, in some cases, could do very little more than read and write. If delicate instruments were used in mines, these men would not be able to handle them properly, and instead of being a safeguard they would be a danger.

MR. G. SCOTT RAM (H.M. Electrical Inspector of Factories) first referred to the Merz-Price system, which cut off the pressure immediately leakage occurred. This had been used very successfully in some of the largest electric power works in the North of England, but the conditions there were not the same as in a mine. The application of the system involving the use of pilot wires would be useful in the case of shaft-cables. Beyond that point, however, the necessity of putting in a pilot wire wherever one had a branch going to a different district would condemn it, as the small pilot wire might readily be broken, and the whole device would be out of order without anyone being the wiser. The method of using the system, without the pilot wire, had, he believed, not been tried. Mr. Patchell had very rightly pointed out that in the regulation referring to the use of motors in places to which General Rule 8 applied, the term "flame-tight," and not "gas-tight," was used. The term "gas-tight" was, however, used in connection with enclosures for switches and fuses. Mr. Patchell had also spoken about the "breathing" of motors with the variation of temperature. The same phenomenon happened in the case of a switch-box. One case which he had had to investigate a year or two previously showed the danger of such a box, which was supposed to be gas-tight, with very large cubical capacity. The box was about 4 ft. high, 1 ft. wide, and 10 in. deep; somehow or other the gas got in through the gas-tight joint, and the box was blown to pieces as soon as the man touched the switch to cut off the current. If earthing the cases of coal-cutters were neglected, one never knew that a fault had occurred until an accident happened: the machine might be quite in order until suddenly the insulation broke down somewhere, and it became alive, when someone would get a shock, and possibly be killed. There had been a number of fatal accidents in the last few years from coal-cutters. Earthing through the sledge of the machine was not sufficient. In one case which he had had to investigate the coal-cutter was on a sledge standing in 6 in. of water. The insulation broke down, and a man who was about 30 yards away came into contact with the haulage-rope of the coal-cutter, and was killed. It was extremely difficult to get a good earth locally in a mine. In his opinion, the only satisfactory method was to run a special earth cable (an old haulage-rope or winding-rope might be used) right through the mine from the surface, connected to a good earth-plate at the surface and another in the sump, and in as many other places as was desired. To put an electrical installation in the charge of a man who did not understand it was simply playing with fire. He mentioned one installation in which all the apparatus was oil-immersed; even the resistance grids were in oil, and were cooled by a water-jacket. But the safety of the whole was nullified by the terminals of the resistances being brought through the case. About fifty little ends of wires about an inch long were sticking up, and were connected with the leads by little two-penny connectors, with a small thumb-screw at each end, half of which were loose. Thousands of pounds had been spent on the installation with a special view to safety, and the whole thing was spoilt in that respect by the inability of those concerned to appreciate the importance of apparently trifling details.

MR. W. H. PICKERING (H.M. Inspector of Mines, Yorkshire and Lincolnshire) agreed that there was great danger of fire at the surface. Shocks would only be individual, and would not cause a very large loss of life during the year; but there was very great danger of big explosions and very serious fires being initiated by electricity. He had reason to believe that there had been several very narrow escapes. One case had come under his own notice some years ago, in which a stone fell from the roof upon an armoured trailing cable, cut it, and caused a gas explosion. Probably there were a good many cases of cables being cut in that way when there was no gas present. The hinged switch-box with the rubber ring around it was unquestionably a very bad design. He knew of one explosion at least which had been caused by a box of that sort. The author had advocated iron of a certain thickness, with the idea, on the principle of the safety-lamp, that even if there was a small crack the flame would be cooled down sufficiently not to fire the gas. He doubted whether

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that condition would obtain. He knew of a case in which a man was burnt by a flash from a box made by a very good firm. It was not, however, of quite the thickness which the author advocated; it was perhaps ⅝ in. thick. The man was burnt on the arm, and if there had been gas there, it would have fired.

Mr. G. H. TWEDDELL (Whitley Bay) thought that it was highly desirable that the leading manufacturers and the Government Department concerned should consult together and conduct a set of experiments in England to settle definitely whether plate protection was safe.

Mr. JOSEPH S. MARTIN (H.M. Inspector of Mines, Bristol) referred to the opposition to Mr. Nelson's suggestions on the part of some members who pointed out that they had to deal with very small plants, that they had put them up more or less temporarily, and that they could not afford his elaborate precautions. Electricity was not a subject to be dealt with on those lines. To make "a thoroughly good job" of it would be far and away the most satisfactory and economical. It might cost a little more to employ efficient electricians to supervise the plant and to work it, but he was certainly of opinion that in the end it would be found that the expenditure of a few pounds in that direction would be very well repaid. He would not like to see electric coal-cutters, even with enclosed motors, working at the face of some of the South Wales fiery mines. Electricity might be made use of for driving compressors at places of comparative safety, whence compressed air could be taken into the faces.

Mr. WILLIAM MAURICE (Hucknall Torkard) wrote that there was no question as to the efficacy of perfect earthing when it could be carried out; but he was doubtful if it were possible to get it done in all colliery installations. There were many collieries with comparatively small outputs, where the plant was not sufficient to justify the maintenance of a staff of skilled electricians, and where such operations as flitting coal-cutters and moving up gate-end boxes were done by coal-cutter chargemen, perhaps under the supervision of a deputy. On the cable question, he said that there were many mines in which main-road cables ran little or no risk of injury, and in which probably a severance due to falls would cause no more inconvenience than temporary interruption of supply. He had laid some scores of miles of cable underground, and had repeatedly seen them buried by falls of roof; but did not remember seeing a cable either severed or damaged in such a way as to produce an arc. He had had an opportunity of inspecting the Merz-Price system of protection, and if he were laying out a new mining installation he would be disposed to adopt it. The risks of sparks in and about switch and fuse-boxes, plugs for trailers, and on small lighting circuits, should be considered seriously by electricians in charge. The tendency, which had been noted by Mr. Nelson, to design "explosion-proof" rather than gas-tight boxes, marked a definite advance in the evolution of electric mining gear, for it was extremely doubtful whether any so-called "gas-tight" box was ever gas-tight in a mine.

Mr. JAMES DOUGLAS (New York) admitted that in the United States there was a certain amount of recklessness, but he thought that such recklessness was more on the part of people than on the part of the mine owners, who were not so absolutely heartless and callous as they were usually described. In America they had had no great trouble in their coal-mines with deaths from electric shock, but in his copper-mines they had had several deaths.

MR. ROBERT NELSON (London), in the course of his reply, referring first to danger from fire, said that inflammable material should be kept altogether clear of electrical apparatus. On the interpretation of Special Rule 37, he pointed out that it laid down that the motors should have all their current-carrying part completely enclosed in flame-tight enclosures, and no Inspector of Mines had any other opinion than that the words pointed to total enclosure. He agreed with Mr. Gerrard that the less portable electrical apparatus there was in a gassy mine the better. He would not give way one inch on the question of armoured cables. The Merz-Price system of cable protection introduced no more "refinement" than an ordinary overload trip-coil, and it was no more complicated than apparatus in common use every day in mines at the present moment. Experiments were required, however, to show that this protective system would keep the sparks inside the cable. Squirrel-cage motors offered the best mechanical construction that could be obtained in a motor, and he advised mining engineers to demand squirrel-cage motors for every service for which their use was possible. He fully realised that limitation of the squirrel-cage motor, but wound rotors should be adopted for underground work only when unavoidable. He held that every colliery using electricity should have someone on the premises who knew something about it. It was not always possible to wipe the joints in connection with lead-sheathed cables, but wherever a joint was necessary a disconnecting-box with a well-designed mechanical joint for the lead could be used. It was very surprising to him that anyone at that time day of day should advocate direct current. He thought that there would be found a marvellous unanimity among electrical engineers that for colliery work three-phase current was much safer than direct current. Some Continental rules absolutely prohibited the use of direct current in gassy mines. If Mr. Habershon would read the report which the Departmental Committee published at the time when the Special Rules relating to the use of electricity in mines were formulated, he would find that the members of that Committee advocated the use of armoured cable. On the general question of using electrical apparatus in coal-mines in places where gas might appear, he had no opinion personally as to whether electricity should or should not be used in those circumstances. He was not a mining engineer. His object in writing the Paper was to submit for the consideration of the Institution what he believed to be the best methods of overcoming such difficulties as now existed. In conclusion, he might say that very often the choice between tenders for electrical apparatus in mines was decided upon price only. He thought that price should not be even the first consideration. Reliability should be the first consideration.

Mr. Nelson subsequently communicated to the *Transactions* of the Institution a more detailed review of the controversy of armoured *v.* unarmoured cables. Experience, he said, had confirmed what was shown experimentally to the Departmental Committee which sat in 1903, namely, that falls of roof produced far more damage to an unarmoured cable system than to one that was armoured. The effect of frequent falls on an unarmoured cable system was ultimately to produce bare parts, or, at the least, parts where the insulation resistance was seriously diminished. With a cable so damaged, all telephone wires, signal wires, and haulage ropes in its neighbourhood became possible sources of danger. The possibility of an arc appearing external to a cable was much increased if there were no earthed metallic sheath. On the other hand, with an armoured cable system, if the armouring were well earthed (and precaution must be taken to see that it was well earthed, otherwise the armouring was on the whole perhaps worse than useless); if, in spite of the metal sheath, one of the cores should become displaced and be crushed into contact with the earthed armouring, then the protective device, whether fuse or maximum cut-out, should make the circuit dead. Further, an armoured cable was much less likely to be cut in two by mechanical damage than was an unarmoured cable, and therefore there was less likelihood in the former case of an arc appearing external to the cable. An armoured cable system had also one great advantage in the ease with which an efficient earth could be secured for all inbye apparatus such as motor-frames, switch-boxes, junction-boxes, &c. In many cases the only means of securing as good an earth with an unarmoured cable system would be to run a special cable from the surface or the shaft-bottom for the purpose. Cheapness would seem to be the only recommendation possessed by an unarmoured cable system under average underground conditions. If a mine manager were content to have bare parts of cable and parts in process of becoming bare, it was certainly an easy matter to keep the supply going with an unarmoured cable system. Such a system would run, practically speaking, however poor its condition, risk of shock and risk of external sparking being ignored. An armoured cable system, on the other hand, if the armouring were connected to earth, demanded attention immediately it failed; otherwise supply could not be kept going. It did not, in short, encourage slipshod methods.

CORRESPONDENCE

COMBINED LIGHTING AND POWER METER.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In last week's electrical papers an "Ingenious System" of metering was described as being brought out by the Adnil Meter Co.

I might say that I took out Patent No. 14,113 for this system of measuring in 1894. I see this week, other people drawing attention to this "novelty," and one gentleman even patented it four years ago.

This patent was sold by me to the B.T.H. Co., Ltd., and put on the market as their "Duplex" type, but in those early days the objection raised to it was that the Supply Co. did not know whether a consumer had used 1,000 at 5d. or 2,000 at 2½d. This was rather a serious matter in those days when works were run on academical lines; possibly now that they are run more commercially, the Supply Co. will be satisfied if they know how much a consumer has to pay, and not bother about the percentage of units sold as compared with units generated.

Yours truly,
A. G. COOPER.

Electricity Department, Colne, Lancs.
January 22nd, 1910.

Russian Electrical Exhibition.—H.M. Commercial Attaché at St. Petersburg reports that the Imperial Russian Technical Society at St. Petersburg propose to hold an international exhibition there, between September and November next, demonstrating the application of electricity to railways.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Jan. 20th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

129 09. **A.-C. Meter.** G. C. FRICKER and W. M. MORDEY. In a meter of the induction motor type, separate rotor and brake discs are employed. The rotor disc rotates between opposing polar faces which form a uni-polar system, including part of the meter case, and a vertical core with a single shunt coil. Each pair of series coils, with or without cores, are arranged circumferentially adjacent, and both on one side of the disc, in an intermediate angular position with relation to adjacent shunt poles. The rotor may be of cylindrical form, with a suitable arrangement of the poles. An iron screen forming part of the permanent brake magnet separates the two magnetic systems. In order to overcome the initial friction error, a starting horn is pivoted between adjacent pole pieces, so that if inclined in the proper direction, it will give a torque with the shunt current only. Ten claims, seven figures.

282 09. **Metal Filaments.** W. D. COOLIDGE. Filaments squirted from a mixture comprising tungsten powder and a binding agent of cadmium, mercury, and bismuth, are baked in the presence of a gaseous reagent such as hydrochloric acid, chlorine, or hydrogen sulphide in order to dry them. The chemical compounds formed are removed during the sintering treatment. An alternative method consists in baking the wires in a packing of metallic powder, which combines with the mercury and cadmium. These processes are said to prevent the formation of globules of the molten binding agents on the surface of the filament during baking. A special furnace for baking and sintering is described. Four claims, one figure.

353 09. **Time Switches.** H. F. REASON and THE REASON MANUFACTURING CO., LTD. The hour arbor of a time piece is provided with an adjustable dial with inner and outer flanges, between which are marked the hours. The flanges are slotted and the slots can be moved opposite any given hour on the dial. A release lever pivoted on the frame, and controlling a switch, has a pin engaging the dial flanges. When a slot moves round so as to allow the pin to move, one movement of the switch is effected, and when the second slot coincides with the position of the pin, the second movement is made. Five claims, three figures.

416 09. **Regulation of Alternators.** D. K. MORRIS and G. A. LISTER. Choking coils with closed magnetic circuits working at a high flux density, are connected across the phases. On a fall in pressure due to increasing load, the magnetising currents taken by the coils are much diminished, and the counteraction of the coils on the exciting field reduced. Auxiliary transformers may be used with their secondaries in series with the choking coils, for the purpose of further reducing the pressure across the choking coils on an increase of load. Two claims, three figures.

764 09 and 11,947 09. **Trolley Head.** E. M. MUNRO and THE RAILLESS ELECTRIC TRACTION CO., LTD. These specifications relate to the trolley head employed by this company for their trolley bus, and described and illustrated in ELECTRICAL ENGINEERING, Sept. 30th, 1909, p. 855. The method of compensating for the side strain by using horizontal springs on the arm base, and the construction of the rotating pivoted head are described. Ten claims, nine figures in all.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: HANISCH and REGINA BOGENLAMPENFABRIK GES., 1,815 09; SENFTNER [Electrodes] 8,150-1 09.

Dynamos, Motors, and Transformers: ROBERTS [Pump-motors] 12,364 08; LAKE (*F. Bissel & Co.*) [Sewing-machine motors] 753 09; SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*) [Control of motors for ship propulsion and for ventilating fans] 2,176 09, and [Driving of looms] 20,034 09.

Electric Ignition: DAIMLER MOTOREN GES., 25,967 08 and 29,615 09; DIER and PRIMEAU [Lighting gas-burners] 18,680 09.

Electrometallurgy and Electrochemistry: GIBBS [Production of metallic articles by electrodeposition] 20,858 08; DASSONVILLE [Electrolytic cleaning and bleaching] 3,200 09; SCHOTT and GEN [Electrolytic apparatus with liquid anode] 14,288 09; MILLS (*Van Winkle*) [Electroplating baths] 16,951 09; PAULING [Production of nitrous gases] 22,037 09.

Incandescent Lamps: HIRST and WOLFRAM (TUNGSTEN) METAL FILAMENT LAMPS, LTD. [Manufacture of filaments] 142 09.

Instruments and Meters: DENNY and JOHNSON [Electrical torsiometer] 3,814 09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Recording devices for instruments] 17,765 09.

Switchgear, Fuses, and Fittings: HORSTMANN and EDGAR [Time switches] 32 09; DRYSDALE [Coupling] 194/09; SIR W. G. ARMSTRONG, WHITWORTH & Co. and MURRAY [Step-by-step movement gear] 439 09; BELCHER [Tumbler-switch] 3,130 09; TUCKER [Switches] 3,877 09; RUTZKY [Insulators] 6,161 09; CLARKSON [Conduit fittings] 14,532 09; ZEE [Switches] 18,012 09; HOFMANN [Traction controller handle] 20,378 09; BUISSON [Conduit fittings] 21,855 09; LUNDBERG [Switches] 22,896 09.

Telephony and Telegraphy: KNUDSEN [Wireless transmission of pictures] 23,570 08; YEARNEAU [Telephone rent collecting] 1,896 09; AITKEN [Telephone switches] 4,173 09; MARCONI and MARCONI'S WIRELESS TELEGRAPH CO. [Wireless apparatus] 8,581 09 and 11,544 09; AITKEN and BRITISH INSULATED & HELSBY CABLES, LTD. [Telephone sub-station switching systems] 16,643 09.

Traction: EDMONDS, and MCKENZIE & HOLLAND, LTD. [Electrically operated points, frogs, and signals] 21,398 08; FOX and RAILLESS ELECTRIC TRACTION CO. [Traction system] 2,933 09; BOWLES [Brake] 25,113 09; KOHLER [Collector for overhead systems] 26,348 09.

Miscellaneous: PALMER [Electric signs] 25,882 08; THOMAS and HINE [Automatic electric organ] 91 09; SANDERSON [Make-and-break device] 272 09; PEAKE, and CAMBRIDGE SCIENTIFIC INSTRUMENT CO. [Thermo-electric pyrometers] 370 09; SCHRÖDER [Alarm clock] 13,523 09.

The following Specification is open to Inspection at the Patent Office before Acceptance, but is not yet published for sale.

Miscellaneous: PRAT [Forced-draught fan] 13,720/09.

Amended Specifications Published

The following amended Specifications can now be obtained

22,031 02. **Mariners' Compass.** BARON KELVIN, F. W. CLARK and KELVIN & JAMES WHITE. The compass bowl is suspended by knife edges in a bearing supported by spiral springs from the binnacle case.

9,851 08. **Railway Signalling.** A. J. BOULT (*Union Switch and Signal Co., U.S.A.*). This specification was amended by order of the Comptroller as the result of opposition to grant. It relates to a system of block signalling, in which the rails are electrically continuous, but adjacent block sections are supplied with A.-C. currents differing in phase.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

2,106 of Jan. 19th, 1896. **Lightning Arrester.** SIEMENS BROS. & Co., LTD. (*Siemens & Halske A.G.*). This patent covers the well-known horn lightning arrester, which consists of two metal rods vertically parallel for a short distance, and finally upwardly divergent.

2,248 and 2,249 of Jan. 31st, 1895. **Fuse Boxes.** H. HIRST (General Electric Co., London). To prevent the formation of an arc when the fuse blows, an insulating bridge is fitted between the terminals, and the fuse wire is passed through or around it in an irregular manner. According to the second patent, the fuse wire is interwoven with an insulating material, such as asbestos.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: I. A. CARR [Telephonic fault testing on D.C. three-wire systems] 20,269/05.

Electric Ignition: V. FORTI [Ignition of gas lamps] 17,770 00; G. L. HERZ [Switch] 14,978 05.

Electrometallurgy and Electrochemistry: B. J. and A. ROUND [Electro-plating] 19,793 99; J. SWINBURNE and E. A. ASHCROFT [Electrolysis of sulphide ores] 17,611 00; C. GARRARD and FERRANTI, LTD. [Removing scale from metals] 21,299 03; J. BORCHERS, F. GÜNTHER, and R. FRANKE [Electrolytic deposition of metals] 19,638 05; K. VAREILLE [Electrolysis of water] 20,217/05.

Incandescent Lamps: F. LEHNER [Carbon filaments] 17,759 00.

Storage Batteries: W. N. CATON [Suspension of plates] 19,853 05.

Switchgear, &c.: J. PERKS and A. W. SUTTON [Conduit fittings] 21,616 03; L. C. MENSING and PRICE, PEEBLES & Co. [Support for arc lamps] 19,967 05, and [Arc lamp switch] 19,968 05; C. W. CRAWLEY [A.-C. switch opening at zero current] 20,099 05; C. TRIPPE and E. STANILAND [Arc lamp switch] 20,155 05.

Telephony and Telegraphy: H. OPPENHEIMER (*Akt.-Ges. Mix & Genest*) [Military combined telegraph and telephone system] 20,231/05.

Traction: M. WOODS and T. J. GILBERT [Rail grinder] 21,227 04; SOC. ANON. CHAUMY ET CIREY [Third-rail support] 16,221 05; R. C. LOWRY [Increasing adhesion magnetically] 19,904 05.

Miscellaneous: S. S. BROMHEAD (*American Bank Protection Co., U.S.A.*) [Burglar alarm system] 21,454-5/04; A. CRAVEN [Electric control of railway carriage doors] 19,989 05.

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THE NEW STATION OF THE WESTMINSTER ELECTRIC SUPPLY CORPORATION

A VISIT was paid recently by the members of the Junior Institution of Engineers to the new generating station of the Westminster Electric Supply Corporation, in course of erection at Horseferry Road, Westminster, by kind permission of the Chief Engineer, Sir A. B. W. Kennedy, F.R.S.

The Corporation are building this new station to replace the old Millbank Street station, which is about to be pulled down in consequence of the County Council's scheme for making an embankment roadway from the House of Commons towards Chelsea. The County Council have provided the company with a new site in Horseferry Road, and are bearing the expense of rebuilding the station and filling it with plant to an extent equivalent to the present capacity of the old Millbank Street station. The actual size of the Horseferry station and the amount of plant being put in is greater than at Millbank Street, and this additional size and amount of plant is, of course, being paid for by the company.

The buildings as at present completed can ultimately hold steam turbine-driven plant generating continuous-current at 440 volts, aggregating 6,600-k.w. It can also ultimately contain about 14,000 kw. of motor-generator plant, for dealing with three-phase current at 6,600 volts, supplied from the station of the Central Electric Supply Co. at Grove Road, which supplies both the Westminster Electric Supply Corporation and the St. James's and Pall Mall Electric Light Co., and transforming this to current at about 440 volts for supplying the Westminster district.

The plant at present erected, or being erected, is as follows:—Four water-tube boilers, each with its own economiser and superheater, capable of producing 25,000 lb. of steam per hour at 200 lb. pressure with 150° superheat; two 300-kw. turbines, each driving two 150-kw. generators placed tandem, these being the balancer-sets; three 1,000-kw. turbines, each driving two 500-kw. generators placed tandem; separate surface-condensers with air-pumps for each turbine, and a special arrangement of circulating water-pumps, including strainer-boxes and rotary strainers for sucking water from the Thames, forcing it through the condensers and back to the river; direct-current switchboards for controlling the turbine-driven generators, and for controlling the D.C. feeders; a 2,000 ampere-hour battery with 200 cells in all, 100 being a positive battery and the other 100 being a negative battery, arranged across the three-wire system; two battery boosters for enabling these batteries to be charged and discharged, the boosters being regulated by hand; one 500-kw. generator arranged with two 250-kw. generators for balancing, and two 1,000-kw. motor-generators, each with single 1,000-kw. D.C. machines (the three-phase motors of these motor-generators are all of the asynchronous type, with slip rings and resistances for starting up); complete high- and low-tension switchboard for controlling the motor-generator plant; electrically-driven travelling cranes in turbine-house and motor-generator room; coal-conveying machinery, ash hoist and gear, and coal-measuring boxes between the bunkers and the boilers.

The Edison Battery.—It is announced that trials have been made in New Jersey with a tramcar equipped with the latest form of the Edison storage battery. One account gives the capacity of the battery at 12·5 watt-hours per pound weight, although 12·5 watt-hours per lb. are said to be obtainable with the lead battery, greater durability is, however, claimed for the cells. The car in question was equipped with 210 cells, including ten lighting cells, and the total horse-power given as 50. The car carried 24 passengers, and ascended some steep hills without difficulty. A figure of a halfpenny per mile has been given for the cost of propulsion, but it is not clear what items are included.

ELECTROMETALLURGY AND ELECTRO-CHEMISTRY

AT the last meeting of the Faraday Society, beside the Papers reported in our last issue, Mr. Kilburn Scott gave an account of the employment of calcium carbide in Australia. Five years ago only about 2,500 tons were employed annually, but during 1909 the amount imported was about 10,000 tons, mainly from Norway and Sweden. A few years ago the cost c.i.f. Sydney was £18. It was then proposed to manufacture it in Australia at the Barron Falls. The price afterwards fell to £10 per ton, and is now about £12 per ton. At this price it is imported in iron drums as deck cargo, and goes to Australia by way of the Cape route.

The carbide is employed largely for lighting purposes, for small villages and the squatters' houses in the backwoods. As a rule the generators are made in the colony, and very few accidents are reported. Another use is to operate sprayers; such a sprayer was exhibited and worked before the meeting. These sprayers are made of steel, and the carbide, by working on water, generates a pressure of 100 lbs. The pressure of the gas drives the spraying fluid through a nozzle. The sprays are used for killing blight and insects in orchards, for washing cattle with dip, and for lining the holds of ships. For this purpose it is used by the Orient and other lines. Also it has been used for painting the inside of boilers with zinc white and turps. This operation, which originally took four days, can be done by the sprayer in four hours. The prickly pear is being exterminated by spraying with an arsenical fluid. It has even been tried to exterminate rabbits by blowing acetylene down their holes.

In reference to the proposed plant at Barron Falls, it is intended to supply a high-tension alternating three-phase current a distance of nineteen miles. The water falls 1,000 ft., and it is calculated that from 10,000 to 15,000 h.p. can be obtained at a cost of £2 15s. per h.p. year. It would be possible to make the carbide at from £8 to £9 per ton, which would therefore be able to compete with the imported article.

H.M. Consul at Christiania has issued the following information in reference to the manufacture of nitrates from atmospheric nitrogen in Norway. Up to the present £1,222,000 has been expended on the works at Notodden and Svalgfos, and on the power stations which are being constructed at Rjukan and Vamma. At the end of this year, when all the works will be completed, £3,000,000 will have been expended. Nitric acid, nitrates, nitrate of ammonia, nitrate of potash, and nitrate of soda are at present or will shortly be manufactured. The weak acids are now being concentrated by the Birkeland & Eyde & Nobel Syndicate, who are working in conjunction. The interesting point is that no coal is employed for concentrating purposes, the necessary heat being obtained from the gases as they issue from the electric furnace. When the Rjukanfos works and the Rjukan Fall works are quite complete, they and the Notodden works will, combined, represent a power of 240,000 h.p., and will have an annual saltpetre production of £1,278,000.

The value of the nitrate output in Norway in 1908 was about £111,000, and the expenses are stated to have amounted to £83,000, giving a profit of £28,000. At present the following companies are manufacturing, or about to manufacture, nitrates from the atmosphere: The Norsk Hydro Elektrisk Kvaelstof Aktieselskab, Christiania, the owners of the Notodden Saltpeter-fabrikker; the capital of the company is £1,656,000; the Vammafos (Vamma Falls) Co. (works under construction), the Rjukanfos (Rjukan Falls) Co. (under construction); the capital of the company is £700,000; the Matre and Tym Waterfalls are owned by two separate companies, the Norsk Hydro Elektrisk Kvaelstof Aktieselskab and by the Kraft Aktieselskab, but both companies work separately; the Christianssands Elektrokemishe Aktienselskab, which is the property of the Badische Anilin und Soda Fabrik, with a capital of about £11,000.

Vision at a Distance.—The *Daily Mail* gave recently some particulars of a new system for enabling images to be viewed at a distance. The invention is ascribed to Messrs. Rignoux and Fournier and consists in projecting the image on to a screen of some thousands of selenium cells. By means of a rotating contact drum the cells are connected successively to the telephone line at a high speed, and at the other end the line is connected to a coil round a tube containing a liquid which, under the influence of a magnetic field, rotates the plane of polarisation of light. A beam of light, polarised in one plane by means of a Nicol's prism, is passed through the tube, and then through a second prism at right-angles, in order to cut off the light entirely. When a current passes through the coil, the plane of polarisation is rotated 90° and the light gets through the second prism. By means of a moving mirror with as many facets as the screen has cells, the light corresponding to any particular illuminated cell is projected on to the corresponding portion of the screen, and the speeds of successively connecting the cells to the line end of the synchronously moving mirror are so great that the whole picture is viewed owing to the phenomenon of persistence of vision.

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EQUITABLE CHARGES FOR TRAMWAY SUPPLY

A PAPER dealing with the charges by supply authorities to tramway undertakings for electrical energy was read by Mr. H. E. Yerbury (Chief Electrical Engineer, Sheffield Corporation Tramways) on Tuesday last at Manchester, before the local section of the Institution of Electrical Engineers. The Paper was read at Leeds on Wednesday, and will be read and discussed at the meeting of the Institution in London this evening.

The author points out that a higher price is invariably charged for energy for traction than for heating and general power purposes, notwithstanding the heavy consumption and favourable load factor, and that the price charged is considerably more than the total costs in separate tramway power stations. A table given by the author shows the lighting, power, and traction charges made by sixty-five local authorities in Great Britain owning combined stations, and from this it appears that the average price charged to the tramway departments is 1·377d. per unit, the maximum being 2d. and the minimum 0·93d. Another table gives the generating costs for ten separate traction stations. The average for these are : works costs, 0·447d., and total costs, 0·753d. Further tables give the charges made by local authorities owning combined stations to other local authorities and to tramway companies. In all cases the load factors are given; thus the average load factor of the sixty-five combined stations is about 20 per cent., and in the case of the separate traction stations 35 per cent., the highest in the latter case being 46 per cent.

Turning to consider what should determine a fair basis of charging, the author divides the total costs of generation into (*a*) "fixed charges," in which are included interest and sinking fund on land, buildings, and all plant, say, to feeder pillars or trolley wires; rent, rates, taxes, and insurance; and a sum each year for depreciation or renewals, and (*b*) "running costs," in which are included salaries and wages of officials and staff, fuel, water, oil, and waste, repairs to steam and electrical plant, repairs to ducts, feeder cables, &c., and repairs to power and sub-station buildings, &c. In order, he continues, to allocate on an equitable basis to the lighting and tramway departments their respective proportion of above costs, we must know the maximum demand in kilowatts per annum required by the tramway department, and the approximate kilowatt-hour consumption per annum. From these can be estimated the size of plant required (with reasonable spares), the standing charges of which will determine the principal item under "fixed costs"; the actual "running costs" can readily be arrived at when kilowatt-hour requirements are known. With regard to the plant, that required to meet the maximum tramway demand at times of "peak load"—including spares—should be the measure taken. This "peak load" is so little above the average, however, that the costs in, say, keeping boilers under steam and for a "stand-by staff" for this are infinitesimal. Engineers of combined stations do not appear to look upon these costs as "running costs," but invariably include them under "fixed costs," and the fair proportion of these so-called "fixed costs" to actual "running costs" is a debatable point.

The author then compares an analysis of the "fixed charges" made by the Manchester Electric Supply Department to the Tramways Department, with those of a 4,450-kw. low-tension tramway station generating about 13·5 million units per annum, as follows :—Under "fixed charges" we have for a low-tension tramway station of 4,450-kw. capacity : (1) Interest at 3·13 per cent. and sinking fund at 2·05 per cent, 0·241d.; (2) rent, rates, taxes, and insurance, 0·028d; (3) depreciation and renewals based on 1·89 per cent. per annum on total capital expenditure on power station, buildings, plant, cables, &c., 0·102d.; giving a total of **0·371d.**

It appears that about double the above is generally considered chargeable to tramway departments in determining selling price per unit. For instance, the Manchester Electric Supply Department, in selling approximately 29½ million units to the Tramways Department for year ended March 31st, 1908, in addition to above items, also adds items included in "running costs"—viz., coal, oil, waste, water, salaries and wages, repairs and maintenance of plant in the following proportions, viz. :—(1) Coal, 27·35 per cent. of amount included in "running costs" is also included in "fixed charges"; (2) oil, waste, water, &c., 27·35 per cent., ditto; (3) salaries and wages, generating station, 100 per cent., ditto; (4) repairs and maintenance of plant, &c., 33·33 per cent., ditto. On the basis of 29½ million units per annum, the "fixed charges" per unit sold are then as follows :—Coal, 0·043d.; oil, waste, water, &c., 0·004d.; salaries and wages, 0·069d.; repairs, 0·064d.; rent, rates, taxes, 0·087d.; management, &c., 0·036d.; interest and sinking fund, 0·441d.; renewals suspense account, 0·121d.; giving a total of **0·865d.** This amounts to more than the total *generating* costs in a separate generating station.

Comparing the separate items, Mr. Yerbury criticises the justice of the fixed charge for coal of 0·043d. per unit, and points out that it is usual for all coal consumed to be included in "running costs." The cost of water, oil, and waste, &c. (0·004d.), also appears, he says, to be high, and in a tramway station generating about 14 million units per annum, should be sufficient for all oil, waste, and other stores, even where reciprocating engines are in service, and in respect to water, the "fixed charge," if any, should be a very small one. Salaries and wages amount to 0·069d. per unit, and appear to be exceptionally high in view of the fact that under "management expenses" a further fixed charge of 0·036d. is included, making a total of 0·105d., which is considerably higher than the *total* charge under "management, salaries, and wages" in a low-tension tramway station. Presumably tramway departments are being charged *pro rata* for management, &c., with ordinary customers, notwithstanding the fact that the latter require an elaborate book-keeping system, also meter inspectors, and large clerical staff. A fixed charge of 0·064d. for repairs and maintenance appears to be on the safe side. Rents, rates, and taxes are set at 0·087d., whereas in the separate station they amount to 0·028d., or, including rates and taxes on cable ducts, cables, &c., to 0·056d. The high former figure is doubtless accounted for by additional buildings and plant required for converting high-pressure current to the low-pressure tramway feeders, and possibly includes a proportion of income tax, although in the author's opinion this should appear only in the profit and loss account. The charges for interest and sinking fund are 0·441d. and 0·241d. respectively; here again the difference may be due to the additional land, buildings, and plant for conversion. Renewals, suspense, or depreciation amounts, for the combined station, to 0·121d., or 1·68 per cent. per annum of capital expenditure. To bring into line a self-contained undertaking it may be assumed, as is done in Sheffield, that a sum equal to 0·75d. per car-mile is required to be set aside annually to build up a renewals fund, or 1·89 per cent. per annum of total capital expenditure. The proportion of capital expenditure on power station and all cables, &c., to that of the entire undertaking is 22·47 per cent., and spread over, say, 10 years, amounts to 0·102d. per unit, which estimate has proved so far to be sufficient for extraordinary renewals and obsolescence, as ordinary repairs and renewals are directly charged to power account.

Concluding this comparison, the author points out that it has been between a high-tension A.-C. station and a low-tension tramway station, and between units sold and units generated. Where high-tension current is transformed and distributed, the total cost per kilowatt installed amounts to between £40 and £50, and at Manchester it amounts to about £61; whereas in a low-tension continuous-current supply the initial cost of all generating plant and freehold buildings need not be more than £35 per kilowatt, and including cost of all ducts, cables, &c., £50 to £55 per kilowatt, and in the former case the combined conversion and transmission losses and also running costs are considerably higher than from the latter supply. These factors have a most important bearing on the subject of tramway tariffs, and, in the author's opinion, often negative the benefit which should be received by a tramways department obtaining electrical energy from a combined general supply and traction works.

The author also quotes the following figures for Bradford and Sheffield :—For the year ending March 31st. 1909, the Tramways Department of Bradford purchased 10,131,499 units at a cost of £47.384 11s. 8d., the price per unit being 1¼d. from the Corporation works, and 1¾d. per unit from the Shipley Urban District Council. For year ending March 25th, 1909, the Sheffield Tramways Department generated 13,373,958 units at a cost of £21.758 12s. 8d., excluding capital charges, and including all charges at a total cost of £36,765 14s. 9d., the works costs being at the rate of 0·390d. per unit, and total costs per unit = 0·659d., including maintenance of ducts and cables up to feeder pillars.

Referring to the distributing system, Mr. Yerbury states that it is desirable that the cables should be laid and maintained by the Tramways Department. With regard to the registering of the units consumed, if watt-hour meters are used, their accuracy is well within the limits allowed by the Board of Trade, and in the author's experience, with a standard high-capacity meter taking the entire output of a station compared with the readings from twenty separate meters on different feeders, the inaccuracy

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has never been greater than 0·8 per cent. over a period of three years.

Concluding, the author suggests that the capital and management charges should be based on the kilowatt capacity of plant, &c., employed only for tramway supply, and that the running costs should be taken on the entire station, as a tramway load reduces the cost of production. With regard to depreciation, a percentage of 1·75 per annum on the entire capital expenditure on buildings, plant, and cables should be considered a fair allowance. Finally, it is unreasonable to expect a combined station to supply current to a tramways department without profit, and it is suggested that from 3 to 5 per cent. profit should be charged only on the "running costs."

DISCUSSION AT MANCHESTER.

Mr. S. L. PEARCE (Chief Electrical Engineer, Manchester Corporation), said that he felt the question was somewhat *sub judice*, in view of the conference between the Municipal Electrical Engineers and the Municipal Tramway Managers, which would be held in London on Friday. Mr. Yerbury had made a serious initial mistake in assuming the costs given for self-contained stations to be quite correct and comparable with the charges made by combined stations. He had also not distinguished between units generated and units sold, or between low-pressure D.C. and high-pressure A.C. stations. This omission had led him to compare unlikes, with misleading results. The figures for Sheffield and Glasgow on a strictly comparable basis were practically identical. The Sheffield figure of 0·668d. per unit, with an output of 13 million units, and a load-factor of 38 per cent., came up to 0·81d. when allowance was made for ratings on duct and cable work, income tax, and for the units lost in transmission. The Manchester (Bloom Street) figure was on the same basis, 0·88d. per unit, with a total of only 8 million units at a 28 per cent. load-factor. Glasgow was the only system comparable with Manchester; the figure there was 1·26d., as against 1·04d. on the same basis at Manchester. These figures had been admitted by Mr. J. McElroy (General Manager, Manchester Corporation Tramways), and a three years' agreement had just been made for a flat charge of 1d. per unit. Mr. Yerbury's statements with regard to the tramway load-factor were incorrect. At Stuart Street the combined load-factor was 50 per cent.; the tramway load-factor was 33 per cent., and the industrial power load-factor from 60 to 70 per cent., *i.e.*, twice the tramway load-factor. They were, therefore, justified in charging power consumers less. There was also most certainly a peak load in tramway systems; the Bloom Street curves showed distinct peaks morning and evening with as much variation as 3,500 amperes. He did not agree that no portion of the fuel, &c., and management costs should be debited to the fixed charges. Sir Alex. Kennedy had included a portion of these costs as fixed charges. With regard to low power rates, the increased power load had enabled them to put in large modern units at a low cost, say, £3 to £4 per kw., as against £9 to £10 per kw. when the plant for the tramways was installed. He did not see why the tramways should benefit by this; the new plant was not for them. He did not think the allowance of 1·75 per cent. per annum for depreciation and obsolescence was sufficient; in the case of the Sheffield plant, it corresponded to a life of 34 years, whereas a more usual figure was 22 years. He thought the cost of upkeep of cables was independent of energy supplied, and should come partly in fixed costs. He agreed that the tramways departments should have their own meters. Finally, he did not think any case had been made out for overcharging on the part of combined stations.

Mr. J. R. SALTER (South Lancashire Tramways Co.) supported Mr. Yerbury, asserting that even a 3 or 5 per cent. profit was not wanted, as a bulk supply to tramways reduced the generating costs, and that more than half the combined stations in the country would have been financial failures had it not been for the tramway load. It was not right that power customers were metered at their terminals, and tramway systems at the station switchboard. He would like Mr. Pearce to explain why the tramways had to pay for the loss in transmission. Many power consumers had been supplied at under cost price because of alleged extraneous advantages. Why could tramways not be supplied in the same way? He instanced the case of Heywood, where they first had an annual output of 68,000 units, and charged 4·19d. per unit., and after taking on the tramway load, increased their output to 670,000 units, and were able to supply at 1·23d. per unit. There the tramways had made the station a success. Tramways always had their exceptional loads when there was no power load, as on holidays, and thus actually used the power plant. His own company had to pay to the Corporation costs of 1·11d. per unit for the first 800,000 units, and 0·37d. for units over this amount. Above this they paid interest, &c., and profit, so that in all the figure reached an average of 2d. per unit.

Mr. C. C. ATCHISON (Borough Electrical Engineer, Rochdale) asserted that the supply to tramways generally cost the combined station far more than they ever got from them. There was certainly a distinct peak load, and the capital for the plant for this had to be included in the fixed charges. Mr. Yerbury had unfairly compared a system with 104 route-miles with one with only 39 route-miles. He agreed that the cables should be provided by the tramways department. The profit from the supply should, he thought, be comparable with that obtained from lighting and power consumers.

Mr. C. L. STEWART (Rawtenstall) thought that the certainty of a fixed income was a great help to combined stations in the initial stages. In the case of their own small station with regenerative control on the tramways, they often had a negative load, and the load factor was extraordinarily low.

Mr. MILES WALKER (British Westinghouse Co.) suggested that in the case of a combined station generating A.-C. current and supplying through sub-stations, a concession of 10 per cent. should be made for a tramway load on account of its being at unity power factor; if a leading current were taken, a further concession might be made.

Mr. F. H. WHYSALL complained that the question was tied up for want of a common basis of comparison.

Mr. S. J. WATSON (Borough Electrical Engineer, Bury), chairman, held that quite a large percentage of the fuel, wages, and similar costs were standing charges, as fuel was required to keep the station in a condition to supply. With regard to tramway peak loads, there was as much as 600 kw. variation at Bury, and the mean was only one-third of the full load. On the other hand, a power load was very steady. He agreed that the tramways department should provide and pay for cables, but suggested that repairs should be done by the station staff, though paid for by the tramways department. There was nothing to prevent the peak loads of power and tramways coinciding, and this had indeed happened at Bury quite recently. In charging the tramways at Bury, he estimated his general establishment charges, including management, rates and taxes, &c., and from this he took off first charges connected with consumers' accounts, then a proportion based on relative value of mains; he then divided the result in proportion to the relative maximum demands. Mr. Watson then took some figures from Mr. Yerbury's tables, and showed how by making them strictly comparable they nearly always came almost equal. He thought that there ought to be a gross profit of from 9 to 10 per cent. on capital. In his opinion, the whole matter turned on capital, and he did not agree with adding a profit of 3 to 5 per cent. on running costs only. The tramways department wanted to act as middleman and take all the profits.

Mr. YERBURY, in reply to Mr. Pearce, stated that the charges according to the standard form of tramway accounts differed only from those of lighting station accounts in that a proportion of rates and taxes and of insurance premiums was not included in the former. If the fixed charges in a combined station were to be pooled, it would, he thought, certainly be to the advantage of a tramway system to have a separate station.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[*Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."*]

WATER COOLING TOWERS.—A leaflet from Messrs. Balcke & Co., Ltd. (27 Clement's Lane, Lombard-street, London, E.C.), contains a list of the British firms, &c., to whom this company has supplied cooling towers. These include a number of electricity works, collieries, and steel works.

ELECTRICAL ACCESSORIES.—Messrs. A. P. Lundberg & Sons (Pioneer Works, 477 Liverpool Road, London, N.), have issued an index of the catalogue numbers of the items described in their various special pamphlets relating to wiring and other accessories.

CALENDARS.—The wall calendar of the Brush Electrical Engineering Co. (Loughborough), is, as usual, an artistic production. The daily tear-off slips each contain a quotation from Shakespeare, and a coloured picture represents a large multipolar generator with a little Cupid perched upon the bearing.

BELTS, PULLEYS, SHAFTINGS, &c.—We have received from Messrs. Harpers, Ltd. (Aberdeen), a copy of their latest catalogue of accessories for the transmission of power, which is conveniently arranged as a pocket-book, and contains very complete details of belt and rope pulleys, gear-wheels, shafting, couplings, bearing pedestals, brackets, &c., and a series of views of the company's works.

TELEPHONE AND SIGNALLING APPARATUS.—The Adnil Electric Co., Ltd. (Artillery Lane, E.C.), are issuing a very complete new catalogue of over 100 pages dealing with telephones, bells, and other signalling apparatus, electric clocks, &c. In the telephone section some views of recently completed exchange equipments are given, and prices and particulars of a great variety of instruments for exchange and domestic purposes, special telephone sets for railways, loud speaking telephones with hooter call, mining telephones, special telephones for use near high-tension lines, switchboards, &c. Among the bells is a large motor-driven bell for factories, &c., and several patterns of watertight mining bells are listed. Other appliances dealt with include dial signalling apparatus for mines and other purposes, fire alarms, electric time recorders, thermometers, and water gauges, watchmen's time recorders, telegraph instruments, time stamps, electric clocks, &c.

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THE BREMER FLAME ARC LAMP PATENT

Appeal Court Proceedings

THE British Westinghouse Co.'s appeal against the judgment of Mr. Justice Joyce declaring the Bremer flame arc lamp invalid, was commenced before Lords Justices Cozens-Hardy, Fletcher Moulton, and Buckley on Thursday, and continued on Friday, Monday, and Tuesday. Mr. A. J. Walter, K.C., and Mr. E. Russell Clarke appeared for the company, and Mr. W. R. Bousfield, K.C., Mr. J. Hunter Gray, and Mr. Scott appeared for Mr. G. Braulik.

It will be remembered that Mr. Braulik had first endeavoured to secure the revocation of the Bremer patent under Section 27 of the Patents Act, alleging that the lamps were manufactured mainly outside the United Kingdom. The Comptroller of Patents revoked the patent subject to appeal to the High Court, but on appeal the patent was restored. An action brought by the Westinghouse Co. against Mr. Braulik for infringing the patent was then heard, and resulted in Mr. Justice Joyce declaring that the Bremer patent was invalid for want of subject matter.

This decision is now being appealed against.

Mr. Walter, for the Westinghouse Co., recapitulated at length the evidence given in the Court below, and contended that the judge's decision was not warranted on the evidence given. He practically left it to the Appeal Judges to redecide the case on the evidence, without adducing new arguments.

Mr. Bousfield, on behalf of Mr. Braulik, emphasised the point upon which Mr. Justice Joyce's judgment was based, viz., that the lamp was described in an earlier patent than Bremer's, and that one must not rob the public of the work of previous inventors. The Bremer patent was, he said, the application of an old idea (patented in 1882 by Graham) to another type of arc lamp, and this in his opinion did not constitute subject matter for a new patent. He did not argue on the question of infringement, but based his case entirely on the alleged invalidity of the Bremer patent for want of new subject matter.

Mr. Walter, in reply, said that there had been no evidence to show that lamps made in accordance with the earlier patent had ever been successfully constructed and worked. He contended that it should not be permissible to rake up an old and unsuccessful invention, and put it forward as an anticipation of a later and successful application of a similar principle.

Their Lordships reserved their decision.

LOCAL NOTES

AUSTRALIA: *Adelaide: Tramways.*—An interim report has been presented by Mr. W. G. T. Goodman, chief engineer and general manager of the Municipal Tramways Trust, Adelaide, dealing with the working of the undertaking during the first six months. The electric system was inaugurated on March 9th, and during the following six months the total revenue amounted to £72,670, including £71,645 traffic receipts, of which £33,863 has been earned in respect of the electric car system, and £37,782 in respect of the horse-car system. This shows an increase of £15,823 on the previous, and an increase of £16,373 for the corresponding half of the previous year. The car mileage was 522,565, and the number of passengers carried 4,654,382, the average receipts per car mile being 15·55d. The expenditure amounted to £63,193. Of the balance, £1,000 has been set as reserve for renewals, and after bringing the balance from the previous half-year, and meeting interest charges, there remains the sum of £4,832. The working expenses amounted to 10·82d. per mile. There are now 50 cars running, thirty being combination and twenty open cars.

Victoria: Telephone Charges.—The *Australian Mining Standard* states that Messrs. Whitton & Holmes, the departmental accountants to whom was entrusted an inquiry into the working of the telephone system of the Commonwealth, have reported against the continuation of the toll system of charging. The report is a preliminary one, and deals only with the Victorian services, and states that the telephone service in the metropolitan area alone has returned a net profit of over £100,000. This, however, was made chiefly in the years 1901-7, the results for 1907-8 and 1908-9 being a small profit of about £4,000, and a loss of about £7,000 respectively. These two latter results are attributed entirely to the introduction of the measured rate system of charging. The opinion is expressed that the work at the exchanges of recording the calls costs in the aggregate more than the revenue derived from measured rate.

Government Contracts.—A Sydney copper refining and smelting concern has suggested that the Australian Postmaster-General should give preference in departmental contracts to wire made from local raw material. The suggestion is to be complied with in future where possible. At present, the copper wire used by the Department comes principally from the United Kingdom and America.

BARKING: *Electric Supply in Bulk.*—The offer of the British Coalite Co. to supply electricity in bulk to the Council has been considered by the Electricity and Tramways Committee, who have decided that the offer cannot be accepted on the terms mentioned.

BECKENHAM: *Therol Heaters.*—The Electricity Committee recommend the Council not to undertake the supply of Therol heaters on hire-purchase terms. The question of supplying electrical energy in connection with this apparatus has been referred to the resident engineer for report.

BIRMINGHAM: *Tramways.*—The Tramways Committee have reported upon the proposal to construct tramways along Green Lane to the city boundary, to the effect that the road is not wide enough for a single line of tramway, and that the cost of widening it would be prohibitive.

Halesowen Light Railway.—The Tramways Committee recommend the Corporation to oppose the application of a company to construct light railways in certain districts adjacent to the city, including one in the Quinton district. The reason for the recommendation is that by the incorporation of Quinton with the city, it is necessary that the Corporation should obtain control of the portion of the road over which the company are now seeking powers, and which forms the boundary between Smethwick and Oldbury on the north-east side, and the City on the south-west.

CANADA: *Railway Electrification.*—It is stated that the first line which the Canadian Pacific Railway Co. will convert to electric traction is the St. Maurice Valley branch in Quebec, which runs along the River St. Maurice from Three Rivers to Shawinigan Falls.

COLWYN BAY: *Tramways.*—The Chairman of the Llandudno & District Electric Tramways Company has written to the Council suggesting that an agreement should be come to for extending the line to Old Colwyn in accordance with the recent decision of the Light Railway Commissioners. The Council have requested Mr. Sellon to send down a draft agreement.

DEVONPORT: *The Tramways Bill.*—A Special Committee has been appointed to take charge of matters arising out of the Bill which has been deposited by the Devonport & District Tramways Co., and which proposes to vary the terms of the present agreement between the company and the Corporation.

DUNDEE: *Claim against Electricity Committee.*—The Corporation have settled, for £1,250, a claim against them by Messrs. Grimond for failure to supply electricity at a certain date. This failure to supply was in consequence of the delay in completing the new Carolina Port power station.

DUNFERMLINE: *Opposition to Tramways.*—The Corporation have withdrawn their memorial of standing orders against the Dunfermline and District Tramways Extension Order.

HENDON: *Electric Lighting.*—The Rural District Council have decided to oppose the granting of a further extension of the Northwood, Edgware, and Pinner Electric Lighting Provisional Order.

GUERNSEY: *Loan for Services.*—The Local Government Board have refused to extend the period for the repayment of £2,000 recently borrowed for services.

LONDON: *City of London Electrical Department.*—The Streets Committee are to consider a letter from Mr. A. A. Voysey, electrical engineer and inspector, in regard to the necessity for reviewing the duties and responsibilities of the officials in the electrical department, and suggesting, in the event of the Corporation deciding to increase the responsibilities of the position, to put a more robust man in charge of the department.

Greenwich: Tramways.—The L.C.C. have informed the Council that they have been in negotiation with the Board of Trade and the Admiralty concerning the construction of the tramways from Woolwich to Eltham on the overhead trolley system of electric traction, but the Admiralty has declined to agree to the adoption of the usual overhead trolley system. The County Council have therefore decided to use two overhead wires instead of one for each track in order to secure complete insulation.

Westminster: Street Lighting.—The Works Committee have arranged for an experimental installation of improved lighting for Victoria Street. A large number of residents and traders in Victoria Street have recently made complaints as to the inefficient lighting of that thoroughfare.

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MANCHURIA: *Electric Lighting.*—An American Consular report states that through the initiative of the American Consulate at Mukden, an American company is arranging with the Chinese authorities to erect an electric power-house at Changchun, the junction city of the Japanese and Russian railway lines in Manchuria. The estimated cost of the plant is £12,000, and most of the material will be of American manufacture.

NORTH BERWICK: *Electric Lighting.*—A special meeting of the Town Council was held last week to consider a proposal by Messrs. Crompton & Co., for the installation of electric lighting in the borough. After some discussion it was decided to inform Messrs. Crompton that the Town Council have no objection to the introduction of electric light, and asked upon what terms they will promote and work a scheme.

SMETHWICK: *Electric Lighting.*—The Council have passed a resolution refusing to give their consent to the Smethwick Electric Lighting Order, 1910, promoted by the Birmingham & Midland Tramways Company, for the reason that the company have not embodied in the Order the terms and conditions agreed upon with the Corporation.

WEST HAM: *Tramways and Electricity Assessments.*—Appeals are to be withdrawn against the tramways and electricity undertaking assessments, which have been fixed as follows: Electricity undertaking, net rateable value reduced from £12,900, as originally proposed, to £11,500; tramway undertaking, general undertaking, from £11,900 to £10,000; East Ham parish, £400 (as originally proposed); West Ham parish, Forest Hill lines, £55 (as originally proposed).

WINCHESTER: *Purchase of Electric Light Co.*—At a special meeting of the Corporation last week the report of the Special Committee, recommending the purchase of the undertaking of the Winchester Electric Light & Power Co., was adopted. Twelve months' notice is to be given to the company of the Council's intention to purchase.

YORK: *Opening of Tramways.*—The opening of the Fulford-Nestgate section of the City Tramways took place on Thursday.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ASHTON-UNDER-LYNE.—In our notice last week concerning tenders for condensing plant, exhaust turbine and direct-current generator, and balancer, we stated that these should be sent by February 19th. This should have read February 9th.

BARKING.—The Local Government Board has sanctioned a loan of £2,500 for the electricity undertaking.

BELFAST.—The Tramways and Electricity Committee invite tenders for the supply of low-tension insulated V.B. cable during the year ending March 31st, 1911. (See an advertisement on another page.)

BOLTON.—The Corporation invite tenders for a Lancashire boiler, complete with superheater, &c. Particulars from Mr. A. A. Day, the Borough Electrical Engineer, and tenders to the Town Clerk by January 10th.

COVENTRY.—Further particulars are now available regarding the proposal of the Electric Light Committee to spend £54,200 upon extra plant. They recommend the installation of two 2,300-kw. turbo-alternators, and the scrapping of a 300-kw. reciprocating set. The scheme also includes four water-tube boilers, and economisers, in substitution for four Lancashire boilers, which are about fifteen years old, and have a total evaporative capacity of 25,000 lbs. of steam per hour, against an evaporative capacity of 76,000 lbs. per hour with modern water-tube boilers. The new arrangements are also such as to shorten the steam pipes, and consequent loss in condensation and radiation, whilst the boiler pressure will be raised from 150 lbs. to 180 lbs. per square inch. The proposal will involve no alteration or extension of the existing buildings. The estimated cost per kw. installed is £10 9s., which will reduce the total capital expenditure upon the Coventry undertaking from £57 10s. per kw. to £32 5s. per kw.

ISLINGTON.—Mains are to be extended at a cost of £300 to supply electricity at Cathcart Hill, Dartmouth Park Hill, and Wyndham Crescent.

SWANSEA.—Mains are to be extended at an estimated cost of £230, to supply the Cwmdonkin Park district.

WORKSOP.—Tenders are invited by February 2nd for the supply of underground cables. Particulars from the Borough Electrical Engineer.

Miscellaneous

AUSTRALIA.—The Sydney Postmaster-General's Department invite tenders by March 9th for the supply and delivery at the Departmental Stores, Sydney, of magneto switchboards for metallic lines, and switchboards for private branch exchanges for common battery working in accordance with Schedule N.S.W., E.E., 114/09.

BECKENHAM.—Tenders are to be invited for service boxes, cut-outs, and meters.

CHILI.—It is stated that a concession has been granted to the Bio Bio Telephone Co., Mulchen, for the extension of the telephone system from Mulchen to Collipulli, Ercilla, Victoria, Los Sauces, Lumero, Renaico, Esperanza, and Curicó.

COLOMBIA.—Electric tramways are to be constructed in the town of Cali, and a decree has been issued enabling the materials for the works to be imported free of duty.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

S.E.—The London County Council invite tenders for the wiring and fitting of the Cow Lane Elementary School, Rotherhithe. Particulars from the Chief Engineer to the Council, and tenders to the Clerk by February 2nd.

E.—School, West Silvertown (£10,097). Builders, H. C. Horswill, 182 Green Street, Forest Gate, E.

S.W.—Conversion of premises, Plough Road and York Road, Battersea, into cinematograph hall for Electric Theatres Bureau, Ltd., 18 Charing Cross Road, W.C.

Wing to Home for Aged Jews, 105 Nightingale Lane, Balham, S.W. Builders, W. Johnson & Co., Ltd., Besley Street, Streatham.

Conversion of stables into laboratory, offices, and stores, &c., Avery Hill Training College, Bexley Road, Eltham, S.E. L. Kayak, 3 and 4 Station Road, Belvedere.

PROVINCES.

AYR.—Residence, Prestwick Road (£1,500). Architect, J. S. Williamson, Sandgate Street, Ayr.

House, Belmont Avenue (£1,300). Architect, J. W. Morton, 9 Wellington Square, Ayr.

Additions, Davidshill Hospital. Ayrshire County Council.

BELFAST.—Additions to Presbyterian Church, Clifton Street. Architects, Young & McKenzie, Belfast.

BOOTLE.—Tenders are invited for the electric wiring and fitting of the new Orrell council schools for the Corporation. Particulars from the Borough Electrical Engineer, to whom tenders by February 3rd.

BOURNEMOUTH.—Schools £6,060). F. W. Lacey, borough engineer. Builders, J. & M. Patrick, Point Pleasant, Wandsworth.

Science, art, and technical schools (£19,060). F. W. Lacey, borough engineer. Builders, as above.

BRIDGEND.—School (400 places). D. Pugh Jones, architect, Charles Street, Cardiff.

CHESTER.—School (£5,255). Builder, Mr. Harrington, Chester.

DARLINGTON.—Secondary school (£10,000). Architect, W. Rushworth, Shire Hall, Durham.

GLASGOW.—Extensions to works of Sir William Arrol & Co., Ltd. (£5,500). Plans by firm's own staff.

ISLE-OF-WIGHT.—Hospital (£5,960). Architect, S. R. Cocks, Ryde.

JARROW.—Swimming baths. Stephen Sherriff & Son, builders.

LIVERPOOL.—Emporium for Lee & Son, Basnett Street. Builders, J. Henshaw & Sons, Chatham Street, Liverpool.

PETERBOROUGH.—Extensions, Deacon's School. Architect, F. H. Townsend, Cross Street, Peterborough.

PORTSMOUTH.—House for tuberculosis diseases. Clerk to Guardians, Portsmouth.

READING.—Alterations and additions at nurses' home at workhouse (£1,910). Architect, W. Roland Howell, Reading.

SPRINGBURN.—Extensions to store department of N.B. Locomotive Co., Ltd. (£4,000). Plans by firm's own staff.

WELLINGBOROUGH.—School (£8,360). Architects, Sharman & Archer, Wellingborough. Builders, Hacksley Bros., Wellingborough.

Manchester Section, I.E.E. Dinner.—The annual dinner of the Manchester Section of the Institution of Electrical Engineers will be held at the Midland Hotel, Manchester, on Friday, February 25th.

Electrical Trades Benevolent Institution.—In connection with the Festival Dinner of the Electrical Trades Benevolent Institution, which is to be held at the Whitehall Rooms, Hotel Metropole, on Wednesday, February 23rd, Sir William H. Preece, chairman of the committee, is issuing a letter appealing for a continuation of support to the institution, in which he mentions some typical cases of assistance given during the past year. In addition to Prof. Gisbert Kapp, who is to preside at the dinner, the following gentlemen are giving active support by serving on the organising committee:—Messrs. H. Bevis and H. W. Butler, Sir Irving Courtenay, Messrs. W. B. Esson, Emile Garcke, T. E. Gatehouse, Hugo Hirst, R. Wallis-Jones, W. M. Mordey, C. S. Northcote, W. Schmahl, W. Taylor, Edwin C. Wallis, Guy Burney, E. J. Clark, Justus Eck, W. Finlay (President, Electrical Contractors' Association), W. C. C. Hawtayne, E. F. Johnson, A. P. Lundberg, S. L. Pearce, Leonard G. Tate, L. Thurnauer, and C. H. Wordingham. The price of dinner tickets, including wine, is one guinea each. Application should be made to Mr. W. Davenport, secretary to the Institution, Ridler Place, Holland Street, Blackfriars, E.C., to whom contributions in aid of the funds may also be sent.

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FLAME-ARC LAMP CARBONS

WESTINGHOUSE-BREMER BRITISH PATENTS

THE British Westinghouse Electric and Manufacturing Company, Limited, hereby give notice to all concerned that the following firms are at present the only Licensees under the above patents, and that their manufacture only can be sold as licensed thereunder:—

The Birmingham Carbon Works.
C. Conradty.
Companie Fabril de Carbones Electricos.
The General Electric Company, Limited.
H. G. Mayer & Company.
Planiawerke Actien Gesellschaft.
Schiff & Company.
Ship Carbons, Limited.
Gebruder Siemens & Company.
Siemens Bros. Dynamo Works, Limited.
Sloan Electrical Company, Limited.
C. W. Webster.

January 17, 1910

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TENDERS RECEIVED AND ACCEPTED

ADMIRALTY.—It is stated that the Admiralty have placed a large order for electrical machinery and fittings with the Brush Electrical Engineering Co.

BURY.—The Electricity Committee recommend contracts being placed for coal and ash handling plant for the new power station, and also for additional switchgear at the power house.

GLASGOW.—The tender of Messrs. Ferranti, Ltd., has been accepted for switchgear at the Yorkhill sub-station.

GOVAN.—The following tenders have been accepted:—Messrs. J. Howden & Son, turbo-alternator; British Westinghouse Co., rotary converters; British Thomson-Houston Co., switchboard.

LONDON: *Stepney.*—The Council received the following for coal-conveying plant at the Limehouse power station:—Strachan & Henshaw, Ltd., telpher type, £3,820 11s. 6d., ditto, alternative (accepted), £4,040 11s. 6d.; E. Bennis & Co., telpher type, £3,843 15s.; Graham, Morton & Co., bucket type, £4,035 10s.; New Conveyor Co., Ltd., bucket type, £4,127 15s.; ditto, alternative, £4,177 15s.; West's Gas Improvement Co., Ltd., bucket type, £4,347; Naylor Bros., Ltd., bucket type, £4,401, telpher tender, informal and incomplete; Spencer & Co., Ltd., bucket type, £4,499; E. Bennis & Co., bucket type, £4,534; McMyler Manufacturing Co., bucket type, £4,557; Heenan & Froude, Ltd., bucket type, £4,965; Babcock & Wilcox, Ltd., bucket type, £5,059; Gibbons Bros., Ltd., bucket type, £5,317 15s.

Woolwich.—The Council received seven tenders for twelve months' supply of cable at the expiration of existing contracts, and have accepted that of Siemens Bros. and Co., Ltd.

STONE (STAFFS.).—The Joint Hospital Board recommend the acceptance of the tender of J. Richards, of Longton, Staffs, at £356, for the electric lighting and telephone work at the new hospital.

WEST HAM.—The Council have placed the following orders in connection with electricity undertaking: Williams & Co., coal grab, £95; Bruce Peebles & Co., conversion of alternator, £825; Sloan Electrical Co., 100,000 pairs of carbons, 63s. 6d. per 1,000 pairs, less 2½ per cent.; Westinghouse Co., annual supply of transformers, 7½ per cent. less than prices in existing contract; Babcock, Wilcox & Co., chain grate stoker, £310.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Fenchurch Buildings, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday morning was £62 10s. to £63 per ton (last week, £62 10s. to £63).

DISSOLUTIONS OF PARTNERSHIP.—The partnership between E. B. Boucher, J. R. Gardiner, and W. Grisold, trading as electrical engineers, 8 and 9 New Street, Bishopsgate Street, London as Yeoman & Co., has been dissolved. E. B. Boucher will continue.

Harold Hastings and T. C. Roberts, electrical and general engineers, 27 Queen Victoria Street, London, have dissolved partnership. Debts by Harold Hastings, who continues.

B.T.H. METAL FILAMENT LAMPS.—For the future, the B.T.H. tungsten lamp will be known as the "Mazda" lamp, and will bear that name as trade-mark. The new name will be used on the lamps, packing-cases, cartons, &c., as rapidly as the change can be effected, and in the meantime the public are notified that any lamps they may receive marked "B.T.H. Tungsten," are the same as the Mazda lamp.

CANADIAN AGENCIES WANTED.—A firm in the West of England, manufacturing dynamos and electric motors, &c., desires to appoint a reliable firm to represent them in Canada.

A Yorkshire firm manufacturing electrical instruments (transformers, balancers, compensators, &c.) is anxious to do Canadian business.

Further particulars of the above may be obtained from the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W.

LIQUIDATIONS, BANKRUPTCIES, WINDINGS UP, &c.—The trustee in the bankruptcy of T. A. Evans, electrical and mechanical engineer, Swansea, has been released.

The last day for receiving proofs in the bankruptcy of W. T. Harris, electrical engineer, 460 Commercial Road, Portsmouth, is Feb. 4th. Mr. E. W. C. Whittaker, 3 Portland Road, Southampton, is trustee.

A notice appeared in the *London Gazette* for Jan. 21st, calling a meeting of creditors of the London Electrobus Co., Ltd., under Section 188 of the Companies (Consolidation) Act, 1908, to be held at 15 George Street, Mansion House, London, E.C., at 12 noon on Feb. 7th. Section 188 defines the procedure, and deals with the rights of creditors in a voluntary winding-up.

The Telautograph Co., Ltd., is to be wound up voluntarily. Mr. F. A. Bagnall, 21 Budge Row, London, is liquidator.

E.C.C. STAFF DINNER.—The annual dinner and smoking concert of the staff and foremen of the Electric Construction Co., Ltd., took place on Saturday, at the Victoria Hotel, Wolverhampton. The chair was occupied by the manager, Mr. W. Bulloch, and a very enjoyable evening was spent.

MISCELLANEOUS CITY NOTES

METROPOLITAN RAILWAY CO.—Subject to final audit, a dividend of one per cent. has been declared for the past half-year, carrying forward £6,000.

AMALGAMATION OF CANADIAN POWER COMPANIES.—A rumour is current regarding a proposed amalgamation of the Montreal Light, Heat & Power, the Shawinigan Light, Heat & Power Co., and the Montreal Street Railway Co. It is also stated that a system of tube railways is under consideration in Montreal, the capital for which will be found by the new company.

CENTRAL LONDON RAILWAY CO.—A dividend of 3 per cent. per annum has been declared upon the ordinary shares for the December half-year, making 2 per cent. for the year, against 2½ per cent. for 1908. The sum of £2,040 has been transferred to reserve fund, against £20,000 in 1908, bringing this to £100,000, leaving £3,342 to be carried forward.

BRITISH COLUMBIA ELECTRIC RAILWAY CO.—A dividend at the rate of 5 per cent. per annum has been declared on the 5 per cent. non-cumulative preferred ordinary shares, plus a further dividend at the rate of 1 per cent. per annum, for the half-year to December 31st.

MEXICO TRAMWAYS CO.—A dividend of 1½ per cent. has been declared for the quarter to December 31st.

COMPANIES STRUCK OFF REGISTER.—The names of the following companies will, unless cause is shown to the contrary, be struck off the register within three months:—Automatic Telephone Co. (1903); British Electric Separating Co.; Everyday Electricity Publishing Co.; Garcin Renault Electric Cars and Accumulators; Northern Electrical Supply Stores; Reliance Electric Co.

APPOINTMENTS AND PERSONAL NOTES

Mr. A. H. Dykes has resigned the chairmanship of the Beckenham Electricity Committee. At the last meeting of the Council, Mr. Dykes said he was not satisfied with the policy which was being pursued in regard to the electricity undertaking.

Dr. Alexander Russell has been appointed electrical inspector under the Willesden Electric Lighting Order, 1898.

An additional technical assistant to the Borough Electrical Engineer at Hornsey, is to be appointed at a salary of from 35s. to 40s. a week.

Mr. Alfred G. Collis has resigned his position with Messrs. Ferranti, Ltd., and has joined Messrs. Cowans, Ltd., of Manchester.

Electric Driving of Printing Presses.—The appeal of Messrs. J. H. Holmes & Co., Ltd., against the judgment of Mr. Justice Neville, in which he held that the Clatworthy patent for the electric driving of printing presses had been anticipated by an American patent, was commenced before Lords Justices Cozens-Hardy, Fletcher Moulton, and Buckley yesterday. Mr. A. J. Walter, K.C., and Mr. J. H. Gray appear for Messrs. Holmes, and Mr. Astbury, K.C., and Mr. D. M. Kerly appear for the Associated Newspapers, Ltd., who are the respondents in the action. The Associated Newspapers, Ltd., had some "Kohler" equipments, and these were alleged to infringe the Clatworthy patent.

The Floods in Paris.—The serious floods in Paris, of which graphic accounts have been appearing in the daily papers during the past few days, have caused serious interference with the electric railways, tramways, and electric lighting services, as well as the telephones and telegraphs. The service on the Metropolitan and other electric railways has been partially suspended, and attempts were made to run steam trains. Many of the tramway routes have also been interrupted. In view of the confusion which naturally exists, a full account of the damage done is not yet available.

Combination of American Electrical Firms.—The daily papers state that negotiations are on foot for the amalgamation of the General Electric Co., of New York, with the Westinghouse Electric & Manufacturing Co., of Pittsburg. The *Financial News* states that the two companies have worked in close co-operation since 1896, an arrangement having been entered into in that year by which the advantages attaching to the patents owned by the two undertakings were "pooled." In order to facilitate the amalgamation, it is believed that Mr. George Westinghouse will retire from the Board of the Westinghouse Co. Rumours are also current that a third undertaking will be included in the amalgamation.

Electrification of South African Railways.—At a meeting of the South African Electric Power Commission, recently, the possibility of converting to electric traction the eastern line in the low country, and also the Springs—Randfontein line, was discussed. Mr. A. Beaton, Acting Chief Engineer of the Central South African Railways, approved of the general principle of electrification, although he had not gone into details. He anticipated a reduction of drivers by one half, and also of the firemen and coal-trimmers. Electrification would tend to minimise the present discomfort suffered by drivers and firemen working locomotives in an unhealthy and sub-tropical climate.

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COMPANIES' MEETINGS AND REPORTS

METROPOLITAN RAILWAY CO.—The receipts for the half-year to December 31st amounted to £390,756, and the expenses to £205,654. After providing for debenture interest and other fixed charges, and for electrical depreciation, there is a balance of £139,098, and after meeting preference dividends, the directors recommend a dividend for the half-year at the rate of 1 per cent. per annum, carrying forward £5,927. The report states that the installation of automatic signalling on the Inner Circle has greatly facilitated the working of the railway, and a contract will shortly be let for an installation of this system of signalling on the Baker Street—Neasden line.

CITY & SOUTH LONDON RAILWAY CO.—The receipts for the December half-year amounted to £89.885, and the working expenses to £41,275. The net revenue account, including the amount brought forward, shows £50.021. After meeting debenture interest and transferring to renewal fund £1.500, there is a balance of £33.963. The directors recommend the full dividend of 5 per cent. on the preference shares and 1¾ per cent. per annum upon the ordinary shares, carrying forward £712. Both the number of passengers carried and the receipts have increased during the half-year. The meeting is on February 1st.

BOROUGH OF ASHTON-UNDER-LYNE.

ELECTRICITY DEPARTMENT.

THE ELECTRICITY COMMITTEE invite Tenders for the following works, viz. :—

Section A.—For one Counter Current Jet Condensing Plant.
,, B.—For one Natural Draught Cooling Tower.
,, C.—For one Exhaust Turbine and 400 KW. Direct Current Generator.
,, D.—For one Electric Balancer.

Copies of the Specification and Form of Tender can be obtained from the Borough Electrical Engineer, Wellington Road, Ashton-under-Lyne, on payment of a deposit of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Electricity Works," addressed to the undersigned, must be received not later than 12 noon, Wednesday, February 9th, 1910.

By order,
JOHN NEAL,
Borough Comptroller.

Town Hall,
Ashton-under-Lyne.
18th January, 1910.

COUNTY BOROUGH OF BOLTON.

ELECTRICITY DEPARTMENT.

THE ELECTRICITY COMMITTEE of the County Borough of Bolton are prepared to receive tenders for :—

One Lancashire Boiler Complete with Superheater, etc.

Specification and form of tender may be obtained on application to Mr. Arthur A. Day, A.M.I.C.E., M.I.E.E., Borough Electrical Engineer and Tramways General Manager, Spa Road, Bolton.

Tenders, addressed to the Chairman of the Electricity Committee, Town Hall, Bolton, must be sealed and endorsed "Tender for Boiler," and delivered not later than 12 o'clock on February 10th, 1910.

The Committee do not bind themselves to accept the lowest or any tender.

SAMUEL PARKER,
Town Clerk.

Town Hall, Bolton.
19th January, 1910.

JOURNAL OF THE INSTITUTION OF ELECTRICAL ENGINEERS.

EDITED BY P. F. ROWELL, Secretary.

Part 198. Price 5s.

"Economics of Medium-sized Power Stations." (With Discussion.) By A. J. J. PFEIFFER.

"Some Tests and Uses of Condensers." (With Discussion.) By W. M. MORDEY, President.

"Some Considerations in the Manipulation of Dry-core Telephone Cables." (With Discussion.) By F. G. C. BALDWIN.

"Electricity Works and Refuse Destructors." (With Discussion.) By J. A. ROBERTSON.

"The Design of Small Direct-current Machines." By B. E. STOTT and J. HARGROVE.

"Notes on the Elimination of Sparking." By L. H. A. CARR, B.Sc. (Tech.).

"Single-phase Railways." By P. C. JONES.

"The Direct-current Variable-speed Motor and its Application to Modern Machine Tools." By W. S. LONSDALE.

"The Utilisation of Exhaust Steam for Electric Driving." By C. S. RICHARDS, B.Sc. (Tech.).

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CITY AND COUNTY BOROUGH OF BELFAST.

TRAMWAYS AND ELECTRICITY DEPARTMENT.

Low Tension Insulated V.B. Cable.

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The Council do not bind themselves to accept the lowest or any Tender.

THOMAS W. BLOXAM, M.Inst. E.E.,
City Electrical Engineer.

Electricity Works,
East Bridge Street,
Belfast.

CITY AND COUNTY BOROUGH OF BELFAST.

ELECTRICITY DEPARTMENT.

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THOMAS W. BLOXAM, M.Inst.E.E.,
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ELECTRICAL ENGINEERING

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"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 208-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON AND WESTMINSTER BANK (Temple Bar Branch).

BINDING "ELECTRICAL ENGINEERING." — Vol. V. of "Electrical Engineering" (Jan.–Dec. 1909) closed with our issue of Dec. 30. An index for the volume is now ready, and copies may be ordered from any newsagent or bookseller at the price of 1d. each (or post free, 2d.). Binding Cases, including index, are also ready, price 2s. each, post free 2s. 4d. (Abroad 2s. 6d.) Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to us, carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad.

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SUMMARY

OUR monthly supplement on "Electrical Engineering in Mines" is included in this issue. Some correspondence on shaft cables is published, and abstracts of papers recently read on "Machine Mining," by Mr. S. Mavor, and on "Electricity in Coal Mines," by Mr. R. Nelson, are included. Some practical notes are contributed by Mr. S. Skirrow, and illustrated descriptions appear of the Electric Construction Co.'s new coal cutter and a safety gate-end switch-box, designed by Mr. H. J. Fisher. We give special reports of the discussion at the Newcastle and Cardiff sectional meetings of the Institution of Mining Electrical Engineers on Mr. W. Maurice's paper on "Electric Shocks," which forms the introduction to the first part of the inquiry into the causes and prevention of electrical accidents in mines being conducted by that Institution. A summary is also given of electrical mining patents published in January.

MR. H. E. YERBURY'S Paper on "Equitable Charges for Tramway Supply," the discussion upon which at Manchester we reported last week, was further discussed in Sheffield and London. Opinion was divided upon whether the charges should be fixed on a clear and well-defined basis, or whether local considerations and broader commercial relations between supply and demand should be a predominating factor. Mr. J. F. C. Snell defined in detail the basis upon which he thought the charges should be based. Mr. W. G. Bond said that the charge per unit made by municipalities to tramway companies should not be higher than what it would have cost the company to supply from a station of their own, built only for the tramway load. He pointed out that the question was most important in view of the customary quinquennial arbitrations to decide the price to be paid by the tramway companies to the municipalities supplying them. (Page 73.)

JUDGMENT has been given in the appeal in the action brought by Messrs. J. H. Holmes & Co. against Associated Newspapers, Ltd., for alleged infringement of the Clatworthy patent relating to electrical driving of printing presses. The appeal has been dismissed with costs, and the patent is pronounced invalid on the score of anticipation by certain descriptions of equipments published in American journals. (Page 74.)

THE action by the Gravesend and District Electric Tramways Co. against the Gravesend Corporation, in which the accuracy of the meters measuring the tramway current was disputed, concluded on Monday with a verdict for the defendants. The judgment, however, expresses no opinion as to the accuracy of the meters, the judge holding the opinion that the company's remedy was to go to arbitration on the matter, as provided for in their agreement with the Corporation. (Page 75.)

A LETTER from Mr. E. W. Cowan, called forth by the discussions on Mr. Yerbury's Paper on charges for tramway supply, urges the principle that the price of electricity for all purposes should be based on market

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considerations more than on cost. Mr. A. M. Taylor also writes on the same subject, and favours the basis adopted in Manchester. A letter from the Adnil Electric Co. replies to correspondence regarding their combined lighting and power meter. (Page 76.)

WE report the first part of the hearing of an action for infringement brought by the Donnersmarckhütte against the Electric Construction Co. The Ilgner patent for the electric driving of reversing rolling mills is the one in question. The alleged infringing plant is that at the Bilston works of Messrs. Alfred Hickman, Ltd. It is not denied that the Ilgner principle is employed there, but it is asserted in defence that the Ilgner patent is invalid for want of subject matter and on account of insufficiency. The publications quoted as describing the principle include descriptions of a Ward-Leonard motor-generator traction equipment, in which a flywheel-effect is referred to, and a patent by Ferranti for a motor-generator with a flywheel for use in lighting stations to smooth out the fluctuations of a power load. Some interesting evidence with regard to the operation of reversing rolling mills was given by Mr. Swinburne, Mr. Ablett (of Siemens Bros. Dynamo Works), Mr. Parshall, Prof. B. Hopkinson, Mr. Ferranti, and Mr. Mordey. (Page 77.)

AT the annual dinner of the Leeds Local Section of the Institution of Electrical Engineers, reference was made to the backwardness shown by textile engineers in adopting electrical driving, and the unsatisfactory nature of a recent report on the subject. The section is to be known in future as the Yorkshire Section. (Page 78.)

THE annual dinner of the Students' Section of the Institution of Electrical Engineers was held in London on Wednesday of last week. Dr. G. Kapp spoke of the training of engineers, and referred to a prize offered in Italy for an efficient earthing device. Mr. W. M. Mordey, Dr. S. P. Thompson, and Mr. Hammond also spoke. (Page 78.)

AMONG the specifications published by the Patent Office on Thursday last was one by H. Hirst and the Wolfram (Tungsten) Metal Filament Lamps, Ltd., for a method of jointing metal filaments to leading-in wires. This consists in making the joint with a paste of the phosphides of copper or tungsten, and reducing the paste in a suitable manner.—A device for effecting a gradual feed and for taking the weight of the carbons off the stop in arc lamps of the supported carbon type is protected by P. Hanisch and the Regina Bogenlampenfabrik Ges.—Messrs. Siemens Bros. Dynamo Works, Ltd., describe a system of control for shunt-wound D.-C. motors driving ventilating fans or ships' propellors. Two motors are placed on the same shaft and are connected in series up to 80 per cent. full speed, which corresponds with half full load. Finally, the motors are placed in parallel and brought up to full speed by shunt regulation. A patent by E. W. Smith and the New Phonopore Telephone Co., Ltd., for apparatus for telephoning along telegraph lines expires to-morrow, after the full life of fourteen years. (Page 79.)

THE Aberdeen Corporation have offered a supply of electrical energy to the Suburban Tramways Co. at 1·75d. per unit, but the company suggest 1·25d. per unit.—The Cavehill and Whitewell Tramways Co. have offered their undertaking to the Belfast Corporation on arbitration terms.—The Devonport and District Tramways Co.'s Bill, which proposes to vary the terms of an agreement between the company and the Corporation, was referred to by the Town Clerk at the last meeting of the Council as a "monstrous proposal."—Mr. C. P. Sparks has reported upon the Newport (Mon.) electricity undertaking to the effect that the charges for power supply are too low.—People in the Potteries district have been recommended to boycott the tramways owing to the introduction of the "fair fare" system.—The Brompton & Kensington Electricity Supply Co. have introduced a new tariff for lighting and heating which involves the use of one meter only. (Page 80.)

ASTON CORPORATION propose to spend £13,550 on electrical extensions, and the Southampton Corporation £13,000. A loan of £21,000 has been sanctioned at Keighley. Mains extensions to the value of £3,000 are contemplated at Torquay. Arc lamps are required at Grimsby; electrical stores and accessories at West Ham and Marylebone; and switchboard, testing panel, and workshop motors at Oldham. A new power station is to be erected by the River Plate Electricity Co. (Page 80.)

THE Yorkshire Electric Power Co.'s accounts for 1909 show a net profit of £2,664. It is hoped to submit a scheme for the working of the East London Railway by electric traction at the meeting in July. (Page 82.)

THE London Electrobus Co. is to be wound up. (Page 82.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) FRIDAY, FEBRUARY 4TH.

Northampton Institute Engineering Society.

5.45 p.m. At the Institute. "History and Manufacture of Electric Glow Lamps," by L. Wallis.

MONDAY, FEBRUARY 7TH.

P. and O. Batti-Wallah's Society.

8 p.m. Smoking concert at Holborn Restaurant.

TUESDAY, FEBRUARY 8TH.

National Electrical Manufacturers' Association.

2.30 p.m. Committee meeting at Balfour House, Finsbury Pavement, London.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "Three-wire Balancers," by A. G. Cooper.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street. "Equitable Charges for Tramway Supply," by H. E. Yerbury.

WEDNESDAY, FEBRUARY 9TH.

Association of Engineers-in-Charge.

8 p.m. At St. Bride's Institute, Fleet Street, London. "Modern Arc Lamps and their Application," by A. Angold.

THURSDAY, FEBRUARY 10TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, Westminster. "Losses off Transmission Lines due to Brush Discharge, with Special Reference to the Case of Direct Currents," by E. A. Watson.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science. "The Elementary Graphics of Alternating Currents," by T. Tomlinson.

FRIDAY, FEBRUARY 11TH.

Physical Society.

8 p.m. Annual General Meeting. At Imperial College of Science, South Kensington.

SATURDAY, FEBRUARY 12TH.

Royal Institution.

3 p.m. Lecture I., on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson, F.R.S.

Institution of Electrical Engineers: Glasgow Section.

7 p.m. Annual Smoking Concert at "The Grosvenor."

Central Technical College Old Students' Association.

7.30 p.m. Annual Dinner, at Trocadero.

New Equipment at Streatham Telephone Exchange.—On Saturday, January 22nd, at 1.30 p.m., the National Telephone Co. transferred the subscribers connected to its Streatham Exchange to a new central-battery equipment installed in new premises at Ena Road, High Road, Streatham, which have been specially designed. The new equipment has been manufactured and installed by the Western Electric Co., Ltd., of North Woolwich, and is of the No. 1 C.B. type, consisting of 12 subscribers' positions, giving accommodation for 1,730 lines; three incoming junction positions, one electrophone position, and one exchange testing position. The equipment is of similar design to that installed at the company's Altrincham, Birmingham-Midland, Hillhead, Bromley, Dalston, New Cross, and Liverpool-Bank Exchanges.

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EQUITABLE CHARGES FOR TRAMWAY SUPPLY

A PAPER on this subject, by Mr. H. E. Yerbury (Chief Electrical Engineer, Sheffield Corporation Tramways), was discussed last week by the Institution of Electrical Engineers in Manchester, Sheffield, and London. An abstract of the Paper, together with a report of the discussion at Manchester, appeared in our last issue. Mr. Yerbury criticised the usual methods of allocating the relative proportions of generating costs in combining lighting, power, and tramway stations, when determining the charge to be made for energy supplied to the tramways department. A detailed comparison was made between the total fixed costs of 0·865d. per unit assumed chargeable to the tramway department at Manchester, and a figure of 0·371d. obtained in the independent tramway station at Sheffield. The assumption that the difference is justified by the expense incurred in providing plant for the tramway peak load, and in conversion from A.-C. to D.-C., was characterised as incorrect. It was suggested that the charge should be based on capital and running costs in connection with the plant essential to the tramway supply only, with the addition of a profit of from 3 to 5 per cent. on the running costs.

In the discussion at Manchester, Mr. Pearce justified the charges determined at Manchester, Mr. J. R. Salter asserted that many lighting stations actually owed their existence to the tramway departments, and Mr. Watson and other engineers also spoke.

Discussion at Sheffield.

Mr. A. J. Cridge (Corporation Electricity Supply Department, Sheffield) was of the opinion that, considering the low price at which power can be supplied at Sheffield, it ought to be possible for a combined generating station to supply tramway departments at a cheaper rate than they at present do, especially as the respective peaks do not occur simultaneously. He said his station would be prepared to supply the Sheffield trams with H.T., 2,000 volt, 2-phase current at 0·55d. per unit. He thought the profit of from 3 to 5 per cent. suggested by Mr. Yerbury for supplying current to a tramway department as too small.

Mr. R. L. Acland (Borough Electrical Engineer, Chesterfield) mentioned that in his town the peak of the tram load was concurrent with that of the lighting load on Saturdays. He had worked out the figures on Mr. Yerbury's basis, and found that the price to be charged would be 1·10d. per unit, as against 1·25d. the present price charged. He hoped that the joint conference which has been arranged between the municipal tramway managers and the municipal electrical engineers to discuss the subject would arrive at a satisfactory basis of charge.

Mr. I. F. Fawcett (Leeds), referring to the suggestion mentioned in the Paper that a 3 to 5 per cent. profit should be charged only on the running costs, pointed out that the fixed charges would come to a considerable amount in comparison with the running costs, and he did not consider there would be any margin of profit to a combined station on such a low allocation.

Mr. Fenton (City Council, Sheffield) said that it seemed extraordinary to him that some towns should make such high charges to tramway departments, but Mr. Cridge's proposal to supply current at 0·55d. per unit, he said, would not pay the tramway department when the other costs had been added.

Mr. Wardale said that in some instances the supply department had the trams in their grip, and made the best of it. The charges for power purposes must be kept low, because of the competition of private plants and gas engines; therefore they endeavoured to recoup themselves at the expense of the tramways.

Mr. Harold Dickinson (City Electrical Engineer, Leeds) did not agree with the statement that in the maximum demand system all consumers were supplied on the same terms, because, as a matter of fact, separate rates were charged for varying types of demand. No one had yet been able to show what was an "equitable" rate for the allocation of "fixed charges"; in his opinion, the matter was solely a question of policy. There being less competition for lighting than for power, they were justified in charging lighting consumers at higher rates of profit, and on the same principle tramway departments should be charged at a higher rate than power consumers. The supply department was justified in getting as much as it could. Ultimately the power business would grow enormously, and should be encouraged, as it would be of great commercial benefit to the town, while the tramway demand would develop to a much less extent.

Mr. W. M. Rogerson (Electrical Engineer and Tramways Manager, Halifax), who was in the chair, agreed with Mr. Yerbury in the main. In Halifax, he said, they charged 1½d. per unit for trams, and 2d. to ¾d. for power. On working out last year's figures, he found that on the basis suggested by Mr. Yerbury, the prices would have been 1½d. for trams, and 1½d. for power. He could not see any difficulty in arriving at a fair charge. The method to adopt was to separate the capital charges, find the demand in both cases, and charge each class in proportion to his demand; it was necessary at the same time to take into consideration local circumstances in trying to arrive at an equitable charge.

Mr. Yerbury, in replying, referred to the offer of Mr. Cridge, and said that it would not pay them, as the losses in transformation, &c., would bring up the cost higher than at present. Mr. Dickinson's policy of "get all you can" might be a very good one, but at the same time he did not see why there should be such a great difference in the charges to different consumers—170 per cent. in excess of works costs in one case, and as low as 9 per cent. in another. He considered that when a tram's demand is equal to half a million units per annum, the price charged should not be more than 1d. per unit.

Discussion in London.

Mr. J. F. C. Snell said that a mistake frequently made was to attempt to compare tramway supplies in various towns, the circumstances in which had no relation to each other. Many tramway stations, for instance, had to repay their loans only in 30 years, whereas with combined stations the period for repayment was 25 years. This was afterwards reduced to an average of 22 years, and now it was more frequently 17. Mr. Yerbury had made a fundamental mistake in his Paper in attempting to compare a simple direct-current station like Sheffield with a three-phase supply as in Manchester. If Mr. Yerbury had taken Glasgow, which was an independent three-phase station, and compared that with Manchester, then he would have been comparing like with like. He found that at Glasgow the total costs were 1·2d. per unit, which compared with 1·04d. per unit in Manchester, and he was told that the figure in Manchester in future was to be 1d. per unit on a flat rate. In this particular instance the combined station had the advantage. His experience was that there was not such discrepancy between supply from the two kinds of station that Mr. Yerbury suggested. A point which tramway-men frequently forgot was that, as the electrical department of the Corporation developed, the tramway department, which naturally would not grow in the same proportion as the other portion of the supply, would be in a better position to get a reduction in the future than it would be if it had its own independent station. Mr. Snell then suggested the following as the proper way to settle the price between the various departments. He took the ascertained maximum demand of the tramway department, and also the coincident maximum demand, *i.e.*, the demand of the tramways at the time of the maximum peak upon the combined station. He then took a mean of these two figures, and called it the total kilowatts demanded, and in allocating the standing charges he merely took the sinking fund and interest on this demand. In calculating the additional charges, he took management, less the charges of the distribution department; rents, rates, and taxes; insurance; wages at the power station; and if it were a three-phase system with sub-station, he added wages at the sub-stations. This total he divided by the total kilowatts demanded on the combined station, and so got a charge per kilowatt of demand. He multiplied that figure by the ascertained demand of the tramways, and so arrived at the proportion of fixed charges which the tramways should pay. In the running charges he allowed for coal, oil, repairs, and all the charges on the plant, but not on the mains, and divided that by the total units delivered to the switchboard. That gave the running charge per unit delivered to the switchboard, and by multiplying this by the actual units supplied to the tramways at the switchboard, he obtained the proportion of the running costs which the tramways should pay. In addition, he recommended adding from 5 per cent. to 7½ per cent. as profit in order to cover the risks of variation in price of coal, damage from fire, &c., which the combined station had to bear. If this system were adopted and a revision made triennially, he thought this would give the true cost of the tramway supply.

Mr. Stuart Russell (India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.) said that in a combined station there were in most cases certain portions of the generating and distributing plant which were provided solely for the use of the one supply or the other, and in allocating the costs they should take the charges for capital expended on the special items, and charge them to the supply making use of them. The charges on the remainder of the capital expenditure, which was common to both supplies, should be divided in proportion to the relative maximum demands. The suggestion made by Mr. Snell that, instead of taking the actual maximum demand of the tramways, the mean between the maximum demand and the demand at the time of the maximum lighting demand should be taken, seemed to him an improvement, and gave perhaps a fairer division than by taking simply the maximum demand on the station.

Mr. E. W. Cowan (Messrs. Cowan's, Ltd.) suggested that the market value of the various classes of supply was a factor which electrical engineers had hitherto overlooked. Throughout all industry the law of supply and demand came into effect, and the neglect of this had led the commercial side of electricity supply into an entanglement which they ought to get out of. The fact that electrical energy for tramway supply

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had a higher market value than electricity for other supplies was, he thought, a partial cause of the higher price.

Mr. A. H. SHAW (Electrical Engineer, Ilford District Council) said that fully half of the author's examples were small stations to which the circumstances of the larger stations could not apply, and, therefore, comparisons between them were unfair. In a small station like Ilford supplying some 20 cars, one small set was sufficient for the supply required, but the variations in the load were from no load to 25 per cent. overload on that set. Consequently the coal cost was more than on a set supplying both power and lighting. Wear and tear was also heavier on such a set. He found from experience that the maintenance and cost of repairs of such sets were very much higher than lighting sets. When the Ilford trams were first started, the Council were advised that it was illegal for one department to make a profit out of another. They, therefore, did not fix any charge for the tramway supply, but reckoned up the actual cost at the end of the year and charged that. For the last two years the charge at Ilford had been 1½d. per unit, which he did not think a very high rate for 800,000 units. At the same time, it was not low enough to satisfy his Tramway Committee, who claimed to be supplied at as cheap a rate, namely 1d., as certain large power users. In answer to the President (Prof. Kapp), he said that the load factor for traction was 26 per cent., and for the private supply mentioned 20 to 25 per cent.

Mr. C. H. WORDINGHAM (Electrical Engineer-in-Chief to the Admiralty) agreed with Mr. Snell as to combined stations. He was glad that the system of allocating the costs which he had inaugurated at Manchester was being substantially adhered to, and he would refer those who really wished to understand the subject to Dr. John Hopkinson's original Paper. He was strongly of opinion that each class of consumer, whether lighting, power, or traction, should pay the proportion of the actual cost that that consumer cost to supply.

Mr. W. G. BOND said that the Paper had only considered one municipal department supplying another. In many places, however, the municipalities depended largely for their profits upon the supply to tramways companies, and in view of the fact that a quinquennial revision of these prices by arbitration was customary, he had hoped that the discussion would lead to some general agreement as to the broad principle upon which the charges should be based. He was perfectly prepared to accept as a basis that the tramways should not be charged a higher price per unit than what would be the total costs if current were supplied from a separate station. The management for the tramway supply was small, and it was unfair to allocate the management charges in proportion to the units consumed for lighting and tramways respectively. Further, as the costs at which the supply to a company were calculated were already debited with 3 per cent. or more for interest, to add a further 5 per cent. for profit as well was not reasonable, though he thought some 3 per cent. profit over and above interest charges might fairly be added to the other costs.

Mr. C. E. C. SHAWFIELD (Borough Electrical Engineer, Wolverhampton) said that it had been complained that at Wolverhampton he was charging ordinary power consumers at a cheaper rate than the Tramways Committee, but it was overlooked that in 1902 special plant was put in for the supply of the tramways, which cost practically £100 per kilowatt, whereas the new plant, for which power consumers, cost only £20 per kilowatt, and, in addition, it was much more economical in its working. Obviously, therefore, the cost of the tramway supply must be higher than for the power consumer. Apart from this, there was another reason. The load factor of a tramway was by no means as good as it was supposed to be. In his own case the average number of cars was somewhere about 25, but towards the evening in the winter it increased to 40 or 45, fully load, and stopping at every stopping-place, just at the time when the peak load of the other consumers was on.

Mr. YERBURY in reply said that Mr. Snell had mentioned Glasgow. From figures given him within the last month, he found that the standing charges per kilowatt installed at Glasgow were £3 5s. 5d., or 0·391d. per unit. On the D.C. traction side this was 0·41d. per unit. At Leeds, which was also a high-tension station, the standing charge per kilowatt installed was £4 1s. 3d., or 0·386d. per unit, and on the D.C. traction side 0·402d. per unit. It was well known that in a low-tension station there were less losses in transmission and conversion. For instance, at Sheffield the standing charges per unit generated were 0·269d., and on the D.C. traction side 0·295d. At Manchester, which was a combined station with a total output of over 82,000,000 units per annum, the standing charges amounted to 0·4503d. per unit. Theoretically, the costs in a combined station should be very much lower than in a separate station, but in practice it was not so.

Owing to the lateness of the hour, the author will reply further in the Institution journal.

A conference upon the same subject took place on Friday between the Incorporated Municipal Electrical Association and the Municipal Tramways Association, but the proceedings were private.

THE ELECTRIC DRIVING OF PRINTING PRESSES

THE appeal against the judgment of Mr. Justice Neville in the action brought by Messrs. J. H. Holmes & Co. against Associated Newspapers, Ltd., for alleged infringement of the Clatworthy patent for the electric driving of printing presses has been heard before the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley, and judgment was delivered last Thursday. A full account of the original hearing was given in ELECTRICAL ENGINEERING, Vol. V., pp. 915 and 936. Mr. Justice Neville considered the patent invalid for the reason that, in his opinion, some descriptions of an American equipment published previously to the application for the patent included the substance of the first claim (which covers certain uses of an auxiliary motor), and dismissed the action with costs. This judgment has now been upheld, and the appeal has been dismissed with costs.

The patent in question is No. 9,802 of April 28th, 1898, and was granted to W. A. Clatworthy and W. H., A., J. H., L. W., and E. Holmes, all of J. H. Holmes & Co., of Newcastle-upon-Tyne. It describes a method of driving printing presses which gives a first slow-running speed, and a gradual acceleration until full speed is reached, without any shock. This is effected by employing two motors, a main motor driving the press direct, and an auxiliary motor connected to the main motor shaft through worm gearing and a free-wheel clutch, so that the main motor can overrun the auxiliary motor. A hand-operated controller causes the clutch to be thrown into gear electrically, and then starts up the two motors in succession. When the main motor overruns the auxiliary motor, the latter is automatically switched off.

The first claim reads as follows: A system or method of electrically driving a newspaper printing machine or the like at very diverse speeds, consisting of the use of an auxiliary motor, in addition to, and driving by power gear through, the shaft of a main motor, both for the purpose of driving the printing machine at a slow and steady rate when required, and for starting the printing machine from rest, to enable the main motor to gather up power and drive without shock or excessive current substantially as described.

In the judgment, the Master of the Rolls interprets this claim to be simply for a series arrangement of a main motor and an auxiliary motor, *simpliciter*, and not for a combination of such motors in series with an automatic device such as the combination switch described in another claim. Lord Justice Fletcher Moulton points out it is the breadth of the claims that is material to the action. He considers it possible that the claim for the whole machine might have been supported. The patentees, however, were not content with claiming the whole machine, but in the first claim covered that which consisted of only two elements. These were, in his opinion, anticipated by the publication of the American description referred to. Nor does the second claim (for the two motors with the disengaging clutch) include any combination switch for securing the machine upon being handled incautiously. His Lordship reviewed at some length the gearing in the American machines, which he considered capable of everything that the plaintiffs' combination could do. Lord Justice Buckley takes up the relation of the combination starting and controlling switch with the other parts of the system, and holds that for the appeal to succeed, it must be shown that the switch is necessary to be used in Claims 1 and 2. In the light of the whole specification, however, he is of opinion that it would be equally competent to achieve the desired result by having a skilled workman to operate independent switches in the right way. If these two claims are regarded in that way, he holds that the patent was anticipated, and, therefore, invalid.

Lancashire Power Company's Consumers' Dinner.—Mr. C. D. Taite, General Manager of the Lancashire Electric Power Co., Ltd., presided on Thursday at the annual dinner of the staff and consumers. He stated it was a remarkable thing that those firms in Lancashire who had come on to the company's mains, and were driving their works electrically, were busier at the present time than those who had retained the old steam drive. In a reference to the South Lancashire Tramways Co., Mr. Taite expressed the opinion that had the Power Company been operating before the Tramways Company, the latter would have taken power in bulk. In reply to the toast, Mr. J. R. Salter, of the South Lancashire Tramways Co., said that although he had at times opposed the Power Company, he was prepared to wish them every success. Indeed, he would go so far as to say that if the Power Company would agree to supplying his Tramway Company as cheaply as they could generate electricity for themselves, he would scrap his existing generating plant.

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ELECTRICAL ENGINEERING
IN
MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "The Editor, Electrical Engineering, 203-206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

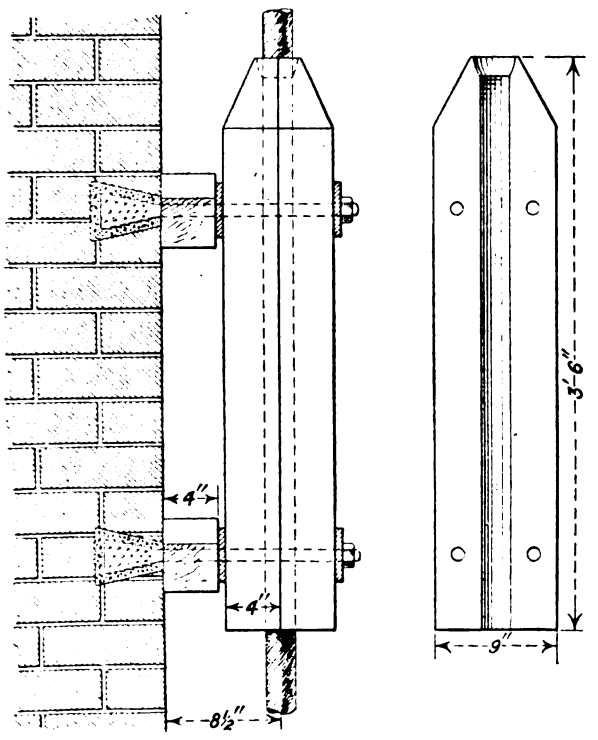
CORRESPONDENCE

SHAFT CABLES.

To the Editor of Electrical Engineering.

Sir,—I read with interest the article in your last supplement on the above. The writer seems to know what shaft cable troubles are as far as mechanical injury goes, but he does not say anything relative to chemical injury caused by water in the shaft.

Most shafts, especially old ones, are liable to allow water to penetrate the brickwork, and very often the water contains a large percentage of chemical matter which acts upon the armouring, and also upon the conductor, if it does by any chance get to it. I have seen wire armouring rusted away to the insulation, and this was worse at the point where the cable



Wooden Clamp for Fixing Cable to Brick Wall.

had been clamped, for at this point the water lodges and soaks into the clamp. If a clamp be removed from the shaft and dried, a thick coating of salts will be deposited on the surface, and it is these salts that cause much trouble in shafts. I do not say this is the cause in every case, but I put it down here as a common one to be met with. In many deep shafts where the shaft side is "buckled," water drops on to the cable, and in time washes the braiding and taping away. As a precaution against this, cables should be fixed in the driest part of the shaft and clear of all pipes carrying water or steam.

Armoured cables are good for a shaft, providing they are fixed in a dry part, but even in that case they should be coated with preservative compound now and again, especially where they are gripped by clamps. A good impregnated vulcanised bitumen cable, with a good layer of bitumen near the conductor half as thick as the diameter of the conductor, with three or four layers of tape, and two layers of stout corded braiding all well compounded, and fixed as shown in the accompanying sketch is not to be beaten for shaft work. The clamps shown in the sketch are to be preferred to the short ones, as they are 3 ft. 6 in. long, and get a good grip of the cable. The rag bolts are let into the wall, secured, and run in with cement, a template being fixed to the four bolts so that the clamp will fall into its proper place. The hard wood blocks are fixed near the wall to keep the clamp out and clear of damp creeping. Two iron plates are then put on the bolts, then the back portion of clamp, the cable, which is put firmly in the groove, the front portion of clamp, and finally the front iron plates. The whole is secured by nuts until the clamp is perfectly tight at the joint. The grooves at the tops of clamps are hollowed out previous to fixing, and when fixed are run in with hot bitumen. This clamp is only intended for one cable.

It will be seen that the cable when suspended by the clamps is 8½ in. clear of brickwork, and thus leaves sufficient space, should the cable be struck, to yield and weaken the effect of the blow on the cable. The clamps should be fixed twenty to thirty yards apart. Where wood casing or trough is preferred as a protection, I should suggest that it be packed off the brickwork in such a way as to allow water and dirt to fall off all joints and supports. The trough should be large enough to allow sufficient space round the cable, and care should be taken to see that the cables do not touch each other or casing. They could be held in position by wood bridges. The trough should be filled in with bitumen quite solid, and the bridges removed. Of course, the filling in can only be done, say, one length of covering at a time, then another length of wood cover is put on and filled in, and so on, commencing from the extreme bottom. Although this method of fixing shaft cables makes a sound, solid job, I prefer the former method myself.

With regard to joint boxes in shafts, it is as well to avoid them if possible, as cable can now be made in any required length. In the case where one portion of a cable is faulty, then a joint box is handy for uncoupling the faulty cable and inserting another without much difficulty. In many shafts it is necessary to feed intermediate seams of coal from one set of cables; the cables are then looped back into joint boxes. If boxes are properly fixed and the cables properly trimmed free of tapes about 2 in. from sweated connections, then filled in within half an inch of disconnecting links, it will prove a sound job, and handy for testing purposes. The box, if fixed in the open shaft, should have a "lean-to" cover of strong timber to keep falling matter off the box, but it is preferably recommended to keep cables out of a shaft, and put them in an insett run in for three or four yards. Cables should be tested at least once a week, and if the test is lower than the previous test, immediate steps should be taken to locate the trouble. A little fault will soon lead to a serious breakdown, and my advice to colliery electrical engineers is to see that full attention is given to their cables.

One who has had Experience.

CABLES IN SHAFTS AND MAIN HAULAGE WAYS.

To the Editor of Electrical Engineering.

Sir,—*Re* article on "Cables in Shafts and Main Haulage Ways," by Mr. J. P. Simpson, published in your issue of January 6th. In the first paragraph Mr. Simpson refers to "Cables armoured with steel *tape*, wound so that the armour is locked or wedged." I presume Mr. Simpson means the well-known "Key" or "Lock" armour, a combination of shaped steel strip and steel round wire fitting into the shaped strips. The ordinary man, on reading of "steel tape," immediately thinks of a cable lapped with two layers of steel tape, wound so that they break joint one with another. This, of course, is unsuitable for shaft cables.

In the second paragraph the writer of the article says that he "has found that the best class of cable for shaft work is that in which the conductors are insulated with bitumen compounds, and the space between the insulated cores filled in with jute mixed with a plastic compound, *so as to keep any moisture from creeping in.*" I agree that it is a very important point to stop moisture from creeping in between the insulated con-

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ductors, but *no fibrous material*, such as jute is, however treated with compound, can be said to thoroughly keep out moisture; on the contrary, if moisture is present and in contact, a fibrous packing gradually sucks it up, the moisture travelling along the fibre of the material.

As the author in effect states that moisture should not be allowed to creep between the insulated conductors, he will appreciate that an even better type of cable than the one he proposes will be the solid three-core bitumen cable, which was specially designed to meet the wet conditions of shafts. In this type of cable, the conductors are insulated with bitumen compound, then laid up together (no fibrous tapes being applied over the insulated conductors) round a shaped core of bitumen which fills up the central space, and is sheathed over all with a solid tube of bitumen which is ribbed internally, so as to fit the interstices between the laid-up cores; the protective covering, double armour, &c., being then applied. All that has been done in the above type of cable is the replacing of the jute packing in Mr. Simpson's cable with a *waterproof* packing of bitumen. As will easily be seen, the solid three-core bitumen cable, as described, is completely waterproof as to its insulation and packing, and as there is no introduction of any fibrous material of a possible conducting nature, such a cable has a higher insulation and dielectric strength than Mr. Simpson's cable; the *effective* dielectric in the solid three-core cable is the *total* thickness of bitumen over each conductor and around the three cores, *not* the thickness of bitumen on the separate cores only, as in Mr. Simpson's cable

If, in addition, as I strongly recommend, the solid three-core bitumen cable is made with the copper-stranded conductors having the interstices between the wires composing the strand filled with a special solid compound, which will not run or become displaced by the heating of the conductors through overload, you have a cable thoroughly waterproof—*i.e.*, water or moisture cannot enter anywhere under any conditions—and the *ideal* shaft cable.

Yours faithfully,

January 17th, 1910. GEORGE G. L. PREECE.

MACHINE MINING

A LONG Paper on machine mining, with special reference to South Wales conditions, was read by Mr. Sam Mavor before the South Wales Institute of Engineers at Cardiff on November 17th. In the course of his introductory remarks, Mr. Mavor said that the use of coal-cutting machines had rendered possible the working of seams which, on account of their thinness or other difficulties, could not be worked under present-day conditions by hand labour. By reducing working costs, coal-cutters had opened up in the thinner seams an immense field of labour that would otherwise have been lost and had provided increased employment for the miner. Also, it was an ascertained fact that wherever coal-cutting machines were used, the wages of the men were increased. The shortening of the miner's day by the Eight Hours Bill rendered more urgent the adoption of every means of maintaining or increasing output, and both coal-cutters and conveyors were valuable aids to this end. The effect of a coal-cutter was practically to double shift a pit.

These machines were to-day operating with success in thick, thin, steep, flat, faulty, and regular seams under conditions considered impossible a few years ago, and the judicious use of machinery at the coal face went far towards reducing the proportion of small coal and the amount of dirt to be washed away. There were many misconceptions regarding the alleged unsuitability of coal-cutters to conditions prevalent in South Wales, and some of these were reiterated in Government Blue Books, &c., from time to time. Mr. Mavor proceeded to deal with several of these features. In conditions of heavy pressure, for example, it was desirable that the working face should be advanced as rapidly as possible, and both coal-cutters and conveyors were valuable aids. The effect of pressure made the coal yield more freely to the cutters. There were many steam coal seams, too, in which, even if coal-cutters were not suitable, conveyors could be used with great advantage in conjunction with hand getting. Plans of collieries were shown in which the greater compactness, regularity, and definiteness of purpose of the machine worked over the hand-worked sections was very apparent, and examples were quoted to bear out the following advantages claimed to accrue from the concentration obtainable: Reduced cost of road maintenance, rails, and sleepers, reduced risk of accidents at the face and in roadways, reduced interruption of traffic in roadways, reduced danger from gas and dirt, abolition of "putting" or tramming from face to haulage, and improvement in ventilation.

In gaseous and dusty seams, machine mining alleviated the dangers and difficulties by reducing the volume of gas, owing to the concentration of the sphere of active operations, facilitated inspection for gas and simplified ventilation. It had been definitely ascertained that the total volume of dirt produced from a given seam was less with machine than with hand working, and, again, conveyors, by reducing the general breakage of the coal, also diminished the total volume of dust.

It was also a mistake to suppose that friable coal was not amenable to mechanical cutting. Long wall coal-cutters were in daily operation in scores of friable seams in every district in the country, and Mr. Mavor detailed methods of overcutting which were superior to undercutting in some such cases. Also in jointed seams there was ample scope for the profitable employment of machinery. High inclination was not by any means an obstacle to the successful operation of coal-cutters, but, on the contrary, he knew of seams inclined at 40° which were being won by long wall machines at less cost than was possible in similar seams on the flat. This part of the subject was gone into at some length, and a detailed description of the methods employed was given. The limit of steepness was generally considered to be about 45°, although he had visited a colliery in Austria where the system was practised up to about 70°.

The Paper then passed on to a consideration of undeveloped thin seams, and some information regarding a system of opening out such seams as widely used in Scotland was given, in which long wall conveyors and face conveyors were utilised in piercing the shaft pillar, and exceptionally wide headings were driven.

In the latter part of the Paper, comparisons were made between the capabilities of the chain, bar, and disc types of machine. The disc and bar machines, in the author's opinion, could meet conditions impossible to the chain, but there were no conditions met by the chain which could not be satisfactorily met by the disc or bar. For comparatively shallow undercuts in hard material under favourable conditions, the disc would travel faster than the bar, but no other machine had so wide a field of application as the disc, many of which, he said, were working with perfect smoothness where other types had failed. Its great advantage was the small surface exposed under the coal, while the disc was more liable to be jammed by falling coal. Again, neither disc holes nor "stables" were required, as the bar machine could cut itself in at one end of the face and out at the other. Further advantages were the greater ease with which the direction of the cut could be altered, the freedom from vibration when overcutting near the top of a seam, and the more even demand on the power supply.

THE BIRMINGHAM UNIVERSITY MINING SOCIETY

A PAPER entitled "Electricity in Coal Mines—Some Practical Considerations" was read by Mr. R. Nelson, H.M. Electrical Inspector of Mines, before the Mining Society of Birmingham University on January 27th, Professor Cadman in the chair. The author explained at the outset that the opinions expressed in the Paper must not be taken as representing those of the Government department concerned, but were his individual opinions only.

Mr. Nelson attributed the growth of electrical working in mines largely to the fact that the efficiency of distribution was 80 per cent., whereas that of its rival, compressed air, was usually only about 20 per cent. As regards the source of supply, the author was in favour of current being obtained from a power company if prices were at all comparable with those at which electricity could be generated by the colliery itself. He favoured three-phase working, the principal advantages over D.C. supply being that three-phase motors were cheaper and mechanically stronger, their overload capacity was greater, and, in the case of squirrel-cage motors, fire risk was reduced to a minimum. A point in favour of D.C. distribution was that for the same pressure the cables cost 30 per cent. less than with three-phase supply. As, however, sparkless commutation at high pressures was difficult to obtain, the pressure of generation could be but little more than "medium pressure" as defined for the special rules for mines—namely, 650 volts. Hence, before any great distance in-bye is reached, the three-phase system is actually cheaper as regards capital cost of distribution. Safety in working, in the author's opinion, was best secured by the three-phase system.

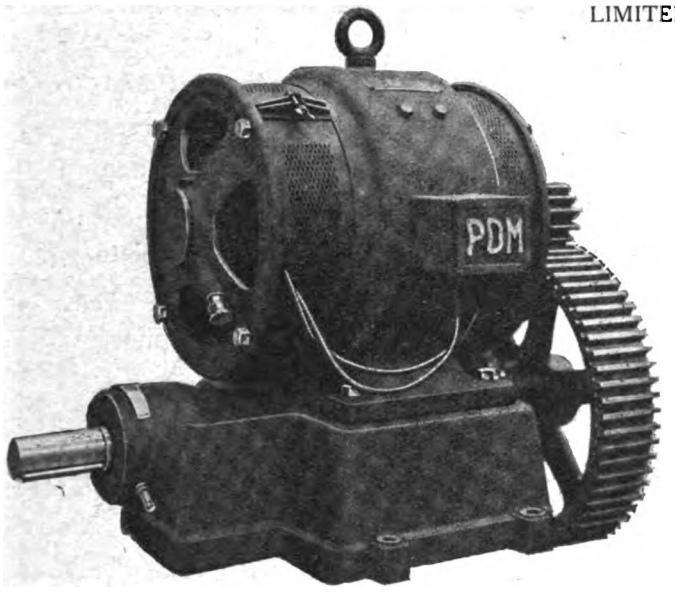
The principal requirements for safety in operating plant in mines were: Strong metallic coverings as protection from mechanical damage and contact with "live" parts; good earth connection for the metallic coverings; and automatic provision for cutting off current immediately leakage occurred; also, in fiery mines circuits should be made and broken either under oil or in flame-proof chambers.

Mr. Nelson expressed a strong preference for armoured as against unarmoured cables primarily because the former type enables provision to be made for automatically cutting off current immediately leakage begins by means of the leakage current in the armour operating protective devices. Falls of roof damaged unarmoured cables far more than armoured cables.

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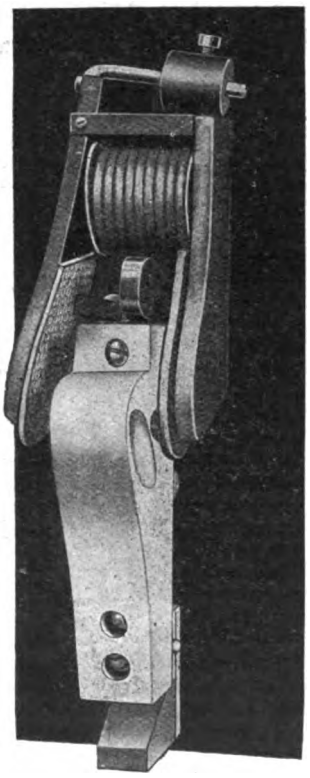
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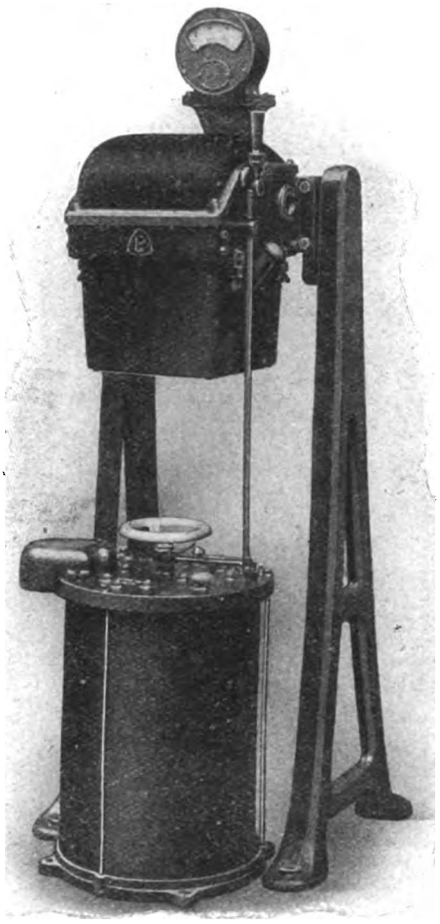
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It was easy to get a good earth connection at the farthest point in-bye with the latter type of cable, but to achieve the same result with the former a special earth wire must be run. Armoured cables, however, demand vigilance in upkeep, and do not encourage slipshod methods.

Switchgear for mines should be enclosed in earthed gas-tight metal cases, the cases enclosing as little air as possible. The contacts should be oil immersed. The common fault with the present air-break boxes is that they are not gas-tight or flame-proof. Motors of the squirrel-cage type with no exposed live terminals should be used. Transformers should be oil immersed, and the cases, as well as the motor frames, efficiently earthed. Lighting cables may be run on porcelain cleats in dry places and where no fall of roof is likely, or in stout screwed steel tube, permanently and efficiently earthed. The bulbs of incandescent lamps should be enclosed in strong glass globes.

A large number of gentlemen took part in the discussion, amongst others being Professor Redmayne, H.M. Inspector of Mines, and representatives of the leading cable makers.

The majority of the speakers agreed with most of the author's opinions, the chief point of divergence being on the subject of armoured *versus* unarmoured cables, and in this connection a strong feeling was expressed by one or two members in favour of unarmoured cables except in special cases.

LEAVES FROM A COLLIERY ELECTRICIAN'S NOTE-BOOK

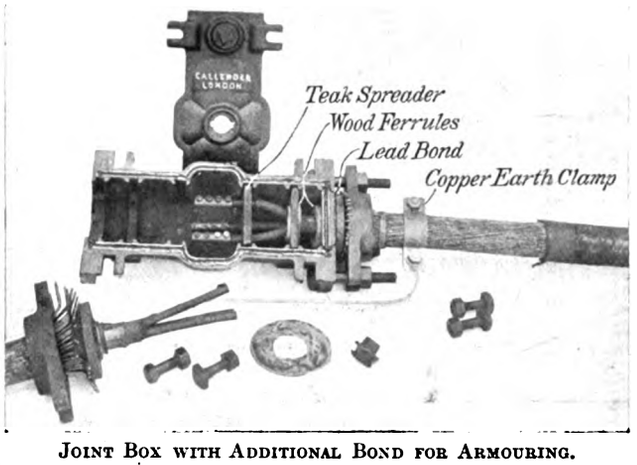
WE have received from Mr. S. Skirrow, of the Harton Coal Co., some notes on the erection and maintenance of colliery electrical plant, founded on his experience with both continuous and alternating current equipments. Mr. Skirrow points out that the status of the "colliery electrician" is far from satisfactory under present conditions. He is defined as a "competent person," and in the majority of cases has no official standing. Sometimes he comes under an engine-wright, who has not a knowledge of electrical matters, but is held responsible by the manager. The suggestion is made that it would be better if the electrician were placed on an official footing, and if the responsibility for the safe running of the installation were put by law partly, if not wholly, upon his shoulders. However well an installation has been arranged by the contractors, when it is first put in, a good deal depends on the colliery electrician, when such alterations are made as the moving of haulage, pumps, &c., further in-bye as the workings extend.

The choice and arrangement of cables is one of the most important of these matters. Mr. Skirrow favours bitumen insulation, and holds that decentralisation need only be secured in exceptional circumstances. He is in favour of armoured cable, well bonded across junction boxes, and with the armouring efficiently earthed in the pit by a copper plate in the slump and also at bank by two galvanised plates bonded together, and buried six inches apart in coke breeze, under a down spout, and emphasises the importance of periodical testing of the earth connections for conductivity. Cables should be carried along intake airways, as return air is apt to have an injurious effect on the armouring. Cables may be supported in tarred rope slings hanging from 3-in. plate nails, driven into props at the side of the way. Where main cables are put in iron or wooden cleats, plenty of slack should be allowed, so that the cable hangs in festoons, in order that in case of a fall, slack cable can be drawn through. Where there are sharp curves in a direction away from the wall, it is best to bury the cables if the bottom is reliable, and they should be protected in a wooden trench filled with bitumen, where they enter and leave the ground. Cables must not be passed over roof timbers. Connecting cables between controllers and resistances may be put in wooden trenches filled with clean, dry sand, and if rubber-covered they should be taped with asbestos to a safe distance from the resistance. If unarmoured trailing cables are used for portable machines an extra copper wire should be provided, through which to earth the machine.

The writer of these notes considers that leakage indicators (although these are compulsory under the Special Rules), can be dispensed with in three-phase systems if the neutral is earthed, on the ground that leakage to earth then compels attention, and he emphasises the necessity for overload release gear to be fitted to all three-phases, and not to only two. Other practical points which he mentions are the advisability of keeping a short length of loose cable in all switch rooms, &c., wherewith to discharge to earth cables that have just been made "dead," before commencing to work on them.

Attention is called to the need for constant inspection of unarmoured cables when they are used, and a case is quoted of a cable which had been placed by a wagon-way man over a spike nail, which ultimately found its way through the insulation, although three electricians at that pit passed the very point three times a day, but had failed to notice it.

In speaking of jointing, the necessity for thoroughness is dwelt upon. Each joint should be completely finished by the man who has it in hand, who should not leave the filling up of the box with compound to pitmen or others. An example of a failure due to incomplete filling of a box from this cause is mentioned. The accompanying figure shows a good form of joint-box, with additional copper bond for the armouring. The arrangement shown is preferable to glands screwing into the ends of a box, as the latter are a source of weakness if there is a twist on the cable. This form of box can be nearly filled with the lid off, ensuring compound all round at the bottom, and the filling completed through the three plug holes in the cover. When a box is required for use a second time, the only renewal parts needed after melting out the compound are two teak spreaders, four bushes, and two lead washers. One circumstance which sometimes tends to hurry in jointing is the necessity sometimes for an official to stay with the jointers when they required a naked light. It is of the utmost importance that any shot fired in proximity to a joint-box



JOINT BOX WITH ADDITIONAL BOND FOR ARMOURING.

should be reported, and that inspection should be made. A case is mentioned of an E.H.T. link-box, which was blown to pieces without causing the switches to trip. Another matter requiring careful inspection is the condition of trailing cable plugs and sockets, as loose contact is apt to cause sparking with vibration.

Passing on to deal with transformers, Mr. Skirrow says that these are too often used as radiators for drying boots, &c. One point which requires attention is the condition of the oil, and a test is much required to tell when it requires changing. A little can, however, be drawn off from the bottom of the tank, and if it is thick it should be renewed. A useful arrangement for drying out transformers is the employment of an auto-transformer starter belonging to a coal-cutter motor. A voltage from one to five per cent. of the working voltage can be then applied by this to the H.T. winding, while the L.T. winding is short circuited.

It is an advantage to have the motors of one size in a mine all interchangeable. Among the points which Mr. Skirrow refers to in connection with motors are the need for adequate facilities for draining oil from the stator case, and for slip rings to be easy to detach in the pit without unsweating. Slip-ring motors should have the maximum rotor current marked on the name plate, and all fuse boxes should be marked with the size of fuse to be used. Oil-immersed controllers require an amount of attention, both as regards keeping the contacts in order and changing the oil, depending on how often they are used. In the case of large controllers, a tell-tale to give warning when an unusual pressure is developed inside the case is admirable. Liquid starters may be used with good results where there is no liability to explosion, as for haulages near the shaft. No-voltage releases are of particular value with fan motors to prevent them being exposed to a sudden application of the full voltage after an interruption of supply; some sort of indicator is, however, required to ring a bell to give warning when the air pressure drops.

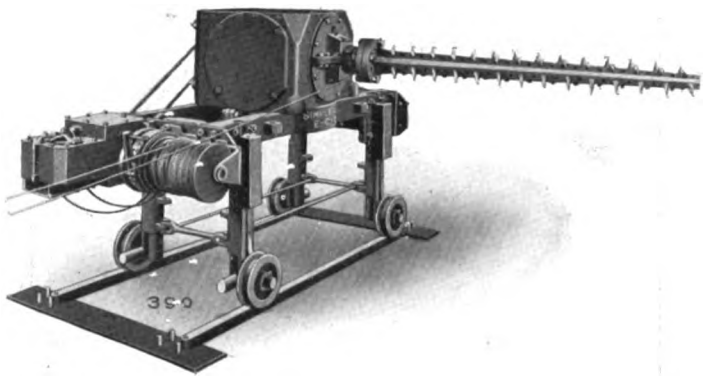
In conclusion, Mr. Skirrow emphasises the importance of cleanliness and keeping apparatus as free from coal dust as possible, care in keeping connections and joints in order, and immediate investigation of any irregularity.

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THE "SIMPLEX" COAL-CUTTING MACHINE

AN electric coal-cutter, which is manufactured by the Electric Construction Co. (Wolverhampton) under the Peake and English patents, is shown in the accompanying illustration. The machine is of the bar type, and is so arranged that it can cut both ways without alteration in the position of the main frame, and for ordinary duty drives its cutter bar direct from the motor shaft without intervening gear through an ordinary flange coupling. A new cut can be started entirely without hand holing by swinging round the motor in the frame, and for this purpose one of the elevating brackets or legs can be removed. For altering the direction of cutting, all that is necessary is to remove the hauling drum and switch to the opposite end of the machine. It is possible to cut at any point in the vertical section of the coal, from practically at floor level up to 5 ft. above floor level. The machine is slightly tilted to cut at the lowest point, and elevating brackets, made in various lengths, are used to enable the whole of the aforementioned range to be covered. With the motor supported underneath the main frame, the range is from practically at floor level to 2 ft. 6 in. above floor level; with the motor mounted above the frame, as shown in the illustration, from a point 2 ft. 4 in. to a point 5 ft. above floor level.

The hauling gear is of the friction type, with an epicyclic



SIMPLEX COAL-CUTTER WITH MOTOR MOUNTED ABOVE THE FRAME.

train of gear enclosed in dust-tight case and running in oil. It is adjustable to any desired rate of feed while the machine is running, and is to a great extent automatic in its action, unlike the usual arrangement of positive feed, which forces the machine along at a fixed rate. This machine is fed faster or slower according to the nature of the material which it is cutting and to the condition of the cutters. The machine can be mounted on flanged wheels or skids, and the change from one to the other can be made rapidly. The wheels are arranged so that they can be placed on supplementary axle pins at right angles to the main axle pins for transverse movement.

The electrical equipment consists of motor, control switch, resistance, and interconnecting cables.

The motor, which is steel-clad and flame-tight, is liberally rated. The rotating portion is of special construction for direct connection to the cutting bar. Continuous-current motors are usually compound wound, and alternating-current motors have wound rotors and slip rings. The control switch for continuous current is of the double-pole type, breaking circuit simultaneously at four points, two on each pole. The renewable contacts are of the floating type, readily adjusting themselves to the fixed contacts, and always ensuring perfect electrical connection. The resistance is compact, light, and practically indestructible. For three-phase alternating current, the switch is of the barrel type, arranged so that in the "off" position the supply both to the starter and to the motor circuit is disconnected in each phase. A modification of this controlling arrangement is made for two-phase supply. Switch and resistance are contained in a single flame-tight case. If desired, the case can be filled with oil, so that all circuits are broken under oil.



A SAFETY GATE-END SWITCH-BOX FOR MINES

AT the meeting of the Newcastle Local Section of the Institution of Electrical Engineers on Monday, January 24th, a Paper entitled "An Electrical Safety System for use in Mines" was read by Mr. H. J. Fisher. In this Paper he described a form of gate-end switch-box which he has designed to eliminate various causes of danger which are apt to be present with portable motors, such as those working coal-cutters. The chief object of the apparatus is to cut off the current automatically in the following circumstances:—Persistent overload (time-limit setting); short circuit between phases (time-limit setting); a fault between any phase and earth (instantaneous release); no-voltage, or failure of supply (instantaneous release); a break or a bad contact in the earth circuit (instantaneous release).

The system involves the use of a trailing cable, having a pilot or subsidiary wire in addition to an earth conductor. The gate-end switch is controlled by a solenoid in circuit with the pilot and earth conductor, so that if the earth circuit is not complete, current cannot pass through the solenoid, and it is impossible to close the switch.

Fig. 1 shows the arrangement for a three-phase supply having

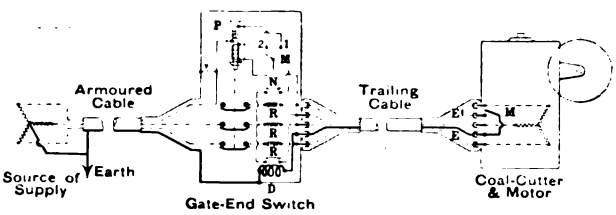


FIG. 1.—DIAGRAM OF CONNECTIONS FOR THREE-PHASE CIRCUIT.

an earthed neutral. Similar connections, but with a two-pole switch can be used on a direct-current supply with an earthed neutral-point obtained by the addition of an extra brush on the commutator of the generator in the power station. When the operating switch M is closed, and provided the pilot circuit E_1 and the earth conductor E are complete through the framework of the machine, then the solenoid P is energised, and the main switch is closed. On releasing the handle of the control switch M the switch springs automatically on to the contact No. 1, which puts a high-resistance solenoid in circuit, and also affects a change-over by which the connection through the solenoid is taken from the outgoing side of the switch. It will be seen that the main switch cannot be held in the closed position unless current passes through the solenoid, and there will be no circuit through the solenoid unless the earth circuit is complete through E and E_1, or if the supply voltage fails. By this means the switch opens automatically under the required fault conditions enumerated above.

Details of the box are shown in Fig. 2, in which is seen the

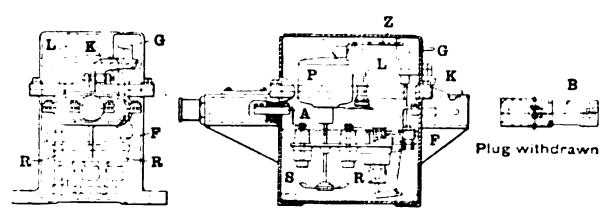


FIG. 2.—GENERAL ARRANGEMENT OF SWITCH-BOX.

three-pole oil break switch (S), with three release coils (R), and fitted with an oil dashpot time-lag device. The solenoid (P) has two windings, one of which is used to give a maximum pull at the moment of closing the switch, and the other a coil of high resistance consuming only the small amount of energy sufficient to hold up the armature when the switch is in the "on" position, but the switch is knocked out by means of simple mechanism when the weight of the armature is released by the solenoid. F is a small control switch worked by a handle on the "free handle" system, so that the trip cannot be held out of action. An indicating lamp shows through a window whether the supply is on or off. Mechanical terminals are provided, so that joints can be made without soldering, and suitable glands are fitted for earthing the armouring of the incoming cable to the box.

The trailing cable is attached to the plug B. The plug is enclosed in a strong cast-iron case, and it is so interlocked with the control switch that it is impossible to withdraw the plug when the main switch is closed. This interlocking is effected by a simple pawl at K, and it is obvious that it is impossible to

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draw out an arc in manipulating the plug for the reason that the plug cannot be withdrawn when the circuit is alive. A corresponding plug is used at the coal-cutter end of the trailing cable, and a socket is made, suitable for fixing to any existing coal-cutter frame. Like the corresponding socket on the gate-end box, it carries a locking pawl inter-connected with a small switch, by which the men working the coal-cutter can open the control circuit, and so make the trailer and the motor dead, and ensure that they cannot be made alive until the switch is closed at the coal-cutter end. The plug is made reversible, so that the motor can be reversed, if necessary, by simply withdrawing the plug and reinserting it the other way round. Of course, if the plug is not in the socket, the control circuit is incomplete, and it is impossible to close the main switch.

Mr. Fisher suggests that the apparatus may be also found useful in connection with a variety of other applications than mines.

At the conclusion of his Paper, Mr. Fisher demonstrated the working of the apparatus, and referred in further detail to the difficulty experienced in relation to the earth wires in trailing cables. It was found necessary either to have them of the same size as one of the conductors, or to make the earth connection of flexible braided copper. In this latter form it is now in use in about forty coal-cutters. He referred to the question of armouring trailing cables, which was bad practice, because if the cable became crushed, due to the fall of a heavy stone, the flattening was permanent, being removed only with extreme difficulty. Moreover, there was the difficulty of kinking. The proper way to coil a long trailing cable was to lay it in a figure of eight, but pitmen in a hurry were apt to coil it in circles.

DISCUSSION.

Professor W. M. Thornton (Armstrong College, Newcastle) said that if there was any fault to find with this gate-end box, it was that it was too compact. It appeared to be both flame-proof and explosion-proof, inasmuch as the flanges appeared to be sufficiently wide to cool the gases of explosion. The question of bonding especially interested him, as a case was brought to his attention only two days ago, when an earth wire was led on to several junction boxes on its route. There did not appear to be proper bonding, and a fatal accident was the result. Perhaps one of the most important points about the gear was its absence of fuses.

Mr. L. Wood (Messrs. Sleigh & Wood) suggested two cases in which it might be possible to question the action of Mr. Fisher's gear. The first was that, when two coal-cutters were working near each other, if one of them developed a fault, could not earth current come through the frame of the other cutter and so to the pilot wire? The other case was that, if a coal-cutter lying on the ground developed a high resistance fault, and if the earth wire of a second cutter near it were broken, there might be a danger when closing the switch *M* into contact 2 of raising the frame above earth potential, and thus providing a shock for an operator.

Mr. Guns asked whether the high resistance coil in the control solenoid *P* could not be done without, and the indicator lamps put in series with one of the other coils, as in the commercial solenoid starting switches.

Mr. R. C. Morton (Messrs. Callender Cable & Construction Co.) said that the trailing cable described had been designed by the firm which he represented, in conjunction with Mr. Fisher, to meet the different conditions under which trailing cables operate, and to carry out the working of the system under real fault conditions without allowing any unnecessary interruption of the circuit. In view of the rough handling which trailing cables receive, the small wires for subsidiary circuits were very likely to get broken, but in this cable the risk was reduced by placing the pilot wire in the centre of the cable instead of between a pair of the three outer cores. Moreover, it was made so that it would both extend and contract, meeting mechanical strains from sharp bends in the cable. The earth wire was laid round the cable in a close spiral to act as an earthed shield, and its mechanical damage due to bending of the cable was thus avoided, and it was arranged so as to envelop the cable. Also any severe damage which might cut the insulation would also cut the spiral, interrupting the subsidiary circuit, and instantaneously open the main switch before damage to the main conductors could be done. In addition to a ribbed bitumen sheath, each rubber core was, before being twisted up, provided with a sheath also of $\frac{1}{16}$ in. thickness.

Mr. A. Clothier (Messrs. Reyrolle & Co.) mentioned that the firm with which he was connected had had the pleasure of developing the design of this gear in conjunction with Mr. Fisher. A recent article in a mining journal had given a summary and account of accidents in mines over a period of $6\frac{1}{2}$ years. In that time 48 accidents were due to electricity, in which 51 lives have been lost, from shock. There were also 19 accidents in which 16 lives had been lost from explosions due to electrical causes. These figures excluded doubtful cases, such as that of West Stanley, and represented an average of over 10 deaths annually. There were three deaths from explosion accidents experienced with coal-cutters, switches, or trailing cables, and eight deaths from shock from the same apparatus. Accidents on coal-cutter apparatus might seem surprising to people above ground, having regard to the moderate voltages used. The maximum voltage for a coal-cutter was 500, and in many cases accidents have happened when 250 volts or even lower have been used. This was probably due to the clammy condition of the men, the resistance of surface-contact being lower. From an engineer's standpoint, in order to avoid explosion, arcing or sparking must be avoided—a difficult thing to do absolutely. The only way to attempt it is to have absolutely instantaneous cut off of current immediately a fault which would create an arc begins to develop. In order to avoid shock, it must be impossible to get personal contact with live conductors, by complete enclosure and with interlocking arrangements, as in the device described. The protection of electrical gear must be given greater consideration. Many people in the colliery industry opposed it, some wanting a fuse with no complication in automatic protective gear, and others being frightened at the extra cost.

Mr. Hunt presumed that from the sectional drawing, the oil dashpot arrangement was provided by the oil break switch itself. If this were so, was there no trouble in sticking due to the gradual carbonisation of the oil. He noticed that in the Paper it said that the gate-end switch could not be put on when the plug is not on the motor. He supposed the shrouding on the plug was sufficiently deep to prevent a foreign substance lodging across the two essential cores.

Mr. Fisher, in reply, said that with regard to Mr. Wood's two questions, the first possibility was tried in practice, but the conductivity of the coal strata would not be good enough to give any effect such as described. In the second case, no experience of the sort had been found. In one colliery there had been eight or nine breakages of earth wires, but no complaints had been received from the men registering shocks. They seemed, as a matter of fact, to be in favour of the gate-end gear described. Replying to Mr. Guns, the lamp resistance was tried at first, but it was considered more satisfactory to make a separate connection, in order to give a clear indication to the men whether or not the current was ready for them to use. In the arrangement proposed by Mr. Guns, the lamps would not indicate before the switch was used. With regard to Mr. Hunt's question, it was almost impossible for a short-circuit to occur on the plug due to a foreign substance, as the shrouding was so deep. With reference to the oil dashpots, there had been no trouble due to sticking up to the present, as the oil was changed very frequently. It was found in practice that with certain classes of oil fire could take place if the oil was not changed frequently in all switchgear, and attention given to contacts. As a result, in the gear under his own control, all oil was drawn out once a week, filtered, and filled in again to keep it in good condition.

PREVENTION OF ELECTRICAL ACCIDENTS IN MINES

A SHORT Paper on "Electric Shocks," by Mr. W. Maurice, President of the Institution of Mining Electrical Engineers, which forms the introduction to the first part of the inquiry by the Institution into the causes and prevention of electrical accidents in mines, was discussed last Saturday at sectional meetings of the Institution at Cardiff and Whitehaven, and on Wednesday last at Newcastle. In his introductory remarks Mr. Maurice stated that it was frequently said that electrical plant was a source of danger in mines because it was badly selected, badly installed, and badly maintained, and that the blame was apportioned part to the maker of the apparatus, part to the buyer, and the balance to the individual who was responsible for its care.

There are many explanations, he continued, for the undoubted fact that there is a great deal of unsuitable apparatus in use. Mines vary in character; there are fiery mines where no experienced mining engineer would risk the installation of the most elaborately conceived and perfectly executed protective devices at present known. There are others where the local conditions would turn certain much-belauded measures of protection into sources of danger within a few weeks of erection. There are mines, again, for use in which no really satisfactory apparatus is yet available. And there are others where the simplest possible methods afford, in practice, ample security. Moreover, conditions may change in the same mines. Certain general principles may be laid down, but any attempt to confine electrical work in mines to particular systems merely argues inability to appreciate the conditions and requirements of the industry.

An individual may be a thoroughly competent electrician and yet be quite "at sea" when in charge of a colliery installation. At present there are not a sufficient number of experienced mining electricians to "go round." Many mine managers must, therefore, by sheer force of circumstances contrive without that aid to safety, which is beyond doubt of greater practical value than the over-elaboration of automatic protection.

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An investigation of the kind projected by the Institution can only be of material service if it succeeded in eliciting causes. The first step in this inquiry is not that of finding answers to the question: "How can electrical accidents in mines be prevented?" but "How, and why, do they occur?"

For convenience of study the inquiry has been divided into three broad classes:—(*a*) Accidents from shock; (*b*) accidents from ignition of firedamp; (*c*) accidents from electrically caused fires.

It is known that not one, but many, elements enter into the setting up of a risk of electric shock, and the study should progress through innumerable questions of detail until it arrives at a discussion of the comparative merits of systems.

Mr. Maurice, in conclusion, submitted the following list of questions, which, however, was not intended to cover all the ground. It was, however, he said, desirable that the class of information contributed should be such as would provide answers to these questions, and at the same time bring forth others tending to throw light upon the subject which the Institution had taken in hand:—

1. What are the causes of death by electricity?
2. Define, if possible, the limits of risk.
3. Show the extent to which the ascertained range of risk applies in mines.
4. What means are there for the rescue, resuscitation, and subsequent treatment of persons suffering from shock (and burns)?
5. Assuming that shocks may be received owing to the defective condition or inadequate protection of parts of the installation, show how, and why, such defective conditions arise.
6. Have accidents occurred mainly in connection with the machinery of generation, of transmission (main lines), of distribution (branch lines), or of utilisation (motors, lighting, &c.)?
7. Detail the various conditions under which accidents have occurred.
8. Does the evidence of recorded fatalities indicate any difference in the degree of risk between different systems of supply employed in mines?
9. Are accidents from shock especially associated with any particular applications of electricity to mining? If so, what means of protection are there (under each system of supply, &c.) for that particular application?
10. What measures and protective devices are available for use in connection with (*a*) generating stations, sub-stations, switch-houses, &c., (*b*) main transmission lines, (*c*) distributing mains, (*d*) coal-cutters and other machinery operated through "trailers," (*e*) other mining machinery, and to what extent are they in use?
11. Is there any absolute protection against risk of shock, or is protection subject to the effective maintenance of conditions not wholly under human control?
12. Is risk of shock entirely a leakage problem, or are there risks apart from leakage? If so, state the varieties of risk?
13. If it is found that fatal accidents occur both on direct-current and three-phase systems, and whether regular earthing is practised or not, the question arises, have electric shock accidents any relation to systems or apparatus, or is the problem of protection absolutely controlled by the human element?
14. What measures of precaution can be taken, as distinguished from measures of protection?

Discussion at Newcastle.

Mr. Clothier (Messrs. Reyrolle & Co.), in opening the discussion, suggested that the first question was essentially a medical one. Two theories were held as regards the way death was caused. The first was that paralysis of respiration was caused, the current passing through the nerves destroying their control over the lung muscles. The second theory was that paralysis of the circulation of blood ensued. Referring to the extent of the limits of risk, he pointed out that the majority of the accidents which had occurred in mines during the last seven years had been with pressures under 250 volts. This seemed to show that it was the amount of the current which caused death. The resistance of contact and of the body was particularly low in a man working in a mine. In a record of accidents in mines which he had, he found that the lowest voltage which proved fatal was 120 volts, the shock being received from a portable lamp. With regard to the means used for resuscitation, he was in favour of the new method of laying the patient flat on the stomach and affecting respiration by pressing the back.

Mr. H. J. Fisher (Secretary of the local section) mentioned that Dr. Thornton had lately been experimenting upon the effect of electric charges on bullocks' blood. He found that the resistance of the blood increased with time. A feature that was noticeable in cases of electric fatalities was that the victims blacken quickly after death, which is analogous to the effect of morphia poisoning, and hence the theory that electric shock acts directly on the blood appeared to be correct. He knew of two cases of non-fatal shock from 5,750 volts. In one instance the man recovered after 10 weeks, and in another burns were received which took 12 months to heal. He also described two fatal cases with 500 volts. Dealing with the after effects of shock, he had noticed that paralysis often occurred after shock. He himself received a lightning shock while down a pit superintending the sweating of a joint on a cable which was connected to an overhead line on the surface which was struck by lightning. At the moment of shock he was pouring metal on the joint. The metal in the pot beneath volatilised, and for some time after he was unable to keep still owing to the nervous system being disorganised by the shock. As regards the means of resuscitation in case of shock, there is a rule that a card of instructions shall be placed in every machine room or distributing station where electricity is used, and hospital apparatus for the treatment of burns, &c., is kept at bank. A great mistake is frequently made in not continuing artificial respiration long enough. An alternative method to working the arms, which can be tried when only one rescuer is present, was to induce respiration by pressing in the pit of the stomach. Electric burns were very difficult to treat, as the skin withered, and it takes a long time for new skin to grow. There was often blood poisoning. Another danger was to the eyes, a flash often producing intense irritation, particularly at night, which was best relieved by the application of cocaine.

Mr. Wood (Messrs. Ernest Scott & Mountain) said it would be interesting to know the approximate current strengths which proved fatal, and the relative liabilities of the different parts of the body. He understood that the heart and the brain were the most vulnerable parts.

Mr. W. C. Mountain (Messrs. Ernest Scott & Mountain) referred to the fact that it was extremely difficult to define limits of safety as regards pressures, as in the Shoreditch accident death was caused at 110 volts. He believed that the average hand-to-hand resistance of a man's body, assuming his hands were dry, was about 800 ohms, so that 500 volts would give about half an ampere, which would probably be sufficient to kill. They had a man in their works, however, who could handle 500 volts without any trouble.

Mr. Ralph (Messrs. J. H. Holmes & Co.) said that it was impossible to generalise upon the physical effects of electric shock. They depended so much on whether the feet were wet, the hands were hard, and on the constitution. He had had three bad shocks, the first being at 1,850 volts from left hand to earth, the second at 900 volts alternating from hand to hand, and the third at 550 volts continuous from hand to hand. The last was the worst, as he made good contact, but in all cases he was able to let go. He knew of an old man (about 80 years of age) who was able to handle 2,000 volts direct current with impunity.

Mr. Coates thought that the conditions of death depended on the quantity of electricity, and, therefore, to some extent on the voltage, also upon which part of the body it passed through. On ordinary voltages a quarter of an ampere was generally dangerous, but on very high voltages and frequencies it was possible to carry double this current.

Mr. Carr mentioned cases of successful resuscitation of artificial respiration, and two other members spoke, one emphasising the wide difference in the recorded conditions of voltage, &c., producing fatal shock, and the other drawing attention to the use of picric acid or thermine, applied on cotton wool, in the treatment of electric burns. This not only allows the wound to heal quickly, but cleanses it of copper dust, which might otherwise produce subsequent blood poisoning.

The discussion was then adjourned.

Discussion at Cardiff.

Mr. Richards (Electrical Engineer, Maesteg) wished to know what Mr. Maurice meant by Question 2, and whether it was required to inquire into causes of death by electricity?

Mr. S. F. Walker (in the chair) said that the question was not to be taken too literally, but was cited in order to ascertain, as far as possible, the circumstances leading to the death in any case.

Mr. McCoy (Colliery Manager, Lydney) stated that he had had many years' mining experience, and was only too glad to make the best use of electricity at his colliery when occasion demanded. He did not think there was much cause for alarm, as he found a very low percentage of the accidents recorded were debited to electricity. Some accidents would happen in the most perfectly conceived apparatus installed. He believed that the electrical department, like all other branches, needed improving. In the older days, when electricity was first installed in collieries, a great deal of "cheap" work was done, but of later years great strides had been made.

Mr. Ellis (General Electric Co., Swansea) spoke of methods of earthing. Inasmuch as earthing was very important in mines, he thought it would be better, in the case of cables, and most economical, to have a concentric outer conductor, with good continuity throughout.

Mr. Humphries (Cardiff Technical School) preferred a four-core cable, say, on a three-phase three-wire system, with a definite mark of distinction, so that no mistakes could be made when jointing the cable ends, and to use one of these for an earth, connected at the surface with an earth plate. He preferred this, although the cost would be higher, yet he considered it most economical, and better than earthing to the delivery or suction pipes of a pump. Regarding the laying of cables, he preferred laying solid in the centre of the roadway under the

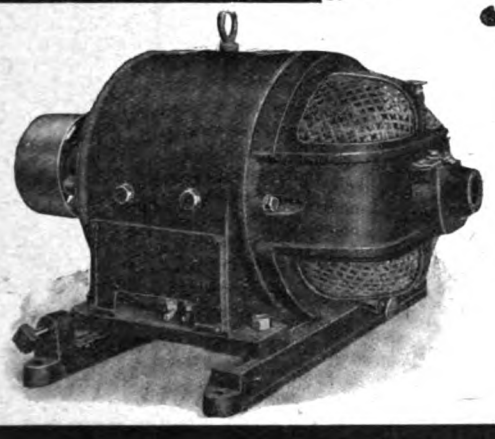
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track, when they would be protected against "*falls*," "*run-aways*," &c.

Mr. McCoy preferred to have everything in sight, inasmuch as cables were liable to be lost, through disturbances of the strata. He believed an efficient "earth" would be obtained by boring a hole down through the ground, and inserting a bar surrounded by coke. He had found this answer all purposes in his colliery, being a damp one.

Mr. Ellis urged using a separate cable of large capacity as an earth wire.

Other members also took part in the discussion, which was further adjourned until February 26th.

The Paper was also discussed at an informal meeting held at Whitehaven on Saturday last, where a considerable number of mining men in the district were present. Mr. T. P. Martin, who was in the chair, spoke of the prospect of a regular branch of the Institution being formed in Cumberland, and Mr. J. Glynn Williams announced that a further meeting would be held on February 26th, at 4 p.m., at the Grand Hotel, Whitehaven. From the number of proposals handed in, there was every possibility of a local branch being formed.

ELECTRICAL MINING PATENTS OF JANUARY

THERE were only two patents published in January of especial interest to mining electrical engineers. No. 18,802 of 1909, published on January 13th, was communicated from Siemens Schuckertwerke Ges. to Messrs. Siemens Bros. Dynamo Works, Ltd., and describes improvements in a system of control for electrical winding-gear and haulage machinery covered by a previous patent No. 14,134 of 1908. In this system the speed of hoisting is controlled automatically so as to depend on the position of the cage in the shaft, and means are provided for obviating the irregularities of speed due to variable loads. A depth indicator worked by the winding gear to be controlled is caused to act on a differential speed gear driven at a constant speed by an auxiliary motor, instead of the indicator working directly on the speed-regulating device of the machine, as in the Leonard system. The variable-speed shaft of the speed-gear acts as a guide or master speed, and is so geared to the winding-drum that any difference in their speeds affects the regulator of the driving motor, and corrects the variation. Thus the depth-indicator may reduce the speed of the master shaft near each end of the travel of the cage, and this will cause the winding motor to slow down. The present patent covers a safety device for use in this system for the purpose of ensuring that the starting switch of the winding motor shall be brought to the off position automatically when the operating handle is put to the stopping position, and the brakes are applied. Both these specifications have diagrams to illustrate the system.

An abstract of the other patent will be found in the Patent Record on another page of this issue. It describes a method of series-parallel control for large ventilating fans driven by direct-current motors.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during January.

January 6th.—Supplement on electrical engineering in mines, opening with a practical illustrated article by Mr. J. P. Simpson on cables in shafts and main haulage ways, and containing an illustrated description of the electrical equipment of an ironstone mine, including some specially designed haulage controllers, and another illustrated article describing a three-phase winding plant in South Wales. An electric pumping plant in a New Zealand mine is also described, and other articles deal with the general question of electrical working in mines, a new electric safety lamp, and some electric mining plant seen at a visit to a well-known works. A summary is also given of electric mining patents published in December.

January 13th.—Ontario power plant at the Niagara Falls. Discussion on the German electrical industry.

January 20th.—Illustrated description of a new design of flame-proof motor. A Paper on the choice of vacuum for working steam turbines.

January 27th.—Safety precautions in mines.

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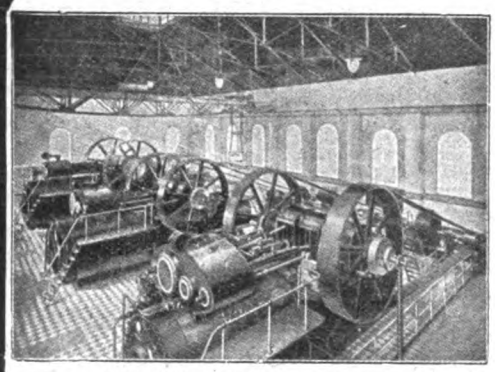
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METER DISPUTE AT GRAVESEND

Judgment for the Corporation

THE action by the Gravesend & Northfleet Electric Tramways, Ltd., against the Gravesend Corporation, in which the accuracy of the meters which measure the tramway energy supplied by the Corporation is challenged, was further proceeded with before Mr. Justice Hamilton on Thursday and Friday, and was concluded on Monday. The company allege that from August 7th, 1907, to August 8th, 1908, the three B.T.-H. meters installed in the Corporation power-house recorded a supply of about 40,627 units in excess of the actual supply, and that from August 7th, 1908, until the action, the meters recorded about 47,000 units too much. We reported the earlier proceedings in our issue for January 20th, p. 49.

On Thursday, Mr. H. M. Sayers gave evidence on behalf of the company, and put in figures of tests and diagrams made to compare an Aron meter with the three B.T.-H. meters, all metering the same current at the same time. During September and October of 1908, he said, the B.T.-H. meters were reading, on the average, 21·9 per cent. fast. At the same time, the readings of all the B.T.-H. meters differed from one another. In all his tests, the B.T.-H. meters showed a percentage excess over the Aron meter. His figures also brought out other facts to support the contention that the B.T.-H. meters were varying in their readings from time to time. The general experience of tramway engineers and managers is that the consumption on Saturdays is in excess of that on Sundays. He took five typical week-ends, in September and October, 1908, when the Aron meter readings varied according to the car miles run, which were less on the Sunday than the Saturday. The B.T.-H. meters on the same days and on the same load, however, showed practically in all cases, an excess consumption on the Sunday when the fewer car miles were run. In one or two instances, the readings were very close for both days.

In cross-examination, Mr. Sayers said his complaint against the B.T.-H. meters was that they were not astatic, and were surrounded by a large number of cables carrying heavy currents. He had tested the fields set up by these cables with a pocket compass, and found that they were mainly horizontal, and were in the same direction as the fields set up by the field coils of the meters. Pressed upon the point as to the direction of the stray fields, Mr. Sayers said emphatically that they were in the same plane as the field of the field coils of the meters, and thus made them read fast. He did not think that recalibration would make the meters read accurately, as they would still be subjected to the same stray fields which were the cause of the present inaccuracy. If they were moved, say, 12 ft. away from their present position, an improvement could be effected, but he believed the switchboard did not allow of this. In their present position, the meters were subjected to other fields due to the lighting cables, but it would involve a very long investigation to determine the amount of these. He agreed that the weakening of the magnets of B.T.-H. meters continued to a certain point and then remained more or less constant, and that, if this were allowed for, an accurate reading could be obtained, but his figures showed that the three B.T.-H. meters at Gravesend varied against each other day by day, both numerically and in percentages, and also varied against the Aron meter. In his opinion, the Aron meter was a better measuring instrument for tramway load than the B.T.-H. For the stray fields to interfere with the accuracy of an Aron meter it would be necessary to have a field in one direction for one pendulum, and a field in the opposite direction for the other pendulum, and a few inches away from them. But these were not the kind of stray fields that were obtained behind a switchboard. With regard to the statement that many B.T.-H. meters were still being used for tramway purposes, Mr. Sayers pointed out that all the B.T.-H. meters of this type installed during the past two years were astatic, whereas those at Gravesend were not. It was true that the meters there had been shielded, but this only protected the brake magnets and not the armatures, which were affected by the fields. Questions were then put to Mr. Sayers that the criticism of the Aron meter was that it would not register small currents accurately. On this, Mr. Sayers mentioned a test which he had carried out at Willesden in a test room with a 300-ampere Aron meter. This recorded when only one ampere was passing, or one-third of 1 per cent. of the full load current. The meter was running for 24 hours, and took 12½ units. The calculated units were 12·28. He did not know of any meter that gave such a straight line as the Aron meter.

This concluded the case for the plaintiffs.

Mr. SCOTT, for the Gravesend Corporation, submitted that there was no case. There was an agreement between the parties which both were bound by, and the only basis upon which the agreement could be upset was that the meters were, in fact, not meters with the meaning of the agreement. The company had full power to have the meters recalibrated, and if they then were not satisfied, they could go to arbitration, as provided by the agreement. On the first occasion the plaintiffs complained, he said, the meters were recalibrated and found to be reading in favour of them, and it was not until a year afterwards that they complained again.

Mr. H. A. BROWN (Town Clerk) detailed the negotiations with the company prior to the action.

Mr. J. RENNIE, who is in charge of the Electrical Standards Laboratory of the Board of Trade, produced the certificates which were originally issued in respect of the three disputed B.T.-H. meters, but declined to express any opinion as to the respective merits of various meters. The Board of Trade, he said, merely tested meters, without any cognisance of the purpose for which they were to be used.

Mr. C. F. MCINNES (Electrical Engineer to the Gravesend Corporation) disagreed with Mr. Sayers that the meters were interfered with, to any appreciable extent, by stray fields. There was only one unbalanced tramway cable, and the effect of this was taken into account in recalibrating. All the lighting cables, which were 4 ft. 6 in. away from the meters, were positive and negative, and thus the field produced by one was negatived by the other. Some of the cables were "dead." Mr. McInnes ventured the opinion that as the car miles on a tramway were reduced the consumption per car mile went up, but when asked by the judge to explain this, he said he could not, but he said it was the fact.

In the course of Mr. McInnes's evidence, figures of tests which had been made were put in, and counsel, on behalf of the Corporation, said he accepted the position that the meters were 12 per cent. fast, but the company alleged that they were 21 per cent. fast. Mr. McInnes was confident that the meters could be put right by recalibration *in situ*. The error was due to weakness of the brake magnets. He would not recommend an Aron meter for this purpose, as, he said, the mechanical portions gave trouble, and he had found the results vary from day to day.

Mr. J. H. HOLDEN, formerly of the British Thomson-Houston Co.'s meter department, and Mr. A. H. Preece, of Messrs. Preece & Cardew, also gave evidence confirming the opinions of Mr. McInnes concerning the speed of the meters.

During his cross-examination of Mr. Preece, Mr. A. J. Walter, K.C., was told that the meters were 600-ampere meters, and that they never worked beyond 130 amperes. Was it not obvious, then, he said, that as it was acknowledged that B.T.-H. meters read faster at light loads, smaller meters were necessary.

Mr. Justice HAMILTON said this was a new point, for no suggestion had been made yet that the meters were too large. Apparently the meters had worked satisfactorily from 1902 until 1907.

Mr. WALTER said it was a new point brought out by the evidence.

On Monday Mr. BOUSFIELD, in summing up for the Corporation, argued that there was no cause for action in the matter, as under the agreement between the two parties the company could have the meters recalibrated as often as they thought necessary, and the charge would then be based upon the amount of error that the recalibrations showed.

Mr. HILLS for the company urged that the result of the evidence was that the meters were impossible for recalibration, with any hope of permanent success, so far as the regularity of their reading was concerned.

In giving judgment, his Lordship said that, in view of the terms of the agreement between the two parties, in his opinion the onus was upon the company to prove that the meters were beyond all hope. He failed to see, under the terms of the agreement, any compulsion upon the Corporation to instal meters of another type, and thought that it was quite clear that there had been no breach of agreement on the part of the Corporation in retaining the original meters. There had been considerable conflict of opinion as to whether the meters could, or could not, be made accurate by the necessary recalibration, but in his opinion, the company had failed to make out their case that the meters were incapable of being made accurate within the limits of the agreement, namely, a variation of 3 per cent., and he therefore gave judgment for the defendants on the claim with costs. With regard to the action of the company in deducting £200 from the account for energy supplied during 1907–8, this was wrong, and he also gave judgment for the defendants on the counter-claim for this amount, with costs.

Tramway Running Powers in Lancashire.—Mr. Justice Eve delivered judgment on Thursday in an action taken by the Eccles Corporation to restrain the South Lancashire Tramways Co. from using a section of the Corporation lines in the Worsley Road, Eccles, of a length of about 500 yards. The company were running their cars over this section of the Eccles lines under a licence from the Salford Corporation, with whom there was an agreement, and there was also an agreement between the two Corporations. The company contended that under the agreement the power to grant such a licence was vested in the Salford Corporation, but this the Eccles Corporation denied. Mr. Justice Eve held that the grant of the licence to the company by the Salford Corporation was not a breach of the agreement between the two Corporations, and was not, therefore, *ultra vires*. The action was, therefore, dismissed with costs.

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CORRESPONDENCE

EQUITABLE CHARGES FOR TRAMWAY SUPPLY.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I have taken part on three occasions in discussions at meetings of the Institution of Electrical Engineers upon the subject of the principles which should influence the price of electricity*; one of these occasions being the meeting on Thursday last, when Mr. Yerbury's Paper was under discussion. I gathered at that meeting, I think correctly, that the views I put forward are neither acceptable to, nor of interest to, other engineers concerned with this aspect of the question of electricity supply, and the best course for me to take under such circumstances is to "shut up." This I propose to do; it is the function of a crank and not of a sane engineer, who desires to contribute his quota towards the elucidation of truth, to force his ideas when or where they are not welcome. I do not mean to infer in what I say above that my contributions have not been treated entirely courteously; but I have not gained the active attention of any of those whose business it is to deal with these matters—at least, not so far as I know. Before retiring, however, I am begging the courtesy of your columns to say a "last word" upon the subject.

First, may I clear away a misunderstanding which I think exists, viz., that I definitely advocate an alteration in the existing methods of charging for electricity. I do not. I am not competent to presume to offer an opinion upon a matter, which is beset with many difficulties of a purely practical character, and in connection with which many safeguards must be resorted to, which may involve the setting aside of otherwise right principles. My criticism is directed entirely and solely against the adoption by nearly the whole of the electrical industry of a principle which I believe to be scientifically unsound. That principle was expressed in Mr. Yerbury's Paper on the first page, where he says that the price of any commodity is "determined firstly by its entire cost of production, and, secondly, by the number or quantity sold."

For reasons that I have given I believe that that is a scientifically untrue definition. It may be a useful working hypothesis—I don't know; but it is not true, and it is obvious that engineers who set out with false principles are not unlikely to arrive at false conclusions. To my mind, Mr. Yerbury's definition is as erroneous as to express Ohm's Law as C=E, because in both cases an essential factor is omitted. The adoption of my definition of price (which is, of course, not in any way original) would necessarily have the following consequences :—

(1) The present definition of the word "equitable" would be abandoned, and the basis of the *market price* of the service rendered would be substituted for the present basis of the relation *cost* of supplying different consumers.

(2) As a corollary of above, it would become necessary to distinguish between supplying light, heat, power, etc., disregarding the fact that electricity supply is common to all three, just as in ordinary commercial life the hours of labour which are common to the creation of value of different kinds are generally disregarded.

(3) The recognition that the greatest aggregate gain can be obtained, and its most equitable distribution secured, when every part of supply is sold at its true market price, and that selling according to cost involves the loss of profit to the producer and of profit to the consumer.

(4) The coming into line of the electricity supply business with other commercial undertakings such as railways, steamship companies, &c., which apply as far as they can the principle which I believe to be right.

It may be regarded as impracticable to apply a right abstract principle in the electricity supply business so as to gain the advantages enumerated above—that is not my immediate concern; but it is my concern to ask my brother engineers to realise what they and their consumers are losing by selling upon a wrong principle, even though, on account of practical difficulties, they can see no way of avoiding the loss.

Whether wealth is being lost to the community by the error I have called attention to or not it is impossible to say; but I do feel that there is a great risk of this being the case. Instances have come to my notice of supply being sold at prices which violated the widely established principle which I hold to be a false one and nevertheless a larger aggregate profit has been made, and a larger measure of useful service rendered.

I am, Sir, Yours, &c.,

4 Queen Victoria Street, E.C., EDWARD W. COWAN.
January 28th, 1910.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Mr. Pearce's charges, as given by Mr. Yerbury, are, I believe, perfectly fair. They err on the side of modesty, when compared with "fixed charges" which I obtained about a year ago from an analysis of the Manchester figures, extending over several years, made with the sole object of getting at the true "fixed charges."

Taking a load factor of 30 per cent., the 29½ million units referred to in the Paper would, neglecting losses in distribution, correspond with a maximum demand of 11,200 kw.; and the "fixed charges" per unit given by Mr. Yerbury then work out at the following annual charges *per kw. of maximum* demand :—Coal, £0·47; oil, &c., £0·043; salaries, &c., £0·755; repairs £0·702; rates, &c., £0·952; management, &c., £0·394; interest, &c., £4·82; renewals suspense, £1·32, total, £9·45 per kw. of M.D. per annum.

Now, Sir, I beg to suggest that the dissatisfied tramway men have the remedy in their own hands. For, if the above are true "fixed charges," in the sense that they represent the additional annual charge to the station for every additional kw. of load taken on during the peak (as I believe they do), it follows that if the tramway men make arrangements to entirely remove their load during "peak" hours, the station is left free to take on additional lighting load to that extent without increasing their plant, or their staff; and therefore the station should, in equity, remit the whole or the greater part of the "fixed charge," and charge only for the units consumed, at so much per unit. Suppose, then, that the tramway department were to put down accumulator sub-stations at various parts of the city, in order to carry the above 11,200 kw. for, say, two hours (which would certainly cover that part of the power and lighting peak overlapped by the tramways), the capital cost, including buildings, would not be materially over £11 per kw., of which the batteries would represent some £7 per kw. We then have :—

	Per annum per kw.
Interest at 3½ per cent. on £11	£0·38
Sinking Fund at 5 per cent. on £11 (including depreciation)	£0·55
Perpetual Maintenance on Cells at 12 per cent. on £7	£0·84
Salaries and Wages—say half of steam	£0·57
Maintenance of Roosters and Buildings, say 5 per cent. on £4	£0·20
Total	£2·54

Now :—

	Per annum.
11,200 kw. at £9·45 (as above)	£106,000
11,200 kw. at £2·54	£26,200
Saving per annum ...	£79,800

This saving would, of course, only be effected if the "running charge" remained unaltered.

From the figures in Mr. Yerbury's Paper, I gather that the "running charge" is (1·04−0·865=) 0·17 penny. If this is correct, then the "running charge" will be :—29,500,000 units at 0·17 penny = £20,900 per annum. But the battery losses may render it necessary to purchase, say, another 7,000,000 units, costing another £5,000, and we have :—

	Per annum.
Gross saving	£79,800
Deduct cost of extra units	£5,000
Net saving per annum	£74,800

Of course, there are other factors, concerned with the capital invested in feeders, &c., of which due account would have to be taken in considering the revised "fixed charge" to be levied by the station, and if the tramway load was unduly large in proportion to the station "private" load, the occurrence of "abortive" peaks would have to be discounted for; but the balance in hand in the above is so considerable as to set off a great many such considerations.

I have, to simplify matters, considered only the units sold, as at the generative station, which is, of course, incorrect, but does not affect the result materially. The £20,900 charge is common to both schemes, and need not therefore be considered. My analysis of the Manchester costs disclosed the fact that when curves are plotted over several years, connecting certain annual costs per kw. with increasing kw. of maximum demand, these curves tend to become asymptotic; hence Mr. Pearce is quite right in taking these values as "fixed charges," since every added kw. means a correspondingly increased annual charge.

Yours faithfully,
A. M. TAYLOR.

Avondale, Ashfield Road, King's Heath,
January 28th, 1910.

COMBINED LIGHTING AND POWER METER.

To the Editor of ELECTRICAL ENGINEERING

SIR,—We have read with considerable amusement the remarks by the Meter Department of Simplex Conduits, Ltd., in their letter which appeared in your issue of January 20th, wherein they referred to our combined lighting and power meter as another old friend, generally known as the three-wire system. If the Meter Department in question will again read through your description and examine the diagram more closely, we feel

* *Inst. E. E. Proc.*, Vol. 40, Part 188, p. 338; and Vol. 42, Part 193, p. 52.

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sure that they will see that it cannot in any sense of the word function as a three-wire meter.

However, as they may not be acquainted with the operation of a three-wire meter, we would trepass on your space and give them a short description of this system.

In a three-wire meter the one main current coil is used in series with the one outer of the three-wire system, and the other main current coil in series with the second outer, so that the current taken by one half of the system, *quite irrespective of the type of load, heating, or lighting*, flows through one half of the meter, and the current taken by the other half of the system flows through the second half. The meter thus registers the total three-wire consumption, but has nothing to do with charges for lighting or power.

In terming our meter a three-wire meter, they were probably misled by the coils being split up in the ratio of two to one, and in consequence the power terminal of the meter is shown connected to one half of the total series turns. The lighting current therefore flows through all the series turns, whereas the current utilised for heating or other domestic appliances only flows through that proportion of the series coils which is in the ratio of the heating to the lighting rates.

We should like to point out that the connections of the power terminal to the series turns depends entirely on the ratio of the charges, and as regards the adjustment of the meter there is no difficulty whatsoever respecting the ratio of the lighting and power rates. We, of course, can arrange not only our watt-hour meter, but also our ampere-hour meters, for the same purpose as dealt with by Simplex Conduits in their Figure 2.

With reference to their concluding remark that no special type of meter is essential, we wish to point out that the ordinary meter cannot be used for this purpose, as the meters have to be adjusted to the exact ratios, and this involves not only special terminals, but also special calibration.

Yours faithfully,

ADNIL ELECTRIC CO., LTD.
(R. A. Marples, Manager.)

Adnil Building,
Artillery Lane, E.C.
January 28th, 1910.

THE ELECTRIC DRIVING OF REVERSING ROLLING MILLS

THE action brought by the Donnersmarckhütte Oberschlesische Eisen- und Kohlenwerke Akt.-Ges. of Zabcze, Germany, against the Electric Construction Co., of London and Wolverhampton, for alleged infringement of the fundamental patent for the Ilgner system of electric driving of reversing rolling mills, was commenced before Mr. Justice Parker in the Chancery Division of the High Court on Wednesday of last week. The installation referred to as an infringement of the patent is that at the Bilston Works of Messrs. Alfred Hickman, Ltd., and was constructed and put down by the Electric Construction Co. in the end of 1908. The fact that the Ilgner principle is employed in this plant is not denied, but it is asserted in defence that the Ilgner patent is invalid for want of subject-matter, and also on account of insufficiency. It is stated that the arrangement described in the patent will not work unless the machines are separately excited, whereas the specification particularly refers to shunt-wound machines. Further, it is asserted that some means of regulating the demand of the motor of the motor-generator is necessary, whereas nothing of the sort is described in the specification.

The patent in question is No. 7,188 of 1902 granted to Carl Ilgner of Donnersmarckhütte, and relates to the driving of reversible rolling mills. The object of the arrangement described is to reduce the fluctuations in the current demand caused by the switching in of the motor, and to enable the frequent changing of the direction of rotation and of the speed of rolling to be effected in an economical manner.

Power for the rolling-mill motor is taken from the generator of a motor-generator which is provided with a heavy flywheel and is run from the main supply. Both the starting and the speed control of the rolling-mill motor are effected by varying the excitation of the generator. The flywheel prevents the speed of the set from being reduced suddenly when the rolling-mill motor makes a sudden demand for power, and thus prevents an excessive flow of current from the main supply. To supply the demand, however, the flywheel slows down and gives up a portion of its kinetic energy to the dynamo, which, in turn, delivers it to the rolling-mill motor in the form of electrical energy. When the demand is below the normal, the set speeds up and stores energy in the flywheel. If the rolling-mill motor and the generator of the flywheel set are shunt-wound, the former can be quickly arrested by reducing the terminal pressure of the generator below that of the motor. The latter then acts as generator and drives the flywheel set. The motor of the flywheel set must be designed to drop in speed when an increase of the load takes place, and must have a limited maximum speed.

The patent has only one claim, which is as follows :—

The herein described arrangement for regulating the velocity of electrically-driven reversible rolling-mills without the use of switched-in resistances, and for effecting a gradual demand of current from the main current source so that the said demand of current does not rise to the full amount of current consumption corresponding to the work required by the rolling-mill motor on starting, consisting of a rolling-mill motor driven by a current from a motor-dynamo driven directly from the main current source and provided with flying masses, the E.M.F. transmitted to the rolling-mill motor being regulated by alteration of the field-magnet excitation of the dynamo part of the motor-dynamo which generates the current for the rolling-mill motor.

The case is in one respect parallel to that just concluded in connection with the Bremer flame arc lamp patent, as a petition for the revocation of the two Ilgner patents under Section 27 of the Patents Act, 1907, on the ground that the patented articles are manufactured exclusively or mainly outside the United Kingdom, has been made as a counter move by the defendants. This petition has been delayed by a dispute as to procedure, an appeal with regard to which is down for hearing by Mr. Justice Parker, after the hearing of the infringement action.

Mr. A. J. Walter, K.C., Mr. J. H. Gray, and Mr. G. H. Hume appear for the Donnersmarckhütte Ges., and Mr. W. R. Bousfield, K.C., and Mr. Russell Clarke for the Electric Construction Co.

On Wednesday of last week, Mr. WALTER opened the case for the Donnersmarckhütte by describing the many advantages to be obtained by applying electric driving to reversing rolling mills, and the difficulties which had to be contended with. The defendants seemed, he said, to rely very much upon the Ward-Leonard system; this was before the public in 1891, but in the eleven years betwen that date and the date of the Ilgner patent there had been no application of this system to reversible rolling mills. Ward-Leonard intended his system for controlling motors gradually and economically by varying the excitation of the generator of the motor-generator set, and had no intention of preventing heavy demands on the supply; he had admitted himself in the discussion of an A.I.E.E. paper in 1896 that he did not claim to get a greater H.P. than that which could be obtained direct from the mains. There was an enormous rush of current to the rolling-mill motor when the ingot was first nipped by the rolls, and the flywheel of an Ilgner set gave out energy to supply this sudden demand and prevented the heavy fluctuations from reaching the supply. As an example of the advantage of electric drive, he referred to a certain mill which with steam drive made 6 passes per min., and with electric 11 passes per min. when doing the same work. When no ingots were inserted it could make 30 passes per min.

Mr. J. SWINBURNE, called by Mr. Walter, pointed out that the motor of a Ward-Leonard motor-generator set was a constant-speed motor, and that the load on it would be practically the same as that on the secondary motor. The combination was intended to do away with the wasteful series-resistance control. As an engineer, he would understand the Ilgner specification to imply the use of separate excitation, as if the rolling-mill motor were self-excited, it would loose its excitation and stop when the pressure was reduced. The automatic regulator used in the defendant's plant was only a means of producing a wider variation in speed of the primary motor. There was, he said, obvious invention in the Ilgner idea. Cross-examined by Mr. BOUSFIELD, Mr. Swinburne agreed that flywheels had been used in conjunction with continuous-rolling mills, but pointed out that they would be a hindrance on a reversing mill. Mr. Bousfield stated that 45,000 h.p. seconds could be taken out of the Bilston set (above that taken from the supply at the same time) within the normal limits of speed, and that one-tenth of this was in the moving parts and not in the flywheel. He suggested that the only difference between a Ward-Leonard set and an Ilgner set was the addition of more flywheel effect, but Mr. Swinburne argued that not only was the primary motor smaller than the secondary motor, but also there was a drop of speed in the primary motor in the latter case. Mr. Bousfield then referred to an I.C.E. paper read by Dr. Kapp in 1892 in which he described the use of a flywheel on a spinning-mill motor to equalise the load and suggested applying the same idea to a motor-generator for traction work. Secondly, Mr. S. Z. de Ferranti had taken out a patent (No. 4065) of 1895 for a motor generator with a flywheel to equalise the load on the motor. Thirdly, in a paper by Messrs. Mordey and Jenkin, published previous to the Ilgner patent in 1902, the authors had described a Ward-Leonard traction equipment, and had referred to the flywheel effect and to a 15 per cent. drop of speed of the motor-generator set. In reply to these, Mr. Swinburne said that in all these cases the flywheel had only been used in the ordinary way to smooth out the fluctuations in power and to make the demand on the supply more gradual, but that there had been no idea of actually supplying power from the energy of the flywheel for the whole time the increased demand existed. The Ilgner invention consisted in doing this by combining a flywheel and a Ward-Leonard set.

Mr. C. A. ADLETT (Siemens Bros. Dynamo Works, Ltd.), the next witness for the plaintiffs, said that he had seen the Bilston plant at work. When he saw it, the regulator was not working, the speed of the flywheel set was varying about 5 or 6 per cent. and the current taken by the primary motor fluctuated between

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300 and 1,500 amperes. (Mr. Clarke here pointed out that the normal load of the primary motor was 3,500 amperes, and that the regulator did not work until the demand on the primary motor was higher than this, when the speed was reduced to allow the flywheel to supply the difference). Mr. Ablett admitted, under cross-examination, that all the Ilgner sets installed whether for rolling-mills or for colliery-hoists, had regulators to reduce the speed of the primary motor.

This concluded the case for the plaintiffs.

Mr. Bousfield then opened the case for the E.C.C., and on Monday and Tuesday, Mr. F. Bray (of the Trafalgar Colliery Co.), Mr. H. F. Parshall, Prof. Bertram Hopkinson, Mr. S. Z. de Ferranti, and Mr. W. M. Mordey gave evidence on their behalf.

The report of the proceedings will be concluded in our next issue.

ANNUAL DINNER OF THE LEEDS LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE annual dinner of the above Section was held at the Hotel Metropole, Leeds, on Friday evening, January 28th, and nearly 100 members and friends sat down. Among the guests were Dr. Gisbert Kapp, President of the Institution, the Lord Mayor of Leeds, Mr. W. Penrose Green, Mr. Robt. Hammond, Alderman Ewing Matheson, Councillor H. Brown, Mr. A. G. Lupton, Pro-Chancellor, Leeds University, Mr. John McLaren (Messrs. J. & H. McLaren, engineers), and Mr. Percy Robinson, President of the Leeds and Yorks Architectural Society.

Mr. R. HAMMOND proposed "The Corporation of Leeds." That city, he said, owed its prosperity largely to its abundant supply of coal. He was impressed with the fact that where coal was, there was centred the business of the world. America's output of coal was 426 million tons, and the country was doing an enormous trade, while England, with 290 million tons, was also engaged in an immense business. Another country, which should be nameless, had an output of 207 million tons, so there was only some 200 millions left for the rest of the world. Leeds must continue to prosper, because in addition to its water facilities, its supply of coal, and its energetic citizens, it had a supply of electricity second to none in the kingdom.

The LORD MAYOR, in replying, said that Leeds was fortunate in having so many industries, and the citizens had no need to be ashamed of their electrical undertakings. The capital involved in the Corporation electric supply undertaking had risen from £60,000 to nearly £1,000,000. He would suggest to the department that they encourage in every way the adoption of electric power, but would advise the managers to make the scale of charges more understandable. The tramway system, in which 1½ millions was sunk, was working at a profit, and contributed largely to the relief of the rates.

Councillor H. BROWN, in submitting "The Institution of Electrical Engineers," was glad to find the parent body took such an interest in the local sections, as was evidenced by the presence of the President.

Dr. KAPP, in replying for the Institution, explained why electrical engineers were so numerous, by saying it was because they were the handmaidens of all other engineering professions. He was astonished that in such a great textile district as Yorkshire there were so few mills electrically driven. Mill-owners were undoubtedly prejudiced against electricity, and imagined all sorts of difficulties. About twelve months ago he had asked Prof. Barker, of Bradford, if there were many electrically driven machines in Bradford, and received the answer, "No; but we have a commission sitting to investigate the subject." Dr. Kapp thought it was rather late in the day to start investigations when the utility of electric driving had been proved so conclusively on the Continent. He had received a copy of the Report, and felt that the profession had been injured by it. The members had missed the point entirely, and the electrical engineers who formed part of the Commission had dissociated themselves from the report. It did not redound to the credit of this country that such a report should be issued. In one shop on the Continent he had seen hundreds of motors on the floor which were required for the electric driving. He would suggest that the Leeds Section might do some useful work by getting some association of experts in the manufacture of textile machinery and the users themselves to test the matter, and he would have no fear of the result.

Mr. A. G. LUPTON, Pro-Chancellor, Leeds University, in proposing the "Leeds Local Section," would not admit we were so far behind in this country with respect to textile driving, and said that in 1908 the Yorkshire Electric Power Co. derived half its revenue from that source. He predicted great strides in the future for the application of electric energy, especially in electro-chemistry.

Mr. W. M. ROGERSON, Halifax, Chairman of the Section, in his reply, referred to the fact that in future the section was to be known as the "Yorkshire" Local Section.

ANNUAL DINNER OF THE INSTITUTION OF ELECTRICAL ENGINEERS STUDENTS' SECTION

ON Wednesday of last week, the sixth annual dinner of the Students' Section of the Institution of Electrical Engineers was held at the Trocadero Restaurant, London. The chair was taken by Mr. R. C. Plowman (Messrs. Tyler & Freeman, London), and the gathering comprised some seventy students and guests.

In proposing the toast of the President and the Institution, Mr. H. W. GREGORY, Vice-Chairman, said that he would take the opportunity to thank the Council, on behalf of the Students' Section, for the help and encouragement they gave to them. He also expressed the hope that it would be made possible for the students' papers to be printed in abstract; at present, out of about thirty papers for each session, only four (Premium) papers were printed.

Dr. G. KAPP, responding, said that it always gave him great pleasure to meet students; the student he liked best was the one who never took anything for granted, who picked holes in his lectures, and who experimented intelligently. He always encouraged students to take an interest in general literature, languages and sports; man was not only a thinking machine. Foreign languages were most important; in Germany, a degree could not be obtained unless examinations were passed in English and French, and they were going to grant engineering degrees in Birmingham in future only if the student had mastered two foreign languages. He would advise German and Spanish, the latter on account of the enormous developments in South America. A smattering was not enough; it was necessary to be able to read a scientific book comfortably. English engineers were often preferred by German employers, because, though they were perhaps not so highly trained as German engineers, they had been taught to think independently and to apply their science in a better way. With regard to the position of the industry, there were already indications of improvement. Finally, he thought British engineers might try for the £400 prize which had been offered by an Italian Association for promoting the safety of the public and workmen, for an efficient method of earthing such as could be used in marble and slate quarries, and would also prevent such accidents as that at Olginate. Particulars could be obtained from the Italian Minister of Agriculture and Commerce, and the offer would be open until the end of 1911.

Mr. W. M. MORDEY supported Dr. Kapp, and stated that though the Students' Section was not a paying section financially, the Council did not expect it to be so; they had made the subscription as low as possible, as they well realised that the students were the future members and supporters of the Institution.

Dr. S. P. THOMPSON, in proposing the toast of the Students' Section, said that the Institution had realised from the earliest days that its future was bound up with those who begin as students; an ever-increasing proportion of the full members were once student members. The students should work to promote the professional and industrial interests of the Institution. Dr. Thompson then referred to the long list of illustrious men who had been presidents of the Institution, and suggested how the future engineers would look back with pride upon the present heads of the industry. It was essential that students should believe in the greatness of the Institution, and of the industry, and have a good opinion of themselves; the progress they would make would be in proportion to the amount they had of this "academical conceit."

Mr. R. C. PLOWMAN, responding, referred to the present activity of the Students' Section, and to the advantages to be derived by attending the meetings, but complained of the small percentage of active student members. The Institution did much for its students, and it remained for them to show their appreciation.

The toast of the Colleges was proposed by Mr. F. E. BURNETT, of Faraday House, and responded to by Mr. R. HAMMOND, who paid a tribute to the educational work of Dr. Thompson, and emphasised the utility of a knowledge of foreign languages.

The Theory of the Dynamometer Wattmeter.—An original communication on this subject, by Dr. C. V. Drysdale, has been accepted by the Institution of Electrical Engineers for publication in the Journal. The author goes into the various causes of error with instruments of this class, and discusses them fully from a mathematical point of view, and finally arrives at the conclusion that a wattmeter which is free from eddy currents, and in which the resistance exceeds 1,000 ohms per millihenry of equivalent shunt inductance, will never have an error of more than 0·001 in the power factor under practical conditions, except when testing condensers with very irregular wave-forms. As the above condition is very easily secured with ample torque and small power consumption, he considers that a well-made dynamometer wattmeter is superior to any other device for alternate-current power measurement.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Jan. 27th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

142/09. **Jointing Metal Filaments to Leading-in Wires.** H. HIRST and WOLFRAM (TUNGSTEN) METAL FILAMENT LAMPS, LTD. A strong and electrically good joint between leading-in wires and metal filaments is produced by applying at the joints a paste of the phosphides of copper, manganese, nickel, or tungsten with a little water or a volatile liquid such as xylol which leaves no residue. The filament carriers after this treatment are placed in a drying oven, and are then inserted in the chamber containing an inert gas, in which the paste is reduced with the aid of an electric arc. A small quantity of metal can be added to the phosphide paste. If air or other non-inflammable gas is blown against the joint during the sintering process, it is not necessary to carry this out in an inert atmosphere. Three claims, two figures.

194/09. **Combined Wall-plug and Adapter.** J. H. DRYSDALE. An ordinary bayonet lampholder is provided with two long pins which enter the socket when it is used as a wall plug. An insulating sleeve is fitted in the holder, and when it is desired to use the device as an adapter, this sleeve is released and is forced outwardly by springs until its end is flush with the tops of the pins. Two claims, three figures.

1,813/09. **Arc Lamp with Supported Carbons.** P. HANISCH and REGINA BOGENLAMPENFABRIK GES. The carbons are connected and prevented from falling by a brake or clamp on the negative carbon. This carbon rests on a refractory support pivoted to the lamp base and connected with the brake through a system of levers in such a way that when the carbon is consumed and no longer bears on the support, the latter lifts slightly and releases the pressure of the brake, with the result that the carbon feeds down and bears on the support again. When the carbons are nearly consumed, the brake slips over the top of the negative carbon and tilts the support so that the carbon is free to fall out into the ash-tray. Two claims, three figures.

2,176/09. **Driving Fans and Propeller Screws.** SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*) This is a system of electric driving for fans and ship propellers where the turning moment required varies as a high power of the speed. For a ship, the turning moment at 80 per cent. full speed is about half the full speed value, and that at 40 per cent. full speed is less than seven per cent. of the normal value. Two shunt or separately-excited motors on the same shaft are employed, and the armatures are connected in series up to 40 per cent. full speed; the field of one motor is reduced until all the load is transferred to one motor. This will occur at 80 per cent. full speed, and will correspond to half full load. The motors are then connected in parallel, and the load divided between them. The speed is then increased until both motors are fully loaded. The resistances for working at below 40 per cent. full speed need only be very light, as the current taken is so small. Two claims, one figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: CRAVEN [Voltage regulation] 442/09; SCHMAHL and ARMORDUCT MANUFACTURING CO. [Armoured conductors for portable apparatus] 7,706/09; BULLERS, LTD., and DAGNALL [Insulators] 12,477/09.

Dynamos, Motors, and Transformers: WALKER [Machines] 693/09 and 29,376/09; DAY and WIESENGRUND [Generators] 6,317/09; SIEMENS BROS. DYNAMO WORKS and KLOSS [Generators for searchlights] 6,949/09.

Electric Ignition: SIR W. G. ARMSTRONG, WHITWORTH & CO. and HADCOCK [Firing mechanism of ordnance] 864/09; DAWSON and BUCKHAM [Controlling sighting of guns] 961/09 and 984/09; SIMMS MANUFACTURING CO. [H.-T. magneto apparatus] 1,263/09; STERLING TELEPHONE & ELECTRIC CO. (*Schaffler & Co.*) [Mine exploders] 24,469/09.

Electrometallurgy and Electrochemistry: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Electrolytic cells] 6,872/09; BENDER [Production of nitrogen oxides] 18,203/09.

Incandescent Lamps: WEISSMANN [Illuminating bodies] 321/09.

Instruments and Meters: BOWDEN, ROBINSON, and JACKS [Prepayment meter with warning switch] 7,005/09.

Switchgear, Fuses, and Fittings: PIDGEON [Flashing-sign controllers] 954/09; BAYLISS [Wiring conduit] 4,560/09; DRANSFIELD [Conduit clips] 8,027/09; SCHMAHL [Conduit fittings] 9,971/09; LAKE (*F. Bissel Co.*) [Motor controllers] 13,734/09.

Telephony and Telegraphy: DENNIS [Telephone meters] 986/09; DYSON [Jointing submarine cables] 10,052/09; MCBERTY [Selective switching apparatus for telephone exchanges] 20,839/09; SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Telephone exchanges] 23,310/09.

Traction: ANGER [Tramway vehicles] 26,736/08; STANSFIELD [Junction-points] 575/09; DUTTON and MCKENZIE & HOLLAND, LTD. [Signalling and interlocking] 784/09; PRICE [Visual block signalling] 886/09; CONATY [Axle-boxes] 1,031/09; PARKER [Compensators for wires under tension] 21,713/09; KÖHLER [Current collector] 26,347/09 and 26,807/09.

Miscellaneous: FURLANI [Fire alarm] 1,080/09; CHILDS and HILL [Wind-turbines] 1,175/09; SCHRÖDER [Electric clocks] 2,596/09; MAYOR & COULSON, LTD., and ANDERSON [Coal-cutters] 5,617/09; STOKER [Soldering aluminium] 12,019/09; KOECHLIN [Illumination of looms] 22,125/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrometallurgy: PETERSON [Charging resistance furnaces] 27,674/09; SOC. ELECTRO-METALLURGIQUE FRANÇAISE [Manufacture of nickel] 287/10.

Incandescent Lamps: KUZEL [Metal filament loops] 17,627/09; FELTEN & GUILLEAUME-LAHMEYER-WERKE AKT.-GES. [Metal filament lamps] 17,960/09.

Amended Specification Published

The following amended Specification can now be obtained.

2,216/09. **Arc Furnace.** CENTRALSTELLE FÜR WISSENSCHAFTLICH-TECHNISCHE UNTERSUCHUNGEN GES. This specification relates to the production of long arcs such as those used in the fixation of atmospheric nitrogen, and was amended as the result of unsuccessful opposition to the grant of a patent.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

2,581 of February 4th, 1896. **Telephonic Apparatus.** E. W. SMITH and NEW PHONOPORE TELEPHONE CO., LTD. This apparatus is for telephoning along lines used simultaneously for telegraphic or other purposes. The call is sent by a vibrating reed acted upon by the core of a phonopore, the primary of which is normally short-circuited.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: G. CORNARO [Flame carbons] 22,090/03; BRITISH THOMSON-HOUSTON CO. (*Allgemeine Elektricitats-Ges.*) [Flame electrodes] 20,330/05.

Distribution Systems, &c.: E. T. GREENFIELD [Cable armouring machine] 22,261/02; T. E. DEVONSHIRE [Cement cable conduits] 22,003/04.

Dynamos, &c.: H. W. LEONARD [Motor control] 18,281/00; A. F. PIEPER [A.-C. commutator motor] 20,392/05.

Electrometallurgy, &c.: G. CORNARO [Furnace electrodes] 22,090/03; V. MITKEVITCH [Arc furnaces and welding] 20,769/05.

Incandescent Lamps: SIEMENS & HALSKE AKT.-GES. [Hardening tantalum filaments] 18,403/05; M. FAVERO [Lamp cap] 20,512/05.

Switchgear, &c.: C. B. WALKER [Cable sockets and thimbles] 18,298/00; VERITY'S, LTD., and E. J. SELBY [Circuit-breaker] 20,612/01; C. M. DORMAN and R. A. SMITH [Electromagnetic release for circuit-breakers] 22,421A/02; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Mercury cut-out for heating devices] 20,599/05.

Telephony, &c.: A. M. BULLARD [Automatic telephone exchanges] 21,819/04; SIEMENS BROS. & CO. (*Siemens-Schuckertwerke Ges.*) [Signalling with light waves and selenium cells] 20,371/05; A. J. BOULT (*C. E. Eyan*) [Sub-station apparatus for C.-B. telephone systems] 20,496/05; W. SCHÜTZ [Glass line posts] 20,501/05.

Traction: H. W. LEONARD [Traction system] 18,281/00; W. T. W., and P. C. PHILIPSON [Tramcar lifeguard] 20,512/01; C. BURTON, A. I. LITTLEJOHN, and P. STILL [Wire strainer] 20,365/05; A. NEELEMANS [Signalling and control of points] 20,460/05; C. D. ABEL (*Siemens-Schuckertwerke Ges.*) [Signalling] 20,467/05; O. LOSCHER [Speed indicator] 20,561/05; C. R. BAULINO and F. FESSIA [Speed indicator] 20,675/05; J. MCILWAIN [Signalling] 20,690/05.

Miscellaneous: J. WEST [Electrically-driven charging device for gas retorts] 22,002/02; MAYOR & COULSON, LTD., and H. A. MAYOR [Regulating device for motor-driven punkahs] 21,794/04; E. MACKAY [Magnetic compass] 20,545/05; H. H. LAKE (*H. H. Sylvester*) [Illuminated signs] 20,475/05; J. H. ARJOHN [Automatic feed weighers] 20,514/05.

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LOCAL NOTES

ABERDEEN: *Tramway Guard Wires.*—Owing to the National Telephone Co. having largely placed their wires underground, the Tramways Committee have decided to remove a large number of guard wires, as these have now become unnecessary.

Supply to Tramways Co.—The Aberdeen Electricity Committee recommend an offer being made to the Aberdeen Suburban Tramways Co. for a supply of electrical energy for five years at 1·75d. per unit, which is 0·5d. less than the rate at present charged.

BELFAST: *Cavehill and Whitewell Tramways.*—The Cavehill and Whitewell Tramways Co. have informed the Corporation that they are willing to sell their undertaking at a price to be fixed by arbitration. The matter has been referred to a special meeting of the Corporation. A Bill is to be promoted by the Corporation for this purpose.

DEVONPORT: *Tramways Company Bill.*—At the meeting of the Corporation last week the Bill of the Devonport District Tramways Company, which proposes to vary the terms of the agreement under which certain tramways are now run by the latter, was discussed at great length, and it was decided to offer a strong opposition to the proposal. The Town Clerk said the proposals sought violated the statutory protection which was granted to the Corporation, and on the faith of which the Corporation gave their consent to the promotion of the Company's Bill in 1908. The Company also attempted to alter seriously an arrangement which was deliberately made, and on the faith of which the Corporation expended over £62,000. He doubted whether a more monstrous proposal had ever been submitted to Parliament.

HOUNSLOW: *Electricity Accounts.*—At the last meeting of the Council it was reported that there was a clear profit for the past year on the electricity undertaking of £440, as against £80 in 1908, and a deficit of £62 in 1907. It was further reported that satisfactory progress was being made in regard to the coming Electrical Exhibition, which will commence on February 17th and be continued to the 26th.

HULL: *Sale of Electrical Fittings.*—The Electric Lighting Committee have recently opened a showroom for the purpose of demonstrating the advantages of electricity for lighting, heating, cooking, &c., and this seems to have disturbed the local section of the Electrical Contractors' Association. A deputation waited upon the Electricity Committee last week, and pointed out that they were under the impression that the Corporation intended to develop the sale of apparatus at the showroom. They were assured that there was no such intention on the part of the Corporation.

INDIA: *Electric Power Supply.*—The *Financial News* states that negotiations are proceeding in London for the provision of the capital for carrying out the license granted by the Indian Government, under the Indian Electricity Act, for the supply of electrical energy in Bombay and the surrounding districts. The scheme involves the use of water power in the Ghaut Hills.

LONDON: *London County Council: Purchase of London United Tramways.*—With reference to the proposed purchase, by the L.C.C., of the portions of the London United Tramways which are in the County of London, the company object to the purchase on the ground that the L.C.C. have no tramways connected with the lines proposed to be purchased; that heavy capital expenditure had been incurred in connection with the company's lines in the County of London, and that local authorities adjoining London raise objections to any interference with the prevailing conditions of working the lines. The directors ask for an opportunity of being heard by the Board of Trade. The London County Council have informed the Board of Trade that under the Tramways Act of 1870 they have an unconditional power of purchase, and that the matters referred to by the company do not affect this power. An assurance has been given that the L.C.C. will give consideration to all matters, in order to meet the convenience of the travelling public, and also to enter into reasonable arrangements whereby the company will be allowed to run its cars to Hammersmith Broadway and Shepherd's Bush. On this understanding the Board of Trade have approved of the notice of purchase served upon the company.

Opposition to Private Bills.—The Parliamentary Committee of the L.C.C. recommends petitions being presented against the Baker Street & Waterloo, Charing Cross, Euston & Hampstead, Metropolitan District, and Metropolitan Railway Bills, which are being promoted in the next session of Parliament.

Brompton and Kensington New Tariff.—The Brompton & Kensington Electricity Supply Co. have introduced an alternative contract system of charging for lighting, heating, and cooking. Where electric light is exclusively used the company quote a fixed annual charge, payable in quarterly instalments, and in addition 2d. per unit for all current consumed up to the quantity which at the rate equals the amount of the fixed annual charge, and 1d. per unit for all current consumed thereafter. Under this system a separate meter and wiring for power supply is dispensed with. The company's ordinary tariff for heating, viz., 1d. per unit, has been increased to 2d. per unit.

Fulham: Power Charges.—The Electricity Committee report having had under consideration the charge to be made for energy supplied for driving motors, used for the purpose of producing other artificial light. A rate of 3½d. per unit, with a minimum charge of 13s. 4d. per quarter, plus the usual motor rent, has been fixed.

NEWPORT: *Position of Electricity Undertaking.*—Mr. C. P. Sparks, who was called in by the Council in relation to the financial position and management of the electricity undertaking, has now presented his report. The chief source of loss from the undertaking has been in respect of the supply for power purposes, and it is stated that the report contains recommendations for revising these tariffs. About six years ago reductions were made which involved a loss of revenue of £1,000 per annum, and it is felt that this experiment was a mistake. The full report is not yet available.

PLYMOUTH: *Reduced Electricity Charges.*—The Corporation have decided to revise the charges to the Tramways Committee and to private power users. The Tramways Committee will in future be charged 1¾d. per unit up to 750,000 units per annum, and 1½d. per unit for all in excess of that quantity. The present charge is 1¾d. per unit for any quantity. For power purposes the charge is to be 1¾d. per unit up to 100 units, and 1½d. per unit beyond that. The present charge is 1¾d. per unit.

PORT GLASGOW: *Electricity Supply.*—The Greenock Corporation are to be asked to submit terms for the supply of electrical energy in Port Glasgow.

WEST BROMWICH: *The New Tramway Fares.*—At a public meeting to consider the "fair fare" system last week, it was stated that 1,100 people had pledged themselves not to use the tramways in the district for three months. It was also stated that this number had been obtained in a casual sort of way, and that it was hoped to get at least 10,000 West Bromwich people to join in the boycott.

WIGAN: *Tramway Consumption.*—The Tramway Manager reports that since September 30th last, the current consumption has shown an alarming increase. For the 15 weeks from October 1st, 1909, to January 20th, 1910, the average consumption per car mile had increased from 1·54 to 1·70 units. A "Master" meter is to be fixed at the electricity station, with a view to determining whether the present meters are working correctly, and the cars on the Standish route are to be fitted with meters for the purpose of ascertaining the current consumption per car.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ASTON.—The Electricity Committee recommend extensions at an estimated cost of £13,550. The proposed plant will consist of a 2,500-kw. turbo-alternator, a 250-kw. motor-generator, and a 350-kw. rotary converter.

COVENTRY.—The City Council have approved of the scheme of electrical extensions involving an expenditure of £54,000, particulars of which were given in our last issue.

KEIGHLEY.—The Board of Trade have sanctioned a loan of £21,000 for electrical extensions.

LONDON: *London County Council.*—The following plant is required at the Woolwich tramway sub-station: High- and low-tension switchgear (£2,250), 150-kw. motor-generator (£675), switchgear (£650).

Bermondsey.—A loan of £4,620 for electric lighting is recommended by the Finance Committee of the London County Council.

OLDHAM.—The Tramways Committee invite tenders for (*a*) electric lighting installation at the Hollinwood depot; (*b*) switchboard and accessories; (*c*) testing panel and accessories; (*d*) workshop motors with starting panels, pulleys, &c. Particulars from the Tramway Manager, and tenders to the Town Clerk.

RIVER PLATE.—The River Plate Electricity Co. has acquired an extensive site at the port of Ensenada, near La Plata, upon which they propose to erect a new generating station.

SOUTHAMPTON.—The recommendation of the Electricity Department to carry out large electrical extensions has been passed by the Council, and an application will be made to the Local Government Board for a loan of £13,000. The new plant will include a 1,000-kw. D.-C. generator, 300-kw. two-phase alternator (50 periods), 200-kw. motor alternator, and a boiler. In addition, the Tramways Department are increasing their rolling stock by 14 cars.

TORQUAY.—The Corporation electric supply mains are to be extended to Chelston at an estimated cost of £3,000.

WIMBLEDON.—Tenders are to be invited for the pipe work required for the horizontal "Curtis" turbine to be installed by the B.T.-H. Co., Ltd.

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Miscellaneous

AUSTRALIA.—Tenders are invited for (*a*) telephone switchboard by the Deputy Postmaster-General, Sydney, by March 9th; (*b*) supply of iron and steel poles by the Deputy Postmaster-General, Perth, March 15th. Specifications, &c., may be seen at the office of the Commonwealth in London, 72 Victoria Street, S.W.

CANADA.—A scheme for municipal tramways has been voted upon favourably in Toronto. There is an alternative proposal to grant permission to the Toronto Street Railway Co., to undertake the scheme, which is to be partly in a subway and partly on the surface.

CHESTER.—Five regenerative tramcars are to be converted to the old type of equipment at an estimated cost of £400. The Tramways Manager states that the coils of the new cars under the regenerative system had been a continual source of expense, and their frequent burning out was a source of considerable annoyance.

GRIMSBY.—Tenders are invited by February 19th for the supply of 80 flame arc lamps. Particulars from Mr. W. A. Vignoles, Borough Electrical Engineer. (See an advertisement on another page.)

LONDON: *Marylebone.*—Tenders are invited for various electrical stores during the year, commencing April 1st, 1910. (See an advertisement on another page.)

WEST HAM.—Tenders are invited by February 17th for the annual supply of indiarubber-covered wires and cables; electrical fittings and accessories (including conduits); house service cut-outs; house service A.C. watt meters; engine room stores; and chemicals. Particulars from the Borough Electrical Engineer, and tenders to the Town Clerk.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

W.—Secondary school for boys and one for girls (200 places each), Chiswick. H. G. Crothall, architect, Middlesex Education Committee, Guildhall, S.W.

N.E.—Electric theatre, High Road, Leytonstone. Emden, Egan & Co., architects, Lancaster Place, Strand, W.C.

Electric theatre, Mare Street, Hackney, for the International Electric Theatres, Ltd.

E.C.—Offices, &c., Lombard Street, City. J. Carmichael, builder, Wandsworth, S.W.

E.—Fire station (£11,150), Bromley-by-Bow. H. L. Holloway, builder, Church Street, Deptford, S.E.

S.W.—Headquarters for 7th London Brigade, Royal Field Artillery, High Street, Fulham. Architects, Dunnange & Hartmann, 10 Lancaster Place, S.W.

Electric theatre, junction of Garratt Lane, Wandsworth, S.W., and Algarne Road, Wandsworth, for the London Concessions & Construction Syndicate, Ltd.

S.E.—Hall at Training College, Woolwich, S.E. (£2,000). Architect, Education Committee, L.C.C.

PROVINCES.

CREWE.—Training college (£22,990). C. W. Davenport, builder, Stockton Heath, Warrington.

CARDIFF.—Extension to Wesleyan Sunday School, Cathays (£1,200). Architect, Henry Budgen, 95 St. Mary Street, Cardiff.

CHELMSFORD.—School, Trinity Road (£13,480). Architects, C. & W. H. Pertwee, Chelmsford.

DURHAM.—Theatre (£10,000). Architects, Marshall & Tweedy, Newcastle.

EAST HAM.—Swimming bath with 12 slipper baths and residence for superintendent, East Ham (£1,500). A. H. Campbell, engineer, East Ham Corporation.

FOLKESTONE.—Extension to library, Grace Hill (£3,500). A. E. Nichols, borough surveyor, Folkestone.

GLASGOW.—School, Stranraer (£4,500). Architect, H. & D. Barclay, 245 St. Vincent Street, Glasgow.

Catholic Apostolic Church (£1,500). Architect, Leiper & McNab, West George Street, Glasgow.

HARROGATE.—Additions and alterations to Prince of Wales Hotel (£4,940). Architects, Richardson & Bell, Wakefield.

LIVERPOOL.—Hall and rink (£3,000). Architects, Pritchard & Clegg, 77 Lord Street, Liverpool.

STOURBRIDGE.—Hospital. Architect, H. E. Foulks, Hayley Street, Stourbridge.

UXBRIDGE (MIDDLESEX).—School, Cowley Road. Architect, H. G. Crothall, Education Committee, Guildhall, Westminster, S.W.

The Electrical Trades' Benevolent Institution.—In the list of names of the members of the organising committee of the Electrical Trades' Benevolent Institution Second Festival Dinner, published on page 67 of our last issue, the name of Mr. F. B. O. Hawes (National Electrical Manufacturers' Association) had been omitted.

TENDERS RECEIVED AND ACCEPTED

BEXHILL.—The following tenders have been accepted: Concentric cables for private lighting, Messrs. Callender's Cable & Construction Co., Ltd., £118; street lighting cable, Messrs. Siemens Bros. & Co., Ltd., £103.

ECCLES.—The Council have accepted the tender of the British Westinghouse Co. for a 150-kw. Belliss-Westinghouse traction set at £856. They have also accepted the tender of the Globe Electric Co., Ltd., at £133, for the electric wiring and fitting of the new Beech Street Council School.

LONDON: *London County Council.*—The following tenders have been accepted:—Electric insulating materials:—F. Wiggins & Sons; Micanite & Insulators Co., Ltd. Arc lamp carbons:—W. Geipel & Co.; Ship Carbons, Ltd. Electrical fittings:—British Electrical & Manufacturing Co.; General Electric Co., Ltd.; Messrs. Siemens Bros. & Co., Ltd.; Messrs. Siemens Bros.' Dynamo Works, Ltd.; Verity's, Ltd. Electric lamps:—British Tungsten Lamp Co., Ltd.

A contract has been entered into with Messrs. Hadfield's Steel Foundry Co., Ltd., for the supply of special tramway trackwork, at an estimated cost of £15,500.

The tender of Messrs. Edison & Swan United Electric Light Co., Ltd., for the wiring material for the Abbey Wood and Hammersmith car sheds, and the Woolwich sub-station, has been accepted at £281 11s.

The tender of Messrs. J. A. Bremner & Co. has been accepted for the supply of machinery oil to the Greenwich power house for the year to January 31st, 1911.

SALFORD.—The Council has placed an order with the British Insulated & Helsby Cables, Ltd., for non-fouling trolley wire for the Tramway Department at 8 $\frac{5}{16}$d. per lb.

STALYBRIDGE.—The Stalybridge, Hyde, Mossley & Dukinfield Tramways and Electricity Board has ordered four "Bennis" stokers and compressed air furnaces for 8 ft. 6 in. Lancashire boilers at their Tame Valley generating station.

APPOINTMENTS AND PERSONAL NOTES

A resolution of the Bridlington Electricity Committee to appoint the resident Electrical Engineer, consulting engineer for extensions exceeding £200 in value, at a commission of 1 per cent., was defeated at the last meeting of the Council. The opinion was expressed that if Mr. Beckett's salary was not sufficient to cover the whole management of the undertaking, including extensions, it should be increased.

It is announced that a number of important changes have been made in the Toronto Electric Light Co. Mr. J. J. Wright, who has been General Manager for 27 years, has been appointed second Vice-President and Consulting Engineer, whilst Mr. H. H. Macrae will assume the General Managership.

The salary of Mr. A. M. Mulliner, assistant electrical engineer to the Eccles Corporation, has been increased from £130 to £135 per annum. There are to be annual increases of £5 to a maximum of £150.

A.E.G. Turbo-Alternators.—In the article on these machines in our last issue (page 58), it was stated that they were supplied in this country by the Electrical Co., Ltd. We are, however, informed that the turbo-generator business was taken over on Jan. 1st by the A.E.G. Electric Co. (121-125 Charing Cross Road, W.C.), to whom inquiries for heavy plant, power installations, &c., should be directed. The Electrical Co., Ltd., retain the wholesale business, supplying lamps, fittings, and other electrical accessories and materials to electrical contractors, electricity supply companies, and electrical wholesale houses.

The Paris Floods.—During the last few days there has been a gradual receding of the water, although it will be some considerable time before the streets are clear of water. The Metropolitain has suffered severely, and parts of the flooded tunnels, especially those in course of construction, are a source of anxiety, as fresh subsidences are reported. Pumps are, however, already at work, but the clearing of the tunnels from water will be a work of time, as there is no other course than to pump it up to the street level. According to the *Times*, the interruption to the electric light service still continues. The cables in the principal power stations are under water, and there is no prospect of any improvement for the next few days. The main boulevards, as well as the majority of the principal thoroughfares, are in semi-darkness, and many theatres and restaurants complain of their consequent losses. The performances at the Opera House have been abandoned, but those at the Comédie Française and the Opera Comique have been continued by their emergency installations on the premises. Both banks of the river are now almost without any uniform or efficient light, with the exception of a few favoured quarters in the Bois de Boulogne district. There is also considerable interruption of the telegraph and telephone services by the underground sections having been flooded. The telephone service is practically stopped, but the situation in this respect is now less acute. Damage has been done also to tramway tracks in various places, and some lines will have to be relaid. The reports as to the insecurity of the Eiffel Tower are stated to be unfounded.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £62 to £62 10s. per ton (last week, £62 10s. to £63).

"IGRANIC" COMPETITION.—The Adams Manufacturing Co., Ltd., of 106 New Bond-street, London, and Bedford, recently offered a prize for the best definition of their trade mark, "Igranic." An enormous number of replies were received, and they submitted a selected number to Mr. Frank Broadbent, who has made his award to Mr. Alfred Cockburn, 9 St. George's Square, London, S.W. The following is the winning definition :—

Inspires confidence.
Gives satisfaction.
Requires no attention.
Acts automatically.
Never goes wrong.
Is immensely popular.
Combines cheapness with efficiency.

The Adams Manufacturing Co., Ltd., point out that the word "Igranic" is a coined word, and has no special definition or derivation.

LIQUIDATIONS, BANKRUPTCIES, WINDINGS UP, &c.—The first meetings of creditors and shareholders of the "X" Syndicate, Ltd., were held on Thursday. The statement of accounts shows liabilities of £5,301, and assets £4,425, and a deficiency of £1,882 to the shareholders. The Syndicate was formed to acquire the business of the "X" Electrical Accumulator Co., Ltd. There was not a quorum present, and the meeting was adjourned.

The London Electrobus Co., Ltd., is to be wound up voluntarily. The liquidator is Mr. T. J. Garlick, 15 George Street, Mansion House, London.

CANADIAN AGENCY WANTED.—A Swiss company manufacturing electrical plant and equipment, and also specialities in turbines, variable speed motors, rivetters, drilling machines, &c., seek a competent Canadian resident agent to introduce their machinery. Particulars may be obtained from the City Trade Inquiries Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

COMPANIES' MEETINGS AND REPORTS

METROPOLITAN RAILWAY CO.—At the half-yearly meeting the report and accounts given in our last issue were adopted. Sir Charles McLaren, chairman of the company, who presided, referred to the North-East London Railway Bill, which asks for an extension of time for the construction of the electric railway from the City to Waltham Abbey, and stated that it had been suggested that the Metropolitan Railway Co. should practically work this line as a part of their undertaking. The Board had had this proposal under their consideration, and were of opinion that it would be distinctly to the advantage of the company. The terms were in negotiation at present.

THE YORKSHIRE ELECTRIC POWER CO.—The net profit for the year 1909 amounted to £2,664, against £717 in the previous year. The combined balance is carried forward. The receipts amounted to £25,762, compared with £18,643. Owing to the increased demand, a fourth Curtis turbine of double the capacity of the present ones, together with an additional boiler, is to be installed at the power-house. The meeting is on February 15th.

EAST LONDON RAILWAY CO.—At the meeting last week Lord Claud Hamilton said the directors hoped to be able to submit a definite proposal as to the conversion of the railway to electric traction at the next meeting in July.

Telegraph Traffic and Movements of Cable Ships.—It is hoped that the interruptions caused by the Paris floods and the snow in the north of England will soon be repaired. The El Arich route between Adona and Beyreuth was down on the 26th ult., and repaired on the 29th. The Indo-European Telegraph Co.'s line was broken between Kertch and Soukhoum Kale, and direct communication between Saigon and Bangkok was interrupted for a short while on the 31st ult. The French Cable Co.'s Môle St. Nicholas—Cape Haiti cable broke down on January 25th. The Perim-Assab cable has been down since July 8th last; the Dakar-Kinakry cable was not working on August 19th last; and the Tourane-Amoy cables are still interrupted.—The Lagos-Kotonou cable has been out of use since the 3rd ult., while the cable between Makassar and Balikpapan has been in need of repair since the 19th ult.—The c.s. *Colonia* has been engaged on the diversion of the Commercial Cable Co.'s Canso cable to St. John's, Newfoundland, and has had the assistance of the c.s. *Mackay Bennett*. The new cable, when opened, will be worked for the present to Canso, as hitherto.—Much bad weather has prevailed on the Canadian side of the Atlantic, rendering the work of the ships very difficult. The cable steamer *Minia* of the Anglo-American Cable Co. attended to a repair necessary off the Cape Breton coast, and also repaired a break in the cable between Halifax and Rye Beach, belonging to the Direct United States Cable Co.—The French Telegraph Co.'s Atlantic section between St. Pierre and Cape Cod had to be attended to, and the *Contre-Amiral Caubet* has sailed accordingly.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."]

CENTRIFUGAL PUMPS.—A new catalogue from Messrs. Balcke & Co., Ltd., describes, with the aid of excellent illustrations, a considerable range of high lift and low lift centrifugal pumps, suitable for direct coupling to electric motors, and other methods of drive. Complete tables of dimensions, speeds, capacities, prices, weights, &c., are given, and the pumps are made both in horizontal and vertical forms, from the smallest up to the very largest sizes.

FRICTION CLUTCHES, &c.—We have received from Messrs. David Bridge & Co. (Castleton Ironworks, Manchester), a reprint of an article describing the friction clutch, in which this firm has specialised for about twenty years, and which is in extensive use for driving all kinds of machinery in sizes up to 3,000 h.p. Its power of taking up the load gradually renders it particularly suitable to gas-engine drive. The clutch is of the expanding internal-drum type, and is worked by a sliding collar through an ingeniously arranged toggle gear. Messrs. D. Bridge & Co., who have also a London office at 35 Queen Victoria Street, are also well-known as specialists in rubber, gutta-percha, and balata machinery.

SHUNT-REGULATING RHEOSTATS.—A sheet from the Solenoid Regulator Co. (John Bright Street and Severn Street, Birmingham), contains a price list of shunt regulators, with conveniently arranged tables of maximum and minimum currents and total resistances which enable the size required to be picked out and the price ascertained.

SMALL DYNAMOS AND MOTORS.—We have received from the Small Power Dynamo & Motor Co., Ltd. (Old Lane, Openshaw, Manchester), a leaflet giving prices of continuous-current motors and dynamos from $\frac{1}{2}$ to 3 h.p., and 25 to 50 kw. respectively. These machines are made in the ventilated, enclosed, and semi-enclosed patterns, and a full line of accessories, including starters and regulators, is included. A useful feature is the list of spare parts with separate prices.

CALENDAR.—An artistic calendar is being sent out by the Jandus Arc Lamp & Electric Co., Ltd. (Hartham Road, Holloway), on which is a fine three colour reproduction of a portrait of Sir Thomas Lawrence.

Messrs. Venner and Co., 6 Old Queen Street, Westminster, are issuing to their friends this year a gift in the form of an ash-tray, in the bottom of which is an effective reproduction of an example of one of their well-known illuminated signs. We are asked to state that, due to their limited number, it is impossible to send one of these trays to anyone except the firm's customers, but if there are any of our readers who are customers, and have not received one, a tray will be sent to them on application.

Dublin Electrical Contractors' Association.—The annual dinner was held on Thursday last at Dublin, Mr. C. Cummins presiding. In his speech the Chairman stated that as all the subscriptions for Dublin, if it were a section of the London Association, would go to London, it was thought better to keep Dublin distinct, and not affiliate it.

The National Electrical Manufacturers' Association.—This Association has again been active in the interests of firms sending in tenders for municipal contracts. It appears that a large municipality recently issued an advertisement asking for tenders for certain electrical goods, a fee having to be paid for the specification, which fee was not to be refunded. The matter was taken up with the Town Clerk by the Association, with the satisfactory result that the amounts are to be refunded to all firms who have sent in *bonâ fide* tenders.

OFFICIAL ANNOUNCEMENTS AND SMALL ADVERTISEMENTS.

Official Advertisements are charged at the rate of **9d.** per line (column width).

Small Prepaid Advertisements of Situations Vacant and Wanted, Plant for Sale or Wanted, &c., are inserted at the rate of **1/-** for the first 12 words and 1d. per word afterwards. Three insertions for the price of two. Advertisements can be received up till Wednesday morning first post.

Letters should be addressed to THE KILOWATT PUBLISHING CO., LTD., 203-6, Temple Chambers, London, E.C.

CORPORATION OF BLACKPOOL.

ELECTRICITY DEPARTMENT.

THE ELECTRICITY COMMITTEE invite Tenders for approximately 2,500 yards of .5 Low Tension Single Cable suitable for a working pressure of 600 volts.

Particulars can be obtained upon application to

C. FURNESS,
Borough Electrical and Tramways Engineer.

Electricity Works

For further Small Advertisements, see p. viii.

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ELECTRICAL ENGINEERING

NO. 163 [VOL. VI., NO. 6] THURSDAY, FEBRUARY 10, 1910. [PRICE ONE PENNY.
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"ELECTRICAL ENGINEERING," ALTHOUGH THE CHEAPEST ELECTRICAL PAPER (PRICE **1d.** WEEKLY), CONTAINS THE MOST USEFUL AND PRACTICAL ARTICLES, THE BEST ILLUSTRATIONS, AND THE LATEST NEWS. IT IS READ BY THE LEADING ELECTRICAL ENGINEERS, AND IS REGARDED AS A RELIABLE AUTHORITY IN ALL MATTERS CONNECTED WITH THE ELECTRICAL INDUSTRY.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

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Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON AND WESTMINSTER BANK (Temple Bar Branch).

A SUPPLEMENT "ELECTRICAL ENGINEERING IN MINES" IS INCLUDED (GRATIS) IN "ELECTRICAL ENGINEERING" ON THE FIRST THURSDAY OF EVERY MONTH.

BINDING "ELECTRICAL ENGINEERING." — Vol. V. of "Electrical Engineering" (Jan.—Dec. 1909) closed with our issue of Dec. 30. An index for the volume is now ready, and copies may be ordered from any newsagent or bookseller at the price of 1d. each (or post free, 2d.). Binding Cases, including index, are also ready, price 2s. each, post free 2s. 4d. (Abroad 2s. 6d.) Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to us, carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad.

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SUMMARY

WE are able to contradict the report that there is to be a wholesale displacing of electric light by high-pressure gas in the street lighting of Berlin. (Page 83.)

IN view of the large number of different makes of metal filament lamps now on the market in this country, we have compiled an article giving particulars of the various sizes obtainable from each maker or supplier, and including other information about the lamps. An announcement is made of the improved efficiencies now obtainable with some of the Osram lamps, and particulars appear of several new British-made lamps. Over twenty makes are dealt with, including the latest varieties of the tantalum lamp as well as those with tungsten filaments. (Page 85.)

WE publish in this issue the first of a series of articles (which will appear monthly) describing new designs of electrical supplies and accessories. In the section devoted to fittings, switches, and accessories, descriptions are given of some fittings specially designed for tantalum lamps, a cartridge fuse, some wireless cluster fittings, an arrangement for earthing switch-covers, a locking lampholder, an ironclad switch, some plugs, &c., and also some notes on screwing conduits. Four makes of arc lamps are described, and among heating and cooking apparatus are given notes on a complete cooking outfit, a series of radiators, and a pilot-lamp adaptor for flat-irons. Electric bells are also dealt with, and other apparatus described includes portable vacuum cleaning outfits and electrically-driven pumps. (Page 89.)

AMONG the features of interest in the electrical installation of Messrs. D. H. Evans & Co.'s new premises in Oxford Street is a cable-trough at the back of the main switchboard, from which the separate cables are brought out opposite their respective terminals. The main lighting is by enclosed arcs, and show-windows and show-cases are illuminated from the outside only, a neat form of reflector box being employed for the latter. Power applications include lifts, parcel conveyors, and a very complete ventilating equipment combined with an ozone generator. (Page 95.)

A NEW high-pressure blow-off valve and a specially designed feeder pillar for use on electric capstan circuits in tropical climates are described on page 96.

WE publish extracts from a correspondence between Mr. E. Garcke and the Secretary of the Institution of Electrical Engineers regarding the duties of the Institution to the electrical industry. (Page 97.)

A LETTER from the manager of the Meter Department of Simplex Conduits, Ltd., continues the correspondence regarding the novelty of the Adnil combined lighting and power meter. (Page 97.)

THE hearing of the action between the Donnersmarckhütte and the Electric Construction Co. with regard to the Ilgner patent for the electric driving of reversing rolling mills was concluded last week, but

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Mr. Justice Parker has reserved judgment. In the course of the proceedings particulars were given of the automatic regulator used by the E.C.C. at the Hickman Works. Evidence was given by Mr. H. F. Parshall, Prof. B. Hopkinson, and Mr. W. M. Mordey to the effect that there was no subject-matter in the Ilgner patent, and Mr. Ferranti also gave evidence. Summing up the case, Mr. Walter claimed that the utilisation of flywheel effect without a drop in the voltage supplied to the working motor was the result of the combination of the Ward-Leonard and Ferranti ideas, and the combination was therefore subject-matter for a patent. (Page 98.)

A NOVEL process for depositing metal films on metallic surfaces was described by Mr. A. Rosenberg before the Royal Society of Arts last week. This consists of the use of powders, the constituents of which vary according to the metal to be deposited. The powder is applied to the article to be plated by means of a wet sponge or brush and rubbed on. It has been found that even nickel can be deposited in this way. (Page 99.)

WE give details of the agreement between the Postmaster-General and Marconi's Wireless Telegraph Co., under which the ship and shore stations of the latter are transferred to the former for £15,000. (Page 99.)

AMONG the Specifications published by the Patent Office on Thursday last was one by Mr. Miles Walker for an exciter for supplying alternating current to the rotors of large induction motors to enable them to run at unity power factor or to take a leading current. The machine can also be used for exciting a synchronous generators.—W. Schmahl, of the Armorduct Manufacturing Co., has protected a flexible cable for portable apparatus, in which the outer covering consists of a braiding of rubber-covered cord, and also a water-tight conduit inspection fitting with an elastic packing round the box edge.—An insulator with an oil-cup which can be lowered down the pin for cleaning is covered by H. Dagnall, of Messrs. Bullers, Ltd.—The grant of a patent to W. Borchers for improvements in the electric smelting of titaniferous iron ores is opposed.—Application has been made for the revocation of a patent by J. D. Taylor for an automatic block signalling system.—An important patent for a motor control system in which resistances are inserted into the motor circuit between the successive changes in series-parallel control, and for a controller with an auxiliary resistance drum, expires to-morrow after the full life of fourteen years. (Page 100.)

A 600-KW. mixed-pressure turbine has been installed at Burslem.—A 550-kw. exhaust-steam turbo-generator has been installed at Darlington.—The Edinburgh electric lighting accounts for 1909 show a profit of £2,071.—Gillingham Council are to co-operate in the promotion of a Bill seeking electric wiring powers.—Hastings Corporation have agreed to put their proposed wiring powers in the hands of contractors.—Trailer cars have been sanctioned, as an experiment, upon the L.C.C. tramway system.—Macclesfield Council have decided not to put their Electric Lighting Order into force.—The "Norwich" system of charging is being tried at Redditch. (Page 101.)

EXTENSIONS are contemplated at Hanley and Grays. New mains are to be laid at Bradford, and the cooling plant at Eastbourne is to be enlarged. A tramway scheme at an estimated cost of £25,000 is to be carried out at Bacup; tramway extensions are also to be put in hand at Doncaster and Newport. Electrical stores are required at Wolverhampton, Leeds, Blackburn, Hornsey, St. Pancras, Hammersmith, Bermondsey, and Ilford. Battery plates are required at Kettering; condensing plant at Heckmondwike; motors at Glasgow; and pipe-work at Wimbledon. (Page 101.)

A 3 PER CENT. dividend is recommended on the ordinary shares of the Baker Street & Waterloo Railway Co.; 1¼ per cent. by the Great Northern, Piccadilly & Brompton Railway Co.; and ¾ per cent. by the Charing Cross, Euston & Hampstead Railway Co. The full dividend is recommended on the 4 per cent. guaranteed stock of the District Railway Co. The Liverpool Overhead Railway Co. shows a net profit of £8,965 for the past half-year. Both the City & South London Railway Co. and the Great Northern & City Railway Co. show an increase of passengers carried during the past half-year. Dividends are declared by a number of London electric supply companies. (Page 104.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, FEBRUARY 10TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, Westminster. "Losses off Transmission Lines due to Brush Discharge, with Special Reference to the Case of Direct Currents," by E. A. Watson.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science. "The Elementary Graphics of Alternating Currents," by T. Tomlinson.

SATURDAY, FEBRUARY 12TH.

Institution of Electrical Engineers: Glasgow Section.

7 p.m. Annual Smoking Concert at "The Grosvenor."

Birmingham and District Electric Club.

7 p.m. At Colonnade Hotel, New Street. "The Electric Incandescent Lamp: its Manufacture and Application," by J. Findlay.

Central Technical College Old Students' Association.

7.30 p.m. Annual Dinner, at Trocadero.

Junior Institution of Engineers.

7.30 p.m. Anniversary Dinner at Hotel Cecil, London.

TUESDAY, FEBRUARY 15TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal Technical School. Discussion on "Gas *v.* Electricity for Heating and Power Purposes."

Electro-Harmonic Society.

8 p.m. Concert (Ladies' Night) at Holborn Restaurant.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. Continuation of discussion on "Glare: its Causes and Effects."

WEDNESDAY, FEBRUARY 16TH.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. At the University. (1) "The Influence of Various Cooling Media upon the Rise in Temperature of Soft Iron Stampings," by R. D. Gifford. (2) "Equitable Charges for Tramway Supply," by H. E. Yerburg.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At 92 Victoria Street, London. "Alternating *v.* D.-C. Supply for Sub-stations," by H. W. Gregory.

THURSDAY, FEBRUARY 17TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. "Electric Clocks," by F. Hope-Jones.

STREET LIGHTING IN BERLIN

THERE is a mistaken impression in this country that the municipality of Berlin have been replacing electric light for street lighting by high-pressure gas; and in fact statements have actually been made on one or two occasions that in future all the streets in Berlin are to be lighted by high-pressure gas. We are in a position to inform our readers that the report is entirely erroneous, and that, on the contrary, a decided increase in the use of flame arc lamps for street lighting in Berlin may be expected shortly. It is true that high-pressure gas lighting has been extensively used, and is being adopted in the streets that have hitherto been lighted by gas, but there is to be no wholesale displacing of electric light. In considering the matter, moreover, it must not be forgotten that the gas works in Berlin are under municipal control, while electricity is being supplied to the town by a private company.

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METAL FILAMENT LAMPS

THERE are now so many metal filament lamps on the market in this country that it has appeared to us that an article would be useful, setting forth clearly the sizes of lamps now obtainable and some general particulars concerning them. The demand for lamps, especially of the lower candle powers at 200–250 volts, still enormously exceeds the supply, and although makers are rapidly fulfilling back orders, yet delays in delivery are still unavoidable, lamps should be requisitioned well in advance, and customers will still have to be patient and to refrain from insisting on definite promises as to dates.

The information which we give in this article has been obtained from the various firms of lamp makers and suppliers, who have in nearly all cases been very willing to impart it, and every effort has been made to render these notes as accurate and complete as possible. While it does not cover every make of metal filament lamp on the market, yet we believe that there are few firms other than those mentioned who are actually in a position to accept large orders.

In quoting the candle-powers of the lamps we have not consistently given British candle-power, as in a large number of instances the makers and suppliers have adopted the rating in Hefner candle-power, which should be reduced by 10 per cent. in comparing with British candle-powers. In some cases the suppliers, we regret to say, are very vague as to whether Hefner or British candle-power is intended. Whenever the watt rating is mentioned, we recommend that this should be employed when ordering.

Osram Lamps.

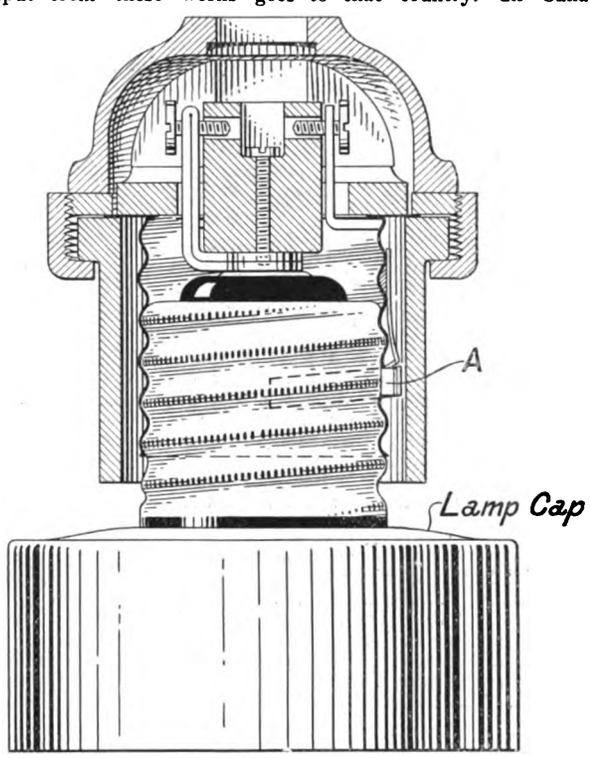
The most important announcement we have to make is an improvement in the efficiency rating of some sizes of Osram lamps. In a new four-page list which the General Electric Co., Ltd., publish in our advertisement pages this week, it will be seen that the 200-260-volt, 50 Hefner candle-power lamp (45 British candle-power) now only consumes 55 watts instead of 63 watts as formerly, and that the 100-135-volt lamps are now rated at one watt per Hefner, with the exception of the 16-c.p. size, which takes 17 watts. In spite of these higher efficiencies, the average life of the lamps is 1,500 to 2,000 hours, and the makers announce that the decrease in light after 1,000 hours burning is less than 5 per cent. Many cases of extremely long life have been noted; we may mention in particular a 100-c.p. 200-volt lamp at the Stafford Electricity Works, which, the General Electric Co. were informed last November, had been burning 14,000 hours.

A large range of sizes is now made. For 25 volts there are three sizes, 10, 16, and 25 watts, consuming 1 watt per Hefner candle-power; the first two sizes are 4 in. long in ordinary bulbs, or 2½ in. diameter in spherical bulbs. The 50-55-volt lamps are in five sizes, from 13 to 55 watts, and with bulbs somewhat larger as the candle-powers increase. The ordinary 100-135-volt lamps are listed in four sizes, 17, 25, 32 and 55 watts respectively; the 17-watt lamp has 16 Hefner or 14·5 British candle-power, and the bulb is 4¾ in. long for the ordinary shape, and 2¾ in. diameter when of spherical shape. There are three sizes of ordinary lamps made for 150 volts, and three sizes (32, 40, and 55 watts) for 200-260 volts. The 32-watt lamp gives 25 Hefner c.p. (22·5 British), and is 5¼ in. long. All these sizes are made both in pear-shaped and round bulbs; for the last-named lamp the round bulb is 3½ in. diameter. It should also be mentioned that these high-voltage lamps are made for voltages rising in steps of five, from 200 to 250 volts, and that all are suitable for burning in any position It is unnecessary to specify this when ordering, but when lamps are required for burning in series this should be mentioned, and the "series number" should be cited if the lamps are for renewals. The watt rating is especially to be recommended in ordering series lamps, but it is clear that, in view of the large number of sizes now obtainable, series burning is rapidly being abandoned.

In addition to the ordinary Osram lamps, the General Electric Co. now supply several sizes of high candle-power, from 100 to 1,000 watts, all at 1 watt per Hefner. From the 300-watt size upwards, E.S. caps are used instead of B.C. caps, and for the 600 and 1,000 c.p. a special E.S. cap and holder is employed, which we illustrate in the next column. The thread of the lamp cap is milled, and a V-shaped piece of metal (*A*) in the holder is pressed against the milled surface of the thread by a spring, which prevents the lamp from working loose, and thus obviates the chief defect in the E.S. holder. These lamps are employed in several places in lieu of arc lamps, and in Hammersmith, for instance, 400-watt Osrams are replacing arc lamps for street lighting.

Several sizes of candle lamps are now obtainable.

We have been shown some colossal figures of deliveries of Osram lamps from the works during the last month, but still larger figures for the demand. Some delay is still occurring in delivery, in consequence, particularly in the 200-volt sizes, but it is hoped that in a very short time it will be possible to deliver back orders from stock. The Hammersmith lamp works are now doing a good share of the manufacture, and owing to preferential Customs tariff in Canada, a large proportion of the output from these works goes to that country. In Canada



Lamp Cap and Special E.S. Holder for 1,000-c.p. Osram Lamp. Scale about Four-fifths.

there is a 30 per cent. tax on electric lamps, and a further surtax on German lamps, making the duty 40 per cent. For English-made lamps, however, a preferential rebate is given, and they only pay 20 per cent. duty, so that while English lamps pay 20 per cent., Austrian lamps pay 30 per cent., and German lamps 40 per cent.

Breakages in transit are now becoming fewer and fewer. A letter received last week from the company's South African house gave the welcome information that during the past twelve months there were less than one per cent. of breakages in transit.

Tantalum Lamps.

The well-known tantalum lamp of Messrs. Siemens Bros. Dynamo Works, Ltd., is distinguished from all other metal filament lamps by its wire-drawn filament of pure tantalum, which gives it a greater durability and toughness, even if it is not quite as efficient as the tungsten filament. A striking instance of the durability of the wiredrawn tantalum filament is furnished by an incident which occurred during the Elections, when an impromptu sign illuminated by two tantalum lamps was rigged up. Unfortunately, the mast was blown down by the wind one night, and broken in two, but the lamps were found to be still burning next morning. As a general rule, the 100-volt lamps are smaller, as well as cheaper than tungsten lamps of equivalent candle-power, and the slightly lower temperature at which the filament is run gives a more pleasing quality of light, with less glare due to high intrinsic brilliancy. It was at first said that they were unsuitable for alternating currents, but the peculiar breaking up of the filament observed with alternating currents only becomes appreciable with the very thinnest filaments and on the higher frequencies, so that in nearly all cases lamps can be supplied quite suitable for alternating circuits. The tantalum lamp was early in the field with high voltages and low candle-powers, and the latest move in the latter direction was the introduction a few weeks ago of a 10-c.p. lamp for 65/120 volts.

The most recent tantalum is a candle lamp, which will soon be followed by a standard list of 2/16-volt battery lamps. With a few exceptions mentioned below, tantalum lamps are run at an efficiency of 1·7 watts per c p. From 20 to 24 volts, lamps are made for 5/10 and 16/25 c.p., and 10-c.p. lamps at various voltages from 50 to 120, while the 16-c.p. lamp is made for

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50/80, 100/130, and 140/160 volts. Between 100 and 120 volts, the 16-c.p. lamp of ordinary efficiency is not suited to alternating current, but a special lamp having an efficiency of 2·2 watts per c.p. must be used. The well-known 25-c.p. lamps are made for continuous current for 50/130, 140/160, and 200/250 volts, but for alternating currents from 50/130 volts only. The next size is 32 c.p., and this for continuous currents suits circuits of 60/160 and 200/250 volts; for alternating currents the 1·7-watt 32-c.p. lamp can only be supplied up to 160 volts, but a 2·2-watt 32-c.p. lamp is supplied from 200 to 230 volts. The largest size at present made is 50 c.p. for 100/160 and 200/250 volts. The new 10-c.p. 100-volt lamp has a bell-shaped bulb 4¼ in. long by 2⅛ in. diameter, and the larger lamps have progressively larger sizes up to 5⅞ in. by 2⅛ in. for the larger 200-volt bulb. All the sizes can be supplied in spherical or "Sun" bulbs at a slight increase in price. The new candle lamps referred to above are made from 20 to 60 volts for 5 and 10 c.p., the former of which, above 40 volts, is, however, only suitable for continuous currents. These are fitted with S.B.C. caps, and have bulbs 3⅜ in. by 1⅞ in., and 4 in. by 1⅜ in. respectively.

Mazda Lamps.

This new name, the etymological derivation of which is inscrutable, has recently been given to the well-known tungsten lamps which are made by the British Thomson-Houston Co., Ltd., at Rugby, under patented processes differing somewhat from those under which other tungsten lamps are made. The following sizes are now obtainable for ordinary supply voltages :—*100/135 volts*—20 British c.p. (25 watts), 40 c.p. (50 watts), and 100 c.p. (125 watts); *200/260 volts*—32 c.p. (45 watts), 100 c.p. (140 watts), and 200 c.p. (250 watts). Lamps from 10 to 25 c.p. are also made for 25/27·5 volts, and 50/55 volts. Lamps for series running bear a series number, and any lamps having series numbers not more than one apart may be run together.

"Z" Lamps.

A special feature of these lamps, which are made by the "Z" Electric Lamp Manufacturing Co. (Orient House, New Broad Street, E.C.) at their works near Wimbledon, is the use of a coating of a compound known as "phospham" on the centre glass pillar, with the object of preventing blackening of the bulbs. The prices are slightly less than for most other makes of tungsten lamps. The company rate their lamps in watts, and not in candle-power, but give the efficiency as approximately 1·2 watts per British c.p. The sizes are as follows : *25/30 volts*– 8/25 and 25/30 watts; *30/45 volts*—25/30 watts; *50/55 volts*—12/35 watts; *60/135 volts*—17/20, 25/55, 60/80, and 90/150 watts; *100/160 volts*—150/200 watts; *140/160 volts*—30/50, 60/80, and 90/150 watts; *200/260 volts*– 40/60, 60/80, 90/150, and 150/200 watts. All sizes are made in spherical as well as bell shaped bulbs. A description of the "Z" lamp factory appeared in our issue of May 13th, 1909.

Aegma Lamps.

The Aegma Lamp is made by the Allgemeine Elektricitäts-Gesselschaft, and is sold in this country by the Electrical Co., Ltd. (122 and 124 Charing Cross Road). The makers were among the first to overcome the difficulties of producing reliable filaments of thin enough diameter to give the required high efficiencies in sizes as low as 16 c.p. at 100 volts, or 25 c.p. at 200 volts, both of them sizes of the utmost importance for replacing carbon lamps in existing installations. The efficiencies are given as 1·1 watts per Hefner candle-power for the low-voltage lamps (20—125 volts), and 1·2 watts per H.c.p. for 200 to 260 volts. A special feature is the mounting of each filament on a copper spring, which is provided to counteract the contraction and expansion of the filament, thus minimising premature failure. The sizes listed range from 5 c.p. at 20–40 volts (a smaller size than usual), to 400 c.p. at 260 volts. A 10-c.p. lamp is made from 40 to 80 volts, a 16-c.p. lamp up to 130 volts, and the useful 25-c.p. size (taking about the same current as the old 8-c.p. carbon lamp) up to 240 volts. Other sizes are 32, 50 c.p., 100, 150, 200, 300, and 400 c.p.; the latter four sizes are supplied in round bulbs only from 100 to 260 volts.

Leuconium Lamps.

The Stearn Electric Lamp Co., Ltd. (47 Victoria Street) were early in the field with a metal filament lamp of English manufacture, to which the name "Leuconium" was given, and some time ago we described the ingenious cluster lamp which they devised for high voltages before single lamps for pressures as high as 200 volts were articles of commerce. Briefly, the idea of the cluster or "Nevaout" system is the provision on each of a number of lamp units in series of a substitutional resistance and automatic cut-in, which comes into action when the filament fails and prevents the whole series being extinguished. There is also the additional advantage that each unit can be small and inexpensive, so that premature failure of one filament does not entail discarding an expensive lamp. In addition to the lamps on this system, the company have made great progress in the manufacture of single high-voltage lamps, and, indeed, their list contains a smaller 200/250 volt lamp than is supplied by any other maker. This is a 16 British c.p. lamp taking 25 watts at 200/220 volts, and costing five shillings. For 230/250 volts the corresponding lamp is rated at 27 watts and 18 British c.p. Other lamps for 200/250 volts are 29 c.p. (40 watts), 45 c.p. (63 watts), and 90 c.p. (120 watts). The 100/120-volt lamps include one as low as 8 c.p.; the full list is as follows :—*100/110 volts*—8 c.p. (12 watts); *112/120 volts*—9·5 c.p. (14 watts; *100/120 volts*– 14 c.p. (15·5 watts), 20 c.p. (22 watts), 29 c.p. (32 watts), 45 c.p. (50 watts), 90 c.p. (100 watts). The low-voltage lamps are as follows :—*25 volts*—8, 12, and 16 c.p.; *40/50 volts*—16, 20, and 25 c.p.; *60/70 volts*—20 to 30 c.p. Twisted flame lamps are made up to 33 volts, as well as miniature carriage lighting and medical lamps.

Cryselco Lamps.

This lamp, which is one of the more recently introduced metal filament lamps of British manufacture, is made at the Cryselco Lamp Co.'s Works at Bedford, from which the well-known carbon lamps of that name have been for some time turned out. We are informed that the following standard sizes can be delivered from stock :—*25 volts*—8 c.p. (11 watts), 10 c.p. (13 watts), 12 c.p. (15 watts), and 16 c.p. (20 watts): *50/60 volts*—8 c.p. (11 watts), 12 c.p. (15 watts), 16 c.p. (20 watts), 25 c.p. (32 watts), and 32 c.p. (40 watts); *100/110 volts*—16 c.p. (20 watts), 25 c.p. (32 watts), 32 c.p. (40 watts), 50 c.p. (65 watts), 100 c.p. (130 watts); *200/250 volts*—25 c.p. (35 watts), 30 c.p. (40 watts), 40 c.p. (55 watts), 50 c.p. (65 watts), 100 c.p. (130 watts), 200 c.p. (260 watts). The bulbs, of course, vary in size, but it may be said that the 100-volt 16-c.p. lamp is 4¾ in. long, and the 200-volt lamps from 25 to 50 c.p. are 5⅞ in. in length. Among special lamps are 12, 16, and 24-volt train lighting lamps of 8, 10, 12, or 16 c.p., in 2 in. by 3 in. bulb. Candle and tubular lamps can also be obtained up to 110 volts. All the above are British candle-powers.

Sunbeam Lamps.

These lamps are manufactured by the Sunbeam Lamp Co., Ltd., at their works at Park Road, Gateshead. The standard sizes are as follows (British c.p.) :—*25 volts*—8/12 c.p. (10/15 watts), 12/16 c.p. (16/20 watts), 20/25 c.p. (25/32 watts); *50/55 volts*—10/12 c.p. (13/15 watts), 12/16 c.p. (16/20 watts), 20/25 c.p. (27/32 watts), 28/32 c.p. (35/40 watts); *60/80 volts*—14/20 c.p. (18/25 watts), 22/25 c.p. (27/32 watts), 28/32 c.p. (35/40 watts); *100/135 volts*—14/20 c.p. (18/25 watts), 23/25 c.p. (28/32 watts), 28/32 c.p. (35/40 watts), 40/50 c.p. (50/63 watts), 80/100 c.p. (100/125 watts), 150/200 c.p. (220/250 watts), 250/300 c.p. (330/375 watts), 350/400 c.p. (450/500 watts); *150/155 volts*—28/32 c.p. (35/40 watts), 40/50 c.p. (50/63 watts); *200/260 volts*—22/25 c.p. (32/35 watts), 32/35 c.p. (40/45 watts), 40/60 c.p. (56/75 watts), 80/100 c.p. (125/140 watts), 150/200 c.p. (220/250 watts), 250/300 c.p. (330/375 watts), 350/400 c.p. (450/500 watts). Candle lamps are also made for 25, 33, and 50 volts up to 16 c.p.

Auriga Lamps.

The lamp known by this name is supplied by the British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester). Among the sizes made, taking only the most usual voltages, are the following :—*25 volts*—9 c.p. [British] (11 watts), 14 c.p. (18 watts), and 22 c.p. (28 watts); *50 volts*—8 c.p. (11 watts), 14 c.p. (18 watts), 18 c.p. (20 watts); *100/110 volts*—14 c.p. (18 watts), 18 c.p. (22·5 watts), 25 c.p. (30 watts), 45 c.p. (55 watts), and 100 c.p. (125 watts); *200/250 volts*—22 c.p. (30 watts), 28 c.p. (40 watts), 45 c.p. (63 watts), 100 c.p. (140 watts). The 100-volt lamps up to 25 c.p. are in pear-shaped bulbs, 120×55 millimetres; a 135×64 mm. bulb is used for the 100-volt 45-c.p. lamp and the two smaller sizes of 200-volt lamp; the 45-c.p. 200-volt lamp is of slightly larger diameter, and the 100-c.p. lamps have round bulbs 160×120 mm. 24-volt lamps, chiefly intended for train lighting, in round bulbs 73×47 mm., are also made for 8 c.p. (10 watts), 10 c.p. (12·5 watts), and 12 c.p. (15 watts).

Metfil Lamps.

The "Royal Ediswan Metfil" lamp is made throughout at the Edison & Swan United Electric Light Co.'s works at Ponders End, Middlesex, where the experience of many years of lamp-making has been brought to bear on overcoming the difficulties of metal filament manufacture and mounting, and a special process has been developed. A very large number of sizes and forms have been standardised, and these are all rated in British candle-powers. For 25 volts six sizes are made, ranging from 8 to 30 c.p., in bulbs 4 in. overall by 2¼ in. diameter. Lamps of moderate c.p. are also listed for 50-55 volts and 60-65 volts. The ordinary 100/120-volt lamps are produced in four sizes, 16 c.p. (21 watts), 25 c.p. (35 watts), 30 c.p. (40 watts), and 50 c.p. (62 watts). These have bulbs 4½ in. long by 2⅜ in. diameter. The smallest 200/250-volt lamp is 30 c.p. (40 watts), in bulbs 5⅞ in. by 2⅜ in., and 40 c.p. (54 watts) and 50 c.p. (68 watts) lamps are also made for these pressures. 100- and 200-c.p. lamps are also made for both high and low voltage. Crinkled, tubular, olive and plain flame lamps are made in various sizes up to 50 volts, and, as has been the case for the last 20 years with carbon lamps, the company are prepared to make any special lamps to order to customers' own requirements. Standard Metfil lamps can now, we are informed, be delivered in practically any quantities from stock.

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Eclipse Lamps.

This lamp, which is being sold in this country by G. Braulik (8 Lambeth Hill, E.C.), is made by the Felten Guilleaume-Lahmeyerwerke. One of the most interesting features is the method adopted to prevent blackening of the bulbs, in spite of the high efficiency at which the lamps are run (1 watt per Hefner c.p.), by the use of a coating of a compound of phosphorus round the glass centre stem. Another feature is the inclusion in the visible centre of the neck, where the leading-in wires are sealed in, of a packing impregnated with a chemical which changes in colour with the effect of light and forms an index of the number of hours the lamp has been burning. This is of great use to contractors dealing in these lamps, as when a lamp is returned as faulty it can readily be seen whether it has been much used or not. It is important to notice that the bulbs of all the sizes are particularly small for tungsten lamps; the 100-volt 16-c.p. lamp does not exceed the ordinary carbon lamp in size, and even the 32-c.p. 220-volt lamp is not more than 4¾ in. in length, including the cap, or smaller than the 100-volt lamp of several makers. No special shades are therefore required. The list of standard sizes is too long to reproduce, but it may be mentioned that a 16-c.p. lamp is made up to 130 volts and a 30-c.p. lamp up to 250 volts. The voltages of 75, 150, and 175 are standardised in addition to the more ordinary pressure, and no less than 48 sizes of low-voltage lamps are listed from 2 volts 1 c.p. to 16 volts 22 c.p., in addition to 50 sizes between 25 and 75 volts. High candle-power lamps are made in high and low voltages up to 500 c.p., and an interesting feature of these is the grouping of the filaments in two sections, so that failure of one filament only extinguishes half the lamp.

Foster Lamps.

The most recent British-made tungsten filament to make its appearance is that which has just been put on the market by the Foster Arc Lamp & Engineering Co. (Warple Road, Wimbledon, S.W.). These lamps are made from start to finish at the Wimbledon works; the company even blow their own bulbs, and are laying down the most approved plant for manufacturing filaments. At present about 500 lamps a day are being turned out, but the company expect very shortly to manufacture about two million lamps per annum. A considerable stock is already on hand, and we are informed that good delivery can be given, and the company make a special point of being able to supply almost any shape of bulb desired by their customers. An average efficiency of 1·25 watts per British c.p. is given, but it is stated that the low-voltage lamps are more efficient than those of higher voltage. At present the following sizes are listed :— *25 volts*—10, 16, and 25 c.p.; *50/55 volts*—10, 16, 25, and 32 c.p.; *100/135 volts*—16, 25, 32, and 50 c.p.; *200/260 volts*—25, 32, and 50 c.p.

Welsbach Lamps.

A good deal of stir was caused a few months ago by the placing of a metal filament lamp on the market in this country by the Welsbach Incandescent Gas Light Co., Ltd. The lamp in question is made by a Berlin firm of considerable experience, and is at present supplied in the following ordinary sizes : *100/130 volts*—16 Hefner c.p. (17 watts), 25 c.p. (28 watts), 32 c.p. (35 watts), 50 c.p. (55 watts), 100 c.p. (110 watts); *200/250 volts*—32 c.p. (40 watts), 50 c.p. (63 watts), 100 c.p. (110 watts), 200 c.p. (220 watts); 25-volt lamps are also made for 10, 16, and 25 c.p., and 50/55-volt lamps for 12, 16, 25 and 32 c.p.

Simplex Lamps.

The metal filament lamp sold by Simplex Conduits, Ltd. (Charing Cross Road, W.C.), is also a tungsten filament lamp, and has an efficiency given as 1·25 watts per Hefner c.p., or 1·0 watt per British c.p. Test results show an increase of candle-power during the first 200 hours or so, followed by a gradual decrease, but even at the end of 1,000 hours the loss is only about 1/5 c.p., and the mean consumption works out at only slightly over 1·3 watts per c.p. The following sizes are made for ordinary voltages :—*60/130 volts*—16 c.p.; *60/135 volts* and *140/160 volts*—25, 32, 50, and 100 c.p.; *200/260 volts*—25, 32, 40, 50, and 100 c.p. All these are made in pear-shaped bulbs, and some of the larger lamps can also be obtained in round bulbs. 25/45-volt lamps are made from 8 to 25 c.p., and 50/55-volt lamps from 8 to 32 c.p. The c.p. rating is Hefner.

Boddy's "Metalik" Lamps.

A good deal of attention has been drawn to the "Metalik" lamp sold in this country by Messrs. G. M. Boddy & Co. (15 Gray's Inn Road, W.C., and Newington Buildings, Liverpool), by the publication of records of extremely long life under working conditions, the figure in one case having reached over 9,000 hours. The efficiency throughout the range is given as 1·25 watts per (British) c.p., and exceptional toughness is claimed for the filaments. The popular 14 (British) c.p. lamp is made from 60 to 135 volts, and a 22-c.p. lamp from 200 to 260 volts. The full list of sizes (in Hefner c.p.) is as follows : *25/45 volts*—8, 12, 16, and 25 c.p.; *50/55 volts*—8, 16, 25, and 32 c.p.; *60/135 volts*—16, 25, 32, 50, and 100 c.p.; *140/160 volts*—25, 32, and 50 c.p.; *200/260 volts*—25, 32, 50, 100, and 200 c.p. Candle lamps will be on the market shortly.

"M.S." Lamps.

The "M.S." Lamp Co. (74 Melrose Avenue, Cricklewood, N.W.) are one of the few firms who are supplying a lamp as low as 9 (British) c.p. for 100/125 circuits. It should also be noticed that the prices are somewhat lower than the majority of tungsten filament lamps. They also supply the following candle lamps, with S.B.C. or S.E.S. terminals : *25/80 volts*—9 and 14 c.p., and *100/130 volts*—14 and 22 c.p. Another speciality is a miniature pear-shaped lamp (2½ in. long) for *100/125 volts*—25 (Hefner) c.p., with ordinary B.C. cap. Of the ordinary lamps, 15 sizes are standardised between 25 and 80 volts, and in addition to the new 9-c.p. 100/125 volt lamp mentioned above, the following sizes (British c.p.) are made for the usual supply voltages : *80/135 volts*—9 c.p. (12 watts), 14 c.p. (17 watts), 22 c.p. (28 watts), 29 c.p. (35 watts), 45 c.p. (55 watts); *160/260 volts*—22 c.p. (31 watts), 29 c.p. (40 watts), 36 c.p. (50 watts), 45 c.p. (63 watts), 90 c.p. (110 watts). The 9-c.p. lamp has a bulb only 3½ in. long, and the high-voltage bulbs none of them exceed 4½ in. in length. We understand that low-voltage lamps can be delivered in two to three days, and those for the higher voltages in 8 to 10 days.

"Field" Lamps.

One of the latest recruits to the ranks of British-made tungsten filament lamps is the "Field" lamp, by Messrs. Feld Bros. & Co., Ltd. (25 Budge Row, E.C.). An exceptionally elastic filament is claimed, and a specially arranged double frame is provided in the case of high voltages. The efficiency is given as 1·1 watts per H.c.p., and so far the following sizes are standardised : *25 volts*—12, 16, and 25 c.p.; *50 volts*—12, 16, 25, and 50 c.p.; *100/130 volts*—16, 25, 32, and 50 c.p.; and *200/230 volts*—25, 32, 50, and 60 c.p.

Gral Lamps.

It is now some time since the Armorduct Manufacturing Co., Ltd., introduced the Gral tungsten lamp, which was among the first to appear in the lower and more convenient candle powers. With regard to the efficiency of these lamps, the makers have found as a matter of experience that the best results are obtained by proportioning the lamp in such a manner as to secure a consumption of about 1·1 watts per Hefner c.p. for low-voltage, and 1·2 watts for high-voltage after completion. The consumption after a short period, we are informed, is considerably reduced until it approximates 1 watt and 1·1 watts respectively per candle or less. A lamp constructed on this principle is stated to possess a very much longer life than a lamp in the construction of which 1 watt per candle is aimed at in the first place. The 100/130-volt lamps vary from 16 to 600 c.p., and lamps from 32 to 600 c.p. are made for 200/260 volts. The bulb of the 200-volt 32-c.p. pear-shaped lamp is 6 in. long, including the cap. Round bulbs are also made. 25- to 80-volt lamps are also made with pear-shaped or round bulbs, as well as in the plain or tungsten flame or tubular styles with small (S.B.C.) caps. Some of these may be found convenient for converting existing multiple candle fittings by wiring them for series.

"E.O.A." Lamps.

A lamp known as the E.O.A. metal filament lamp is supplied by the Electric & Ordnance Accessories Co., Ltd. (Cheston Road, Aston, Birmingham). An efficiency of 1·1 watts per c.p. is claimed, and the following are the sizes at present listed :— *25/45 volts*—8, 10, 12, 16, and 25 c.p.; *50/55 volts*—8, 10, 12, 16, 25, and 32 c.p.; *60/135 volts*—16, 25, 32, 50, and 100 c.p.; *140/160 volts and 200/260 volts*—25, 32, 50, and 100 c.p. Special as well as pear-shaped bulbs are made in the larger sizes.

"Metallum" Lamps.

The "Metallum" lamp is supplied by the Brush Electrical Engineering Co., Ltd. (Supplies Department, 106-112 Belvedere Road, Lambeth, S.E.). It has a tungsten filament made by the colloid process, and is somewhat different in appearance from the majority of makes of tungsten lamp, owing to the way the filaments are mounted at an angle with intermediate supports. In addition to a number of sizes for voltages from 20 to 80, the following are those standardised for the usual supply voltages : *100/110 volts*—14½ c.p. (British) (24 watts), 21 c.p. (30 watts), 25 c.p. (33 watts), 36 c.p. (45 watts), and 72 c.p. (90 watts); *200/250 volts*—29/36 c.p. (48/60 watts), 36/54 c.p. (60/78 watts), 72/90 c.p. (105/110 watts); *240/250 volts*—29 c.p. (48 watts). Lamps are also made for 150/155 volts. The smaller 100-volt pear-shaped bulbs are 5⅛ in. overall by 2⅜ in. diameter, and the 200/250-volt lamps vary from 6 to 6¾ in. in length. We are informed that all the standard sizes can be delivered from stock, and that any possible sort of special lamps can be made to customers' requirements.

The National Lamp.

A recently introduced metal filament of which we have been sent a sample is that supplied by the National Lighting Corporation, Ltd. (Saracen House, Cock Lane, Snow Hill, E.C.). A 16-c.p. lamp is supplied from 60 to 130 volts, in addition to those of 25, 32, 50, and 100 c.p. The 200/260-volt sizes range from 25 to 100 c.p., and sizes are also standardised for 25, 45, 50, 55, and 140/160 volts.

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SIEMENS

"TANTALUM"

METAL FILAMENT

LAMPS

20 to 25 VOLTS
10 to 50 C.P.

FOR ALTERNATING OR DIRECT CURRENT



STANDARD LAM P.



SPHERICAL LAMP.

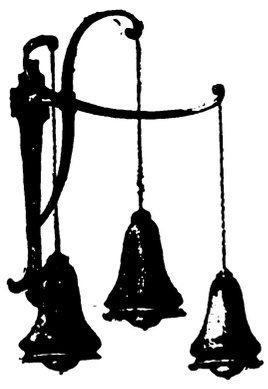
NEW ELECTRIC LIGHT FITTINGS

NUMEROUS DESIGNS IN STOCK

ESTIMATES AND DESIGNS FREE



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Polished Brass Finish.
A Massive and Artistic Wall Bracket for one TANTALUM LAMP.



S. 4679. Price **33/-** each.
Polished Brass Finish.
Neat and Effective Wall Bracket for 3 lamps.



S. 4681. Price **32/6** each.
Polished Brass Finish.
3 light Bracket suitable for fixing to Pillar or Wall.



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Another firm who has sent us particulars of metal filament lamps is the Omega Electric Lamp Co., Ltd. (Elysium Street, Fulham). The 100/120-volt sizes range from 14 c.p. (17 watts) to 50 c.p. (63 watts), and for the 200/250 volts the sizes are 22 c.p. (32 watts), 27 c.p. (40 watts), and 43 c.p. (63 watts); 25- and 50-volt lamps are also made. Any special sizes and shapes will be made to order up to 120 volts.

Messrs. J. L. Cateaux & Co. (10 Bush Lane, E.C.) have sent us particulars of the "Rugby" British-made metal filament lamp, for which they are selling agents. These are made in various sizes within the following limits:—*25 volts*—6 c.p. (7·5 watts) to 20 c.p. (25 watts); *50 volts*—12 c.p. (15 watts) to 32 c.p. (40 watts); *100/100 volts*—14 c.p. (17 watts) to 80 c.p. (100 watts); *200/250 volts*—25 c.p. (35 watts) to 200 c.p. (260 watts). Spherical as well as oblong bulbs can be supplied for any of these sizes. Candle lamps with S.B.C. caps are also made for any voltage up to 110 volts for any c.p. up to 16. The candle-power ratings are British.

NEW ELECTRICAL SUPPLIES AND ACCESSORIES

DURING the present increased activity in installation work, electric light contractors, and also consulting engineers and architects, are suffering from the need of a systematic record of the new designs of lamps, fittings, and various accessories which are being placed on the market. The lists and leaflets which they receive direct from the makers are not always kept, and are very seldom systematically filed and indexed, and a demand has arisen for something more complete and in a more collected form than the notes and short articles that appear in the various electrical papers (including our own) from time to time. To meet this want, Electrical Engineering is publishing on the second Thursday of every month a descriptive review of the new patterns, designs, and sizes of lamps, holders, switches, fittings, and other accessories, heating and cooking apparatus, bells, telephones, &c., which have been put on the market during the previous month, giving the names and addresses of the firms selling them and any other indications that will assist the buyers.

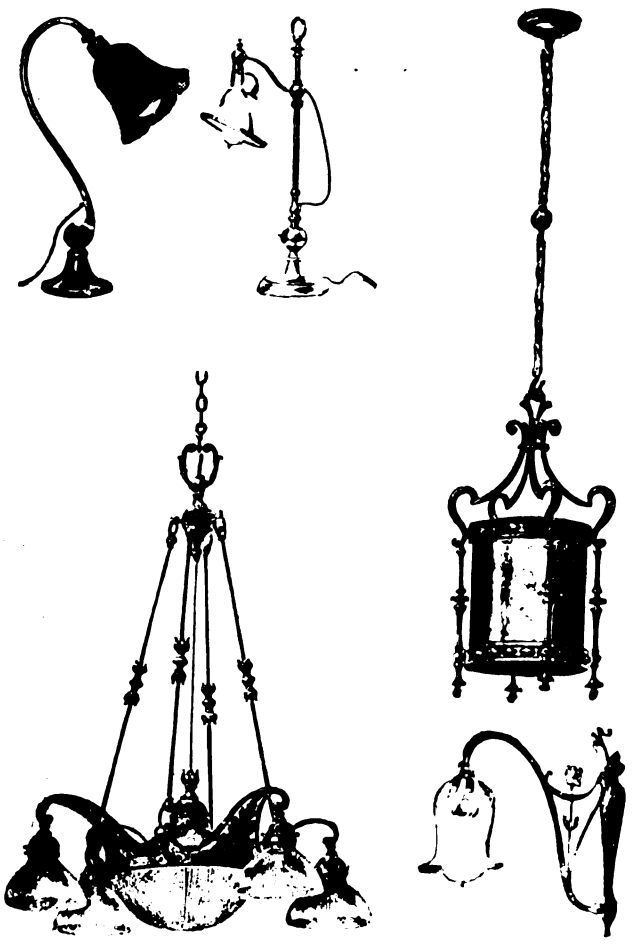
We shall be grateful if manufacturers and suppliers will help us by sending us all their new lists and leaflets as soon as published, and by keeping us very fully informed of any novelties they are bringing out as soon as they are on the market.

Incandescent Lamps.

A special article on another page deals with the subject of metallic filament lamps, and gives particulars of the leading lamps of this class, mentioning several new developments.

Fittings, Switches, and Accessories.

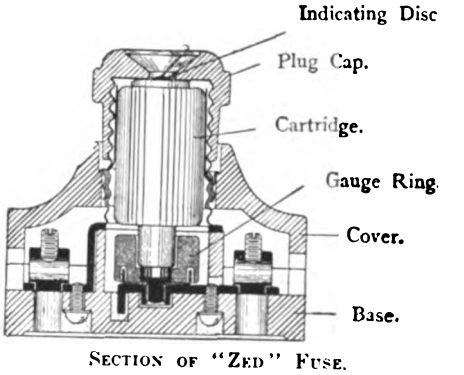
Messrs. Siemens Brothers' Dynamo Works, Ltd. (Incandescent lamp and fittings department) have of late turned an increasing amount of attention to fittings,



Some New Fittings Specially Designed for Tantalum Lamps.

particularly, of course, those adapted to tantalum lamps. Their "majolica," and "solar" fittings and "tantalum arc" clusters with holophane glassware, are now well known amongst other fittings for interior and exterior use. We have before us, however, particulars of an extensive range of entirely new designs, and are able to illustrate a few examples. We would draw particular attention to the large electrolier, using a central holophane bowl in conjunction with four holophane reflector shades, and giving a remarkably good distribution of light, free from glare. The firm also supplies numerous designs of artistic hall lanterns in antique brass, oxidised silver, or oxidised copper finish at very favourable prices. We also illustrate a special table or desk standard, provided with a swivel arrangement, in which three stops are arranged, so that the lamp may be adjusted at various angles. This is supplied in polished brass finish, and has the advantages of being cheap and easily fixed. A special adjustable desk standard supplied with opal shade is also shown. This can be obtained with a sliding bracket arm for adjusting the height of the lamp, whilst the shade and bracket arm can also be moved or adjusted at will. We think that this particular style of fitting should appeal to all who are interested in office lighting of the most up-to-date style. Numerous designs of water-tight fittings and protected hand lamps, fulfilling B.O.T. regulations, are also produced in great variety, and a number of designs of outside weather-proof lanterns are stocked.

The Siemens firms have had considerable experience with the non-interchangeable "cartridge" type of fuse, and some interest attaches to the latest form which these take, under the name of the "Zed" fuse system. The general arrangement of a typical fuse is shown in the accompanying section. A



Section of "Zed" Fuse.

special feature of the cartridges, apart from their solidity and sound construction, is the indicating device. The top of each cartridge is fitted with a small coloured metal disc or button which is clearly visible through the glass window of the plug cap when the cartridge is mounted in its fitting. When the fuse blows, a wire which holds the coloured disc in place is fused, and a small spiral spring displaces the disc, so that the position of the disc at once shows whether the cartridge is intact or has fused. To insert a new cartridge, the plug cap with the old cartridge is unscrewed, the cartridge withdrawn and the new one inserted, and the plug cap again screwed into place. Only the cartridge has to be renewed, the plug cap lasting indefinitely. Non-interchangeability of the cartridges is

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obtained by making the lower contact stud of varying diameter according to the current capacity, and providing the base of the fuse fitting with a gauge ring having a central hole of corresponding diameter into which the stud must fit. The colour of the gauge ring is different according to the current, and is the same as that of the indicating disc in the corresponding size of cartridge, so that the correct cartridge for any fitting is easily ascertained by noticing the colour of the gauge ring. The cartridges are constructed to blow with a continuous overload of about 80 per cent. in the case of the smallest size, decreasing to 45 per cent. for the 60-ampere cartridge. On a dead short, the cartridge will break the circuit instantly and without any danger of a permanent arc being established. A number of new forms of distribution board embodying these fuses have been standardised, and those desiring further particulars should write for list No. 6E.

into two groups with two switches; the third terminal in Fig. 3 is for this purpose. The saving in labour over the ordinary methods with ball fittings is manifest. Fig. 4 shows one of these wireless clusters fitted with "Sun Tantalum" lamps, Holophane reflectors, and an opal reflector shade at the top.

On the occasion of our visit to Mr. Trippe's showrooms we saw some other extremely ingenious fittings. In the case of ordinary ball fittings, it is not possible to remove the shade or reflector, if one shade is used covering the group of lamps, unless the "flex" is first disconnected from the ceiling rose. This is obviated in one type of cluster fitting with a large opal reflector, which is clamped by a split ring that can be easily unfastened, and the reflector can then be drawn down over the fitting when the lamps are taken out. Another useful device was an arrangement for group switching by means of a switch within the



FIG. 1.—ORDINARY BALL FITTING WIRED.



FIG. 2.—BENJAMIN "WIRELESS CLUSTER," OPEN.

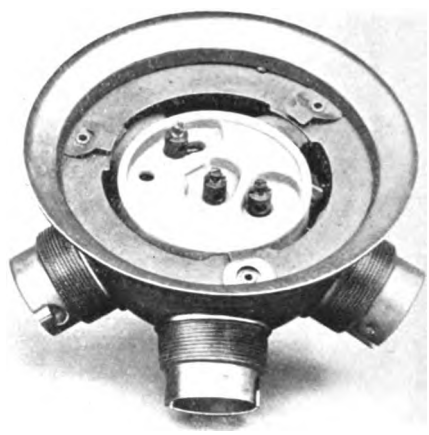


FIG. 3.—BENJAMIN "WIRELESS CLUSTER," WITH PORCELAIN TERMINAL BLOCK.

Although the Benjamin "Wireless" Cluster has been on the market for some time, there are many wiring contractors who have not realised its advantages. We have, therefore, prepared the illustration above from samples lent us by Mr. C. F. TRIPPE (36 Brooke Street, Holborn). Fig. 1 is an ordinary 5-lamp ball fitting wired with "flex"; Fig. 2 is a 6-lamp cluster fitting opened to show the solid connection pieces inside; and Fig. 3 is a cluster fitting of the same size which embodies the very latest improvement, viz., a porcelain terminal block fixed above the strip

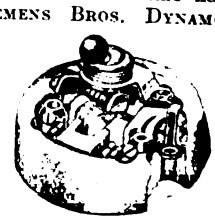


FIG. 4.—A BENJAMIN CLUSTER FITTING COMPLETE.

connections, so that the wireman has nothing to do but to connect the wires to the terminals. The connections in the so-called wireless cluster can be arranged so that all the lamps can be connected on one switch, or so that they can be divided

canopy, or the fitting itself, worked by a cord. In the fitting shown us there were three different ways in addition to the off position.

A device which has been much wanted for some time has just been introduced by Messrs. SIEMENS BROS. DYNAMO WORKS, Ltd. (Caxton House, Westminster), in the shape of the earthing attachment for switches of the tumbler type, shown in the accompanying illustration. By means of the copper strip held under a nut to the bridge piece carrying the handle and cover, the whole of the non-current-carrying parts can be earthed through one of the holding-down screws through the base to the conduit system, and all possibility of shock is avoided. Attention may also be drawn to the excellence of the switch itself, which we have found from inspection of a sample to be very easy in action, owing to the way the contact arm is interlocked with the handle.

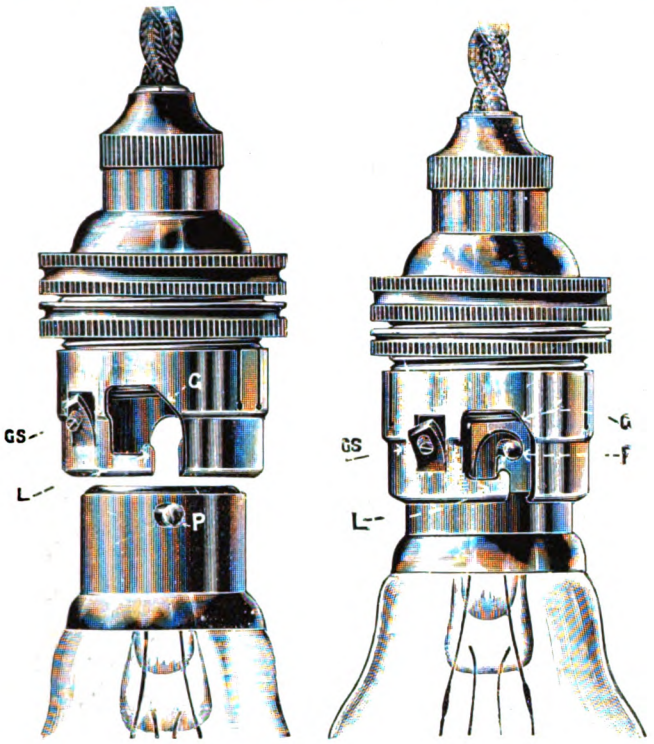


SIEMENS TUMBLER SWITCH WITH EARTHING DEVICE.

With the increasing use of expensive metal filament lamps, a greater need arises for a form of locking lampholder, from which lamps cannot be easily abstracted. A device designed for this purpose, which has just been put on the market by Messrs. W. SANDERS & Co. (Falcon Electrical Works, Wednesbury) is shown in the illustration opposite. The apparatus is screwed on the lampholder in the position shown at *A*, so that the lip *L* is near the bottom of the holder slot, and so that slots in lamp-lock, and in holder, coincide. The lamp is inserted and turned round in the ordinary way, when the pin *P* will bear against the inclined side *G* of lamplock slot, and carry the lamplock round into position as shown *C*. If it is required to prevent the lamp from being removed, the grub screw *GS* is turned until it engages the lampholder. The lamp cannot be removed while the lamplock is in the position B, but the lamp may be switched off by dropping the lamp, with its pins resting on the lip of lamplock, where it will hang on its pins in perfect safety. It will be noted that owing to the width of slit in the lamplock, the latter is not moved back into position *A* in attempting to remove the lamp. To remove the lamp, the-

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lamplock must be turned by hand from the position *C* to *B*, after releasing the grub screw *GS*. It will be noticed that the lamplock may be used to convert any standard shade carrier holder into a "switch-holder," and persons who do not mind turning a lamp in its socket will no doubt use it for this

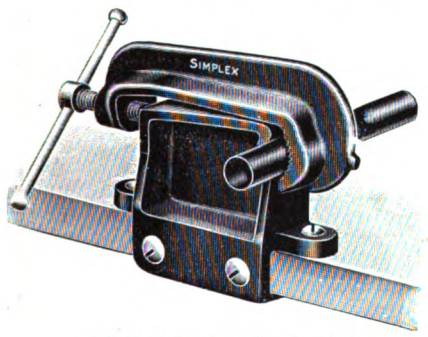


A B

Messrs. Sanders Bros.' Lamplock.

purpose. There are many cases where lamps are now removed from sockets (spoiling the appearance of fittings, and exposing the lamp to risk of breakage, or loss while lying about) to save them from being switched on when wired up with others on a switch; and in these, and many other cases, this lamplock will find a secondary use.

Simplex Conduits, Ltd. (113-117 Charing Cross Road, London, W.C.), have sent us some interesting notes with regard to the screwing of conduits. When there is trouble in threading conduit, the contractor is apt to blame the manufacturer, although frequently the wireman's tools or his methods are at fault, contributed to, perhaps, by the fact that screwing a tube in a proper manner is not such a simple operation as would



A Cheap and Simple Vice.

at first appear to be the case. A properly constructed vice is one of the first essentials, and there is no excuse for using a makeshift arrangement where a simple portable vice of the pattern illustrated, which can be readily attached to any workbench by means of four screws, and may be adjusted to take in all sizes of conduit, can, we understand, actually be bought for 3s. In the case of new dies and taps, plenty of oil should be used, and it should be applied where the cutting edges of the die are in contact with the conduit, and care should be taken to see that the oil gets well down into the threads. This will obviate small pieces of metal lodging inside the threads and causing the die to cut imperfectly, by tearing the threads on the tube when screwing back. In addition to this, before placing the die in the stock, any dirt or loose pieces of metal which may be in the die, and the inside of the stock should be removed, so that there is no chance of the die being thrown out of truth. It is further recommended that the tube be occasionally oiled (by means of a squirt oilcan, applying the oil through the die). If the die be screwed back one or two turns after every three or four turns in the cutting direction, it will assist in getting a clean thread on the tube. In the case of inferior welded tube, the saving in the first cost of the tube is more than lost by the difficulty in screwing, for it is practically impossible to form a clean thread over a bad weld without damaging the tackle.

A convenient form of iron-clad switchbox is one of the novelties included in the new catalogue (No. 95) of fuses, switchgear, accessories, fittings, &c., just issued by Messrs.



"Easy Wiring" Iron-clad Switch, Messrs. Dorman & Smith.

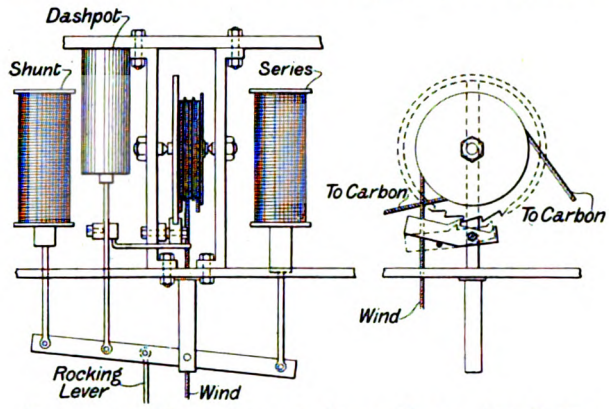
Dorman & Smith, Ordsall Electrical Works, Salford, Manchester. The switch is arranged with bevelled faces to couple to the inlets, so that it can be easily removed without disturbing the pipes or wires. Wiring is also much facilitated. The whole catalogue is well arranged and illustrated, comprises some 225 pages, and covers extensive standard lines of Messrs. Dorman & Smith's well-known "damper" and other fuses, switches, circuit-breakers and fittings. Further novelties include a range of sockets and plugs, hand lamps, &c., designed and made in accordance with the latest regulations and recommendations of the Home Office. Another new line which should be mentioned is the "L" series of patent "easy-wiring" mill and other fittings. In order to facilitate wiring the usual fittings, this line of fittings should be welcome to contractors and users generally, inasmuch as it has been designed with the object of facilitating wiring up, this result being attained by the usual lampholder nipple being dispensed with, the wires having a straight run through from the tube into the lampholder insulator, thereby eliminating dangerous bends in the insulated wires. All the various types of mill and other fittings are stocked of suitable size for metallic filament lamps. The fittings section also includes a line of porcelain body fittings, suitable for use in dye works, chemical works, laundries, &c. A new series of brass ships' fittings, possessing the same advantages as to easy wiring as the "L" series of iron fittings mentioned above, is also shown.

One of the new catalogues issued during last month dealing with installation material is a price list of plugs, wall sockets, branch blocks, and ceiling roses, issued by the Adnil Electrical Co., Ltd. (26-30 Artillery Lane, Bishopsgate Street Without, E.C.). Among the very numerous patterns of plugs and sockets listed, attention may be drawn to the conveniently arranged flush floor sockets, with doors that close flush even when the plug is inserted, as the double doors are shaped to allow the flexible wire to pass out between them. Watertight sockets are also dealt with, and other features of the list are adaptors, including some combinations not frequently found, and branch blocks for open wiring.

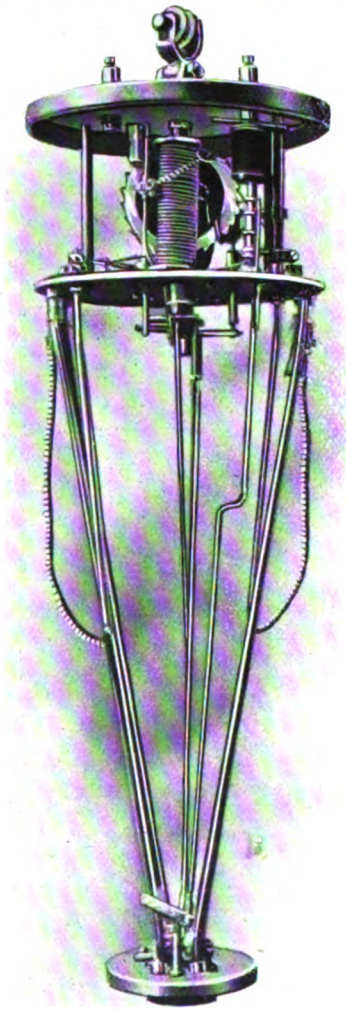
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Arc Lamps.

THE ABBEY ELECTRIC CO. (17 Victoria Street, London, S.W.) have recently improved their flame arc lamp. The feeding mechanism is illustrated in the accompanying sketch, and comprises one large single ratchet wheel and a double-toothed pawl, or click, controlled by the solenoids. This pawl is rocked backwards and forwards by the rocking lever of the lamp, either by the shunt or series coil, as the case may be. There is now also added a small auxiliary coil, connected in parallel with the shunt coil. This device, which can be seen in the general view, acts automatically in connection with a carbon switch. Thus,



SKETCH OF MECHANISM OF ABBEY FLAME ARC LAMP.



GENERAL VIEW OF INTERNAL PARTS OF ABBEY FLAME ARC LAMP.

if the lamp is carelessly trimmed and the carbons are placed too high in the economiser, then it will require more than the drop of one tooth of the ratchet wheel to make the arc strike. When the current is switched on, the shunt coil pulls up its end of the lever, and brings the tips of the carbons together, at the same time allowing them to drop one tooth. If, however, the carbons have been set too high, the end of the stroke will have been reached before the carbon points come into contact. In this case a carbon switch closes just at the end of the stroke, and completes a circuit through the small auxiliary coil referred to above. This coil has a loose plunger with a carbon contact at the end, which rests on another contact through which the current to the shunt coil flows; when the auxiliary coil is energised it immediately breaks the circuit through the shunt coil, and so allows the rocking lever of the lamp to drop again. As soon as this happens, however, the auxiliary coil ceases to be active; hence the plunger drops on to its contact again and once more completes the circuit through the shunt coil, and consequently again draws up the rocking lever of the lamp, thus allowing the carbons to drop one more tooth and so strike the arc. This apparatus works so quickly that it is not noticeable when switching on the lamp, even if the carbons are trimmed *three* teeth too high, and it is most valuable when a number of lamps are burning in series, in which case the carbons may not all start quite even after switching off the day before. To give an idea of how this automatic cut-out works, we may say that if current is switched on to the lamp without any carbons in, and the carbon holders pulled up to the top of the slide rods, they will continue to come down tooth by tooth until they have reached the bottom, or the end of the run, when the shunt coil is automatically switched out of the circuit, and remains so until the lamp is retrimmed. This apparatus is not brought into action at all when the lamp is burning and feeding in the ordinary way, as the stroke of the lever does not go quite far enough to close the carbon switch if the arc is already struck. It has also now been made quite impossible for the carbon points to come below the bottom rim of the economiser, which is made rather deep. Thus a steady arc is assured, and the life of the carbons is appreciably lengthened. The lamp is made in two sizes, which burn 16 in. or 24 in. carbons, and owing to the facts stated above, these last for a minimum of 12 or 20 hours respectively with a continuous run.

A new illustrated catalogue which has just been issued by ARC LAMPS, LTD. (Sphere Engineering Works, St. Albans, Herts), describes the Davy "Sunrae" flame lamps, and several patterns of the Davy patent shuntless enclosed lamps. In the former lamp, there are four converging carbons, and the two carbons of like sign are adjacent and support each other by being in contact at the ends where the arc is struck. Current is supplied near the burning ends through nozzles through which the carbons pass, and feeding is accomplished by gravity without any mechanism. Striking and regulating is effected by a rocking lever controlled by a series coil; a spiral spring takes the place of the usual shunt coil. A long-burning pattern with a length overall of 41 in. burns 35 hours, and requires 50 volts per lamp for series running. A 33 in. lamp gives from 18 to 20 burning hours, and a 24 in. lamp from 10 to 12 hours. These lamps are suitable for both A.-C. and D.-C. circuits. Among the enclosed type lamps is a line taking from 5 to 10 amps. on A.-C. circuits at from 90 to 100 volts per lamp; there is also a group of D.-C. lamps for from 3 to 10 amps. at the same pressure. A twin-carbon lamp for running singly on 200 to 250 volt circuits takes from $2\frac{1}{2}$ to 3 amps. in its D.-C. form, and from $3\frac{1}{2}$ to 4 amps. in its A.-C. form. A miniature D.-C. pattern, called the "Mite" enclosed lamp, only 18 in. long, runs singly on 100 to 125 volt circuits or two in series on 200 to 250 volt circuits. This lamp gives from 250 to 300 c.p. at $1\frac{1}{2}$ to 2 amps., and as in the case of all the other lamps, has no shunt coil to give trouble. Many other patterns are described in the list, which also includes full instructions for adjusting and working the lamps.

The latest design of the FOSTER ARC LAMP & ENGINEERING Co. (Worple Road, Wimbledon, London, S.W.) is known as the Foster "Q" type flame arc lamp, and is of particular interest on account of the peculiar form of moulded multiple carbon that is employed. An illustrated description of this lamp appeared in ELECTRICAL ENGINEERING, Jan. 6th, 1910, page 3. With a four-carbon electrode, a lamp of this type, 40 in. in length overall, gives from 40 to 50 burning hours; a double-carbon lamp gives from 25 to 30 hours. The lamp is suitable for both A.C. and D.C. circuits. Feeding and striking is effected by an improved form of brake mechanism, and, contrary to the usual practice in flame lamps of the converging carbon pattern, striking is performed by an upward movement of the electrodes.

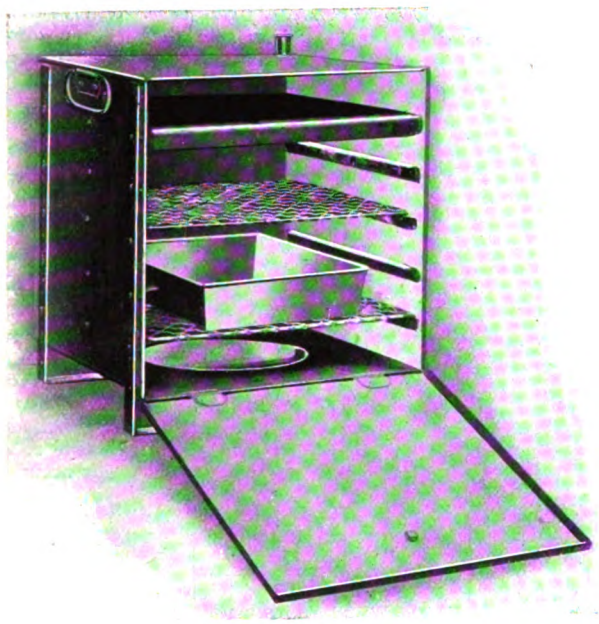
We understand that the well-known "Victor" D.C. lamps manufactured by THE ELECTRIC & ORDNANCE ACCESSORIES CO., LTD. (Cheston Road, Aston, Birmingham), have undergone only very slight constructional changes during the past year, the lamps having given entire satisfaction. A new catalogue has been issued, however, and a few slight improvements in design and reductions in price are noticeable. The distinguishing feature of the "Victor" lamps is the magnetic clutch which is employed to grip the positive carbon and to strike the arc; in the case of enclosed lamps, this is the only moving part,

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and as all clockwork and other mechanisms are dispensed with, a very solid and simple construction is obtained. A "D.E." type lamp of this pattern has 70 to 90 burning hours, and the designs illustrated include a number of special lamps for shop lighting, and for the lighting of ships' decks. The miniature lamps include both indoor and outdoor patterns for use in place of high candle-power incandescent lamps; the former is fitted with a porcelain adapter, to which connection is made by means of a plug. These lamps are standardised in two sizes, 1½ amp. and 2½ amps., and take 100 volts per lamp. From 25 to 35 burning hours are obtained. The "Victor" D.C. flame arc lamp is made on a similar principle to the enclosed lamps, but both the converging carbons are provided with magnetic clutches. Current is led in to the carbons at the clutches near the burning ends, and so metal cored carbons are not required. Special features of this lamp are the short overall length of 30 in., and the fact that the case does not have to be removed to renew the carbons. The burning hours are from 16 to 18. A large number of accessories, including some reflectors for shop lighting, are also listed.

Heating and Cooking Apparatus.

The "Tricity" cooker of the Berry Construction Co. (Charing Cross House, Charing Cross Road, W.C.), which is



"Tricity" Oven.



"Tricity" Oven on Stove.

distinguished from all other systems in having no resistances or connections on the actual cooking utensil, but effecting the heating partly by induced currents in the metal of the utensils themselves, and partly by conduction from a hot plate heated mainly in this manner has been well known for some time, but considerable extensions in its applications are now being made. The latest attachment to be introduced is an oven, which fits on to the top of the stove, as shown in the accompanying figures. This, when placed on a cooker already hot, attains a working temperature of 300° F. in five to seven minutes. Several other new utensils have also been brought out, and the company are now offering a complete cooking outfit comprising the following articles at the low price of £7 15s.: Electric stove, oven, 5-pint kettle, 2½-pint kettle, 6-pint saucepan, 3½-pint saucepan, steamer grill, grease pan, toaster, 4½-pint china casserole, 2½-pint china milk boiler, 1½-pint china saucepan, 9-in. china frying-pan, clothes guard, 5-lb. flat iron, and iron stand. It must, of course, be remembered that the system is only applicable to alternating currents, as the stove depends on the transformer principle for its action.

Several recently introduced new patterns of radiators are included in a catalogue from the British Prometheus Co., Ltd. (Salop Street Works, Highgate, Birmingham). Among them may be particularly noticed a cleverly contrived imitation log fire fitted with Prometheus convector elements, illuminated in such a manner as to give a highly artistic effect. Another feature of the list is the description of bead screens for use with lamp radiators, which increase the convection effect, and shield unpleasant glare.

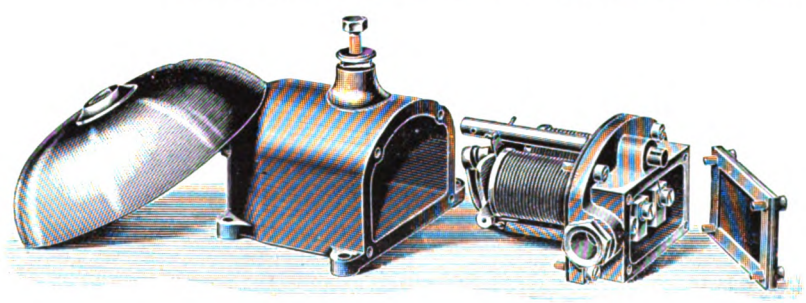
Simplex Conduits, Ltd., who are sole selling agents for "Prometheus" heating and cooking apparatus for the South of England, are selling the combined lamp carrier and adaptor illustrated herewith, an important application of which is in connection with electric irons. These, it may be mentioned, are one of the few pieces of electric heating apparatus which the ordinary householder can, without misgivings, connect to his lighting circuit when a special power circuit and meter are not installed, for they are used only for short periods at a time, and the number of units consumed are, therefore, comparatively unimportant. There is a danger, however, with electric irons that they may be left on circuit when not in use, and not only waste electrical energy, but also give rise to fire risk, for before the heating element breaks down, a high enough temperature may have been reached to ignite the ironing cloth if the iron has been left standing on it. The adaptor shown is wired for this purpose with the lamp in parallel with the iron circuit, and the lamp thus acts as a pilot lamp, and calls attention to the fact that the iron is still in circuit.



Pilot Lamp Adaptor.

Electric Bells.

A new waterproof bell which has been introduced by the Sun Electrical Co., Ltd. (118-120 Charing Cross Road, W.C.), is shown in the accompanying illustration. An inspection of an actual sample shows that the whole is a solidly made piece



Plunger Type Waterproof Electric Bell. (Sun Electrical Co.)

of apparatus, much more substantial than the usual design. The striking plunger, which is worked by the armature, passes through a hole in a special boss in the case, and is protected by being under the gong, so that the entrance of water is not likely, although it is not packed in any way. The bell, however, is naturally not intended to be used submerged. Renewable carbon contacts are used instead of platinum, and an ingenious arrangement permits of their adjustment from the outside of the case. All the joints in the case are rubber packed,

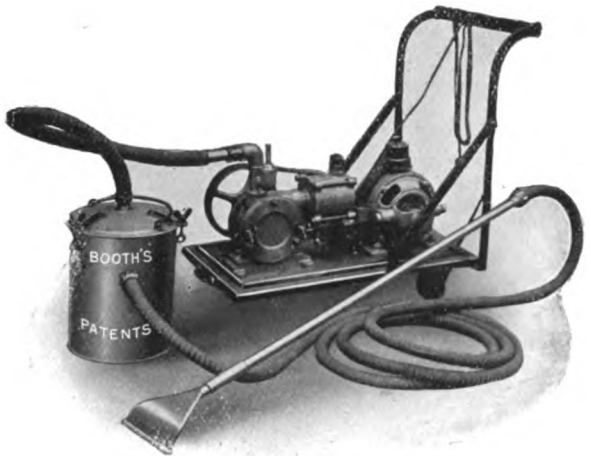
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and the leads enter an enclosed terminal compartment through a gland. Three wires are brought out, so that the bell can be used either as a single stroke or trembler bell.

The FOSTER ARC LAMP AND ENGINEERING CO. have called our attention to their special transformer for bell ringing from alternating current supply circuits, which obviates the use of batteries. The standard bell transformer is only 3½ inches in length, and weighs 2½ lbs., and steps down to 6 or 8 volts.

Miscellaneous.

In view of their extensive experience with vacuum cleaning in all its branches, the new portable electrically driven outfits of the BRITISH VACUUM CLEANER CO., LTD. (Parsons Green Lanes, S.W.), are of considerable interest. The very smallest machines act on the bellows principle, but in all the moderate and larger size outfits a rotary vacuum pump is used. The type shown in the illustration, which is known as model R, has a ½-h.p.

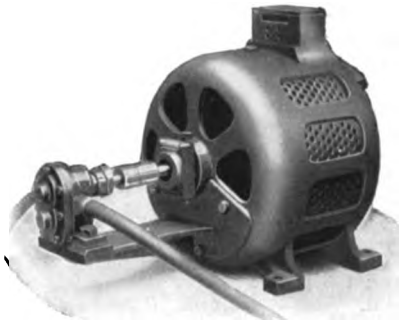


BRITISH VACUUM CLEANER CO.'S "MODEL R" PORTABLE ELECTRICALLY DRIVEN OUTFIT.

motor, and a belt-driven rotary pump of very simple construction, mounted on an easily-moved trolley, and the dust collector separate. The pump runs at 650 r.p.m., and a working vacuum of 15 to 18 in. is produced. The complete equipment only weighs 120 lbs. The whole is covered with a mahogany cover, which need not be removed when the machine is running, and noise is reduced to a minimum. Large fixed outfits are also made.

An interesting apparatus is the "Arnold" portable suction cleaner, which is being placed on the market by MESSRS. DRAKE & GORHAM, LTD. (66 Victoria Street, Westminster, London, S.W.). This comprises a small centrifugal blower, to the inlet of which is attached the fan-shaped mouth or suction nozzle. The blower is driven by a small high-speed motor. Nozzle, blower, and motor are built up together in a compact form, and are attached to the end of a pole, the whole having the appearance of an awkward-looking broom, and weighing only 10 lbs. Fitted over the exhaust pipe of the blower is the neck of a large cloth bag, the opposite end of which is attached to the pole. The dust is drawn up with the air by the blower, and the bag, which is always distended, allows the air to be blown through it, but acts as a filter and retains the dust. A 30-ft. braided cable connects the motor to the wall-plug, or adapter, and there is a switch on the motor case. The apparatus can be obtained with motors for any pressures from 100 to 250 volts, and the 200-volt pattern takes only 0·5 amp., or 100 watts. Thus, with a power rate of 2d. per unit, the cost of working would be only ⅕d. per hour, and only ⅗d. per hour if run off the lighting circuit with a rate of 5d. per unit. An important feature is the provision of a small vibrating brush in the nozzle, which agitates the fibres of the rug or carpet and loosens the dust or dirt. This brush is reciprocated with a ¼-in. stroke at a speed of some 10,000 strokes per minute by the motor. The list price of this cleaner is ten guineas.

We give herewith an illustration of a small direct-coupled electrically driven pump, which is being introduced by MESSRS. POOLEY & AUSTIN (25 Victoria Street). There are a number of purposes in connection with private house and other installations where pumps of this class are likely to prove useful. They are made in sizes from 100 gallons per hour up to 3,000, and are entirely self-contained, as they require no extra bedplate. In the illustration an alternating-current motor



DIRECT-DRIVEN ROTARY PUMP. (MESSRS. POOLEY & AUSTIN.)

is shown, but, of course, a similar arrangement can be adopted for a continuous-current motor.

A new list of advertising signs and flashers has just been issued by the SUN ELECTRICAL CO. An ingenious novelty is the "Singlelite" sign, in which one lamp is used in conjunction with suitable shades and reflectors, to illuminate a circle of gilt letters in an openwork frame. Nothing but the letters catch the light, so that they appear to float in space, giving a brilliant effect, especially when placed against a dark background. Very numerous ordinary glass front signs are also included, as well as ornamental window signs, which also take part in the illumination of the window itself. Another novelty is the "mirrorgraph" sign in which the device is only visible when the light is on, the surface having at other times a surface as of an ordinary mirror. There are also several cleverly arranged small signs for counters, windows, and small notices, including collapsible folding signs, and such accessories as thermal and motor-driven flashers and time switches are dealt with.

Our attention has been called to a portable accumulator lamp, specially designed for police purposes, which MESSRS. L. E. WILSON (20 Cross Street, Manchester) have introduced. The complete lamp measures 5½ in. by 2¾ in., and weighs 29 ozs. The case is serviceable and highly lacquered, fitted with a belt attachment, and there is a detachable bull's eye reflector, together with a strong and convenient switch. The accumulator has a capacity of 4 ampere-hours, and one charge will maintain a brilliant light for 8 to 10 hours. The glow lamp is of the metal-filament type, and gives a brilliant white light.

Rail Planing Machine.—H.M. Trade Commissioner for Australia reports, says the *Board of Trade Journal*, that representatives of an Australian company owning and working a patent for a rail planer machine for the treatment of railway and tramway rails on the track, without removal, are coming to England for the purpose of having a machine constructed for demonstration purposes. They intend then to make arrangements for the construction of machines in the United Kingdom, and for contracting for the use of the machine on railway and tramway systems. The machine is driven by petrol, and costs about £2,000 to construct in Australia. It is working successfully on the Melbourne tramways. The names and addresses of the representatives may be obtained by British firms interested on application at the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

Annual Return of Tramway Capital and Traffic for 1908-9.—A Board of Trade return dealing with tramways and light railways in 1908-9, shows that since the year 1878 the route length of line open for traffic has increased from 269 miles to 2,526 miles; the capital expenditure from £4,207,350 to £71,023,239; the number of passengers carried from 146 millions to 2,660 millions; and the net receipts from £230,956 to £4,595,779. The number of passengers carried in the year is equal to about 60 times the estimated population of the United Kingdom. Of the total of 1,680 miles of line owned by local authorities 1,490 miles are worked by those authorities themselves, and the remaining 190 miles by leasing companies. Last year the route mileage open of electric line was 2,286 miles out of a total of 2,464; this year it is 2,360 miles out of 2,526. Of the 298 undertakings, 176 belong to local authorities and 122 to companies or other parties. The net receipts of local authorities who work tramway undertakings belonging to them or leased from other local authorities amounted to £3,268,514 on the year's traffic, out of which they have applied £964,010 towards the reduction of tramway debt and £280,225 in relief of rates, while carrying £680,202 to reserve and renewal funds. In the cases of four local authorities and four companies, the returns show an excess of working expenditure over gross receipts.

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LIGHTING AND POWER IN A LARGE DRAPERY STORES

THE electrical installation in the new building of Messrs. D. H. Evans & Co., Ltd., of Oxford Street, London, which has been carried out by Messrs. Duncan Watson & Co. (102 Charing Cross Road, W.C.), contains several features of interest. Current is supplied from the 480-volt direct-current three-wire system of the Marylebone Borough Council Electricity Department, and to ensure continuity of supply there are three services; two of these are 0·3 sq. in. cable taken directly from two separate feeder pillars, and one is a 0·25 sq. in. cable from the street lighting distribution network. These three cables are brought to a common set of bus-bars. The three sections of the neutral bus-bar are connected by copper links, but the three sections of each of the outer bars are separated by isolating fuses. These bars are arranged as in a street pillar, and are erected on an angle-iron framework in a locked compartment. From this set of bars two sets of cables are taken off through fuses on the outers to the main switchboard. One set is for the power supply and the basement lighting, and the other is for the main lighting. Should a fault occur on any one of the three service cables, the isolating fuses will blow, and at least one of the sets of cables running to the main board will remain alive.

The main switchboard is 25 ft. long by 7 ft. high. The switches and fuses for the lighting, and 240-volt power circuits on the two sides of the system are arranged respectively at the two ends of the board, and in the centre are the 480-volt power switchgear and the Borough Council meters. The latter comprise a Reason three-wire maximum demand meter and a wattmeter for the main lighting circuits, a basement lighting meter, and the power meters; there are two rates of charging. On the board are also an ammeter and a recording voltmeter, which can be connected by flexible to any desired terminals, and a meter with a flexible cable and a contact device at its end which can be inserted in the contacts of any switch to obtain the consumption of any circuit.

A novel feature in the construction of the board is the provision of a galvanised iron trough for distributing the cables at the back. This trough is divided longitudinally into three parallel portions, and is lined with Uralite. The steel conduit containing the lighting and power cables from all parts of the building terminate above this trough, and the cables drop down into one of the three channels. The back channel contains all the 480-volt power cables, the middle one 240-volt power cables, and the front one 240-volt lighting cables. In all cases "Anchor" vulcanised rubber cables are employed. Each cable passes through an ebonite bushed hole in the bottom of the trough opposite that part of the board where the switch terminal for its particular circuit is situated. This arrangement gives a particularly neat construction.

The wiring all over the building is in enamelled, screwed, seamless steel conduit, which is bonded together and effectively earthed. All the arc lamp circuits in the basement and on the ground and first floors are brought down to the main switchboard, and all fuses and series resistances are in the basement. The incandescent lamp circuits are, of course, supplied from distributing fuse-boards on each floor.

The chief power applications are three Otis passenger lifts and one Waygood lift in the old building, a rotary blower for the Lamson pneumatic cash dispatch system, ventilating fans, conveyors, and a combined water and air pump. There are also four service lifts and four dinner lifts, all electric. The Lamson blower is driven by a 25-h.p. Rhodes motor, and supplies a very large system comprising some 60 tube stations. There is a spare motor, and means are provided for changing over the belt drive from one to the other. The ventilating system, which was carried out by Ozonair, Ltd., comprises a large Sirocco fan belt-driven by a 15-h.p. Crompton motor, which draws in fresh air at the base of the building through a wet filtering screen, and blows it through ducts into the various rooms and out at the top of the building, where there is an 8-h.p. exhaust fan. At the inlet of the main fan there is a pipe leading from an ozone generator, which is supplied with alternating current at 6,000 volts by means of a transformer and a small Crompton rotary converter.

The fire protection system includes, besides a complete equipment of hydrants, a Grinnell sprinkler system, and in order to create a pressure high enough for the efficient working of the sprinklers at the top of the building, there is a hydraulic accumulator in the basement and an air pressure tank on the roof. The latter holds 60,000 gallons. Water is pumped in by means of a combined air and water pump, belt-driven from an 8 h.p. motor, and this pump is also used to keep up an air pressure over the water in the tank of 80 lbs. per square inch.

The parcel and box-handling equipment includes three spiral shoots. One of these in the old building deposits the parcels direct on a turntable, from which they are sorted for dispatch. At the base of one of the others in the new building, there is a canvas belt conveyor, which travels along the subway under the road between the two buildings, finally depositing the parcels on the turntable. This conveyor is constructed in several sections, as it has to follow a winding course, and each section is driven by a separate motor. These are 240-volt machines of from 1½ h.p. to 3 h.p.

Among the other applications is a 3-h.p. motor driving the automatic stokers which feed the boilers for the hot-water heating system, and a number of small motor-driven appliances such as dish- and knife-cleaners, potato-peelers, &c.

The internal lighting of the ground and first floors is carried out with enclosed arcs of the Brockie-Pell B.E. type. These take 5 amperes, and are connected two in series across the 240 volts. There are also a few 3-ampere lamps of the twin-carbon B.E. type. The basement lighting consists entirely of open inverted lamps supplied by the Electrical Co., Ltd., taking from 8 to 9 amperes, and connected five in series. These are hung close to the white ceiling, and give a most pleasing effect. There are no lamps of any kind in the show windows, but these are lighted from the outside by flame arc lamps of the Electrical Co.'s "Sunshine" pattern.

No lamps are exposed in the show cases either, as, apart from the risk of fire, it has been found that the heat of lamps is often apt to damage the goods exhibited. An ingenious device is used, however, consisting of a sheet metal fitting with glass reflectors and a Cloisonné-glass front. This stands on the glass top of the show case, and most of the light is thrown directly downwards, and reaches to the bottom shelves of the case. Part of the light is also reflected through the Cloisonné-glass front, which has either merely artistic designs or an advertisement of some kind. The fitting contains four 17-watt 20-volt Osram lamps. It is interesting to note that it was found that any lamps with a higher specific consumption caused the glass top of the case to crack on account of the heat generated. In all, there are 40 flame lamps outside the shop windows, 380 enclosed and open inverted arcs for interior lighting (including those in the old building), and some 3,000 incandescent lamps, mostly metal filament.

A private inter-communication telephone system affords communication between the work-rooms and the various departments of the shop, but there are also National Telephone slot call-boxes all over the building, and a private exchange. In order that the as-

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sistants may use this system for inter-communication between departments, they are provided with special metal discs.

In conclusion, we should like to express our thanks to Mr. M. Pulver, of Messrs. Duncan Watson & Co., who kindly showed our representative over the installation, and who has been chiefly responsible for the work, and was the designer of the switchboard trough and the show-case fitting described.

The new building itself was erected to the plans of the architect, Mr. John Murray.

A NEW HIGH-PRESSURE BLOW-OFF VALVE

THE accompanying illustrations represent a new form of valve for high-pressure blow-off purposes, &c., which is being put on the market in this country by Messrs. Wallach Brothers, Ltd. (Finsbury Square, E.C.). The construction of the valve is made clear by Fig. 2, which shows the two parts of the casing taken apart, and the parts composing



FIG. 1.—VALVE COMPLETE.

the valve itself separately. The faced disc of the valve slides over a seating against which it is held up by a pair of springs, and is actuated by an arm which is moved from outside the casing by means of a spindle, with a square head to receive a spanner. It will be seen that a full way opening is obtained, while the working face is easily accessible for examination. The arrangement of the springs, one of which is in the centre of the valve face, fitting in the circular recess in the arm, while the other, is over the spindle, keeps the valve from tilting. Also the second spring keeps the spindle tight by causing a collar on it to press upon a special packing ring. The lower part of

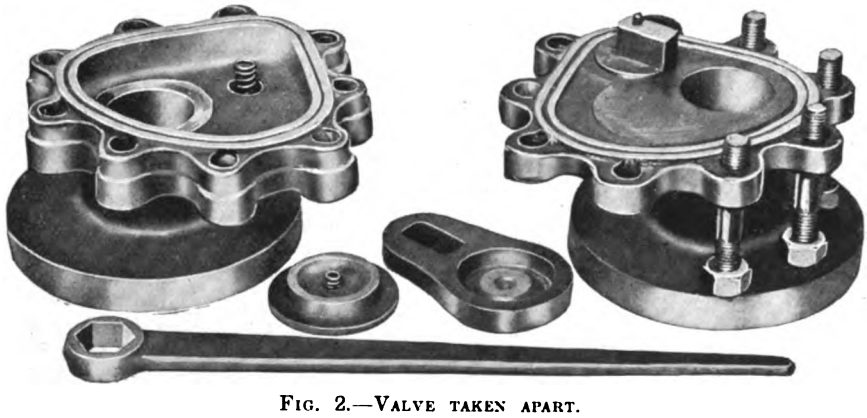


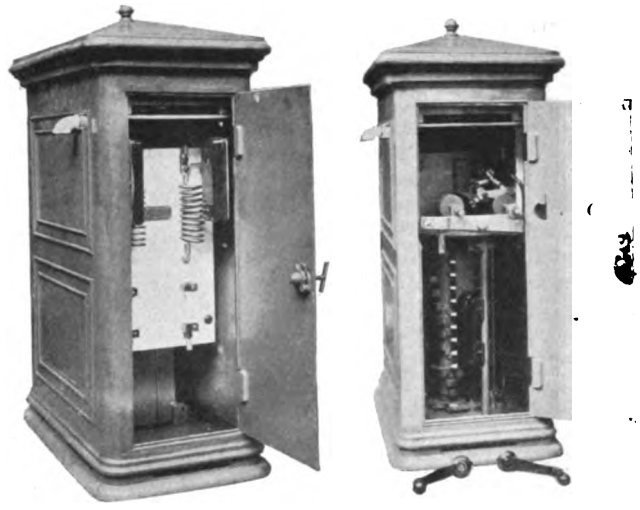
FIG. 2.—VALVE TAKEN APART.

the casing is of brass, and the upper part of cast-iron, while the moving parts are of Admiralty gun-metal. From an inspection of a sample valve it is evident that the whole is of workmanlike construction, as it is of simple design.

Theory of Alternating Currents.—At a meeting of the Dublin Local Section of the Institution of Electrical Engineers on January 20th, a Paper was read by Mr. T. Tomlinson, entitled "The Elementary Graphics of Alternating Currents." The author deals with the effects of self-induction and capacity on a strictly diagrammatic and physical basis, and deduces a number of vector and circle diagrams for determining the results of various combinations of resistance, self-induction, and capacity in series and in parallel.

FEEDER PILLARS FOR CAPSTAN CONTROL IN INDIA

THERE are various special requirements which apparatus designed for tropical countries have to meet, and the feeder pillars shown in the accompanying illustrations, which were produced at the General Electric Co.'s Witton Works for use in India, form a good example. It was required to arrange in each pillar the complete switchgear for the control and efficient protection of a direct-current 15-h.p. capstan motor, consisting of double-pole main switch, double-pole fuses, drum-type controller, starting resistance, choking coils, lightning arresters, and sealing ends for the lead-covered motor cables, and weight and



VIEWS OF CAPSTAN CONTROL FEEDER PILLAR.

dimensions had to be kept within certain given limits to admit of transportation without dismantling. Only such material could be used which would stand the very trying climatical conditions; for instance, no fibre, presspahn, nor even slate could be employed. Particular care had to be taken to prevent the ground moisture from rising into the pillar, but at the same time efficient ventilation had to be provided to carry away the heat generated in the starting resistance. Furthermore, the pillars had to be absolutely safe against the torrential rains which fall periodically. As the pillars were to be operated by natives, they had to be what is generally termed "fool proof."

The pillar is provided with two doors, one at each of the short ends. One of these doors gives access to the choking coils, main fuses, and lightning arresters, the other to the controller and main switch. The choking coils and the main fuses, which are of the well-known G.E.C. porcelain bobbin type, are mounted on a white marble slab reaching across the whole width of the pillar, thus separating effectively fuses and lightning arresters from the rest of the gear. The lightning arresters are of the short-gap magnetic blow-out, series resistance type; they are contained in boxes, and are mounted on the sides of the pillars right and left of the choking coils.

The bottom of the pillar is closed against the cable trench by a diaphragm of boiler plate, through which the lead-covered cables are brought by means of brass-screwed glands made tight with steam packing. The controller is placed on this diaphragm, and, as it stands at a right angle to its actuating shaft, bevel gearing had to be employed for its operation.

In the controller itself only micanite is employed as insulating material, and the drum consists of solid iron castings clamped on to a square steel shaft covered with a thick coat of micanite, and is so designed as to have the smallest possible air-gap in the way of the magnetic lines, thus considerably increasing the efficiency of the magnetic blow-out. The contact fingers are arranged similarly to the drum castings, on a micanite shaft, with which they form a self-contained unit, that can be removed as a whole for inspection and overhauling. The blow-out coil is of ample proportions, and keeps quite cool with the normal current passing permanently, giving a strong field even with the no-load current of the motor.

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The double-pole main switch, of the magnetic blow-out laminated brush type, is mounted on a white marble base, which is bolted on one side of the pillar near the controller, with which it is mechanically interlocked in such a way that it cannot be opened unless the controller is in the "off" position, and if the controller drum should be turned for inspection purposes while the switch is "off," it is impossible to close the switch. The actuating shafts of both the main switch and the controller penetrate the door of the pillar, and a further device is provided which securely locks this door as long as the main switch is "on." It will be seen, therefore, that to open the door of the pillar it is necessary, firstly, to switch off the controller; secondly, to open the main switch; and thirdly, to remove the switch handles as well as the controller handle. These handles can, of course, only be removed in the "off" position.

The starting resistance is lodged in the top part of the pillars under the cover, so that the heat generated is freely radiated by the covers. Furthermore, ventilating slots are provided in the pillars themselves near the bottom and under the cover. The slots near the bottom are slanting upwards and inwards at a steep angle to prevent rain-water drifting in, while the upper slots are securely protected by the overhanging edges of the cover. The resistance itself is of the cast-iron grid type. The individual grids are threaded on micanised steel rods, and are insulated from each other by mica washers, and all connections are bolted.

THE DUTIES OF THE INSTITUTION OF ELECTRICAL ENGINEERS TO THE ELECTRICAL INDUSTRY

WE have received from Mr. E. Garcke copies of a letter from the Secretary of the Institution of Electrical Engineers in reply to a letter of his own of December 10th last (published in ELECTRICAL ENGINEERING of December 23rd, 1909, Vol. V., page 1084). Mr. Garcke's original letter was called forth by a ruling of the President that "politics" were not to form part of the discussions of the Institution, and expressed the view that the Institution did not take a sufficiently prominent part in legislative and administrative matters affecting the welfare of the electrical industry.

The Secretary, in his letter (which is dated January 28th), states that the Council administration of the affairs of the Institution of Electrical Engineers is governed by its Memorandum of Association. The main object of the Institution, he continues, is to promote the general advancement of electrical and telegraphic science and its applications. The Council have always given, and will continue to give, as broad an interpretation to the Memorandum of Association as is consistent with the avoidance of matters which, while possibly affecting one section of the industry beneficially, might be injurious to the interests of another section, or contrary to the public interest. The Council are constantly engaged in the consideration of matters affecting the industry which come within the proper scope of the objects of the Institution, and in regard to legislation they have always welcomed applications from Government Departments for advice or assistance, and have repeatedly taken the initiative in putting before such departments the views which they may have formed on questions connected with the general advancement of the industry. Accounts of the Council's action in regard to these matters appear in due course in the annual reports of the Institution.

To this Mr. Garcke has written a reply, dated February 3rd, in which he reviews the actions taken by the Council in such matters during the last 22 years as recorded in the annual reports, which he says clearly show that the Council has given in the past a broad interpretation to the Memorandum of Association. The points which he wishes to emphasise are :—

(1) That no industry of the magnitude and importance which the electrical industry has now attained can permanently subsist in this country with adequate advantage to British capital and labour unless it possesses an authoritative, representative, and efficient organisation for the promotion and protection of its general legislative, industrial, and commercial interests.

(2) That the electrical industry in this country does not possess such an organisation. It possesses several most praiseworthy societies for the furtherance of sectional interests, but apart from the Institution of Electrical Engineers there is no organisation in the country which is able to represent the industry as a whole, and this correspondence, although it has brought out the fact that the Institution has the power to meet this much-felt want, and that the Council has occasionally exercised this power, still leaves it open whether the Institution may be relied on to provide an organisation as above defined.

(3) The Council of the Institution having from time to time given their attention to certain legislative and commercial questions, many members have formed the belief that the Institution does, in fact, in all cases, protect the legislative and commercial interests of the industry in a manner rendering any other efforts with this view unnecessary.

(4) At the same time many members (including Mr. Garcke) are of opinion that the Council have not dealt with legislative and commercial matters in such a manner as to offer reasonable hope of preventing the industry from being very seriously prejudiced relatively to other industries and interests in this country.

Mr. Garcke continues :—

"In support of this expression of opinion I would point out that in 1902 the then President of the Board of Trade informed the deputation from the Institution that a Bill would be introduced to give effect to the recommendations of the Joint Select Committee of both Houses of Parliament which sat in 1898, but the subsequent annual reports of the Council contain no reference to any efforts that may have been made by the Council to get this official promise realised. I have in my previous letter referred also to what I most respectfully consider the neglect to deal properly with the Electric Lighting Bill of last session, and you are good enough to inform me that this matter will be dealt with in the next annual report, but may I be permitted to point out that the Bill was passed substantially in its objectionable form by the House of Lords in May last before the presentation of the last annual report of the Council, which, however, contained no reference whatever to the Bill. If it had not been for the efforts subsequently made by a few members without the benefit of the great influence of the Institution the Bill would, it is believed, have become law in a form which would undoubtedly have put an end to the profitable investment of capital in many provincial electric lighting undertakings.

"No one," he concludes, "who feels any responsibility for any part of the capital invested, or for the material welfare of those who are engaged in the industry, can avoid the conclusion that it is regrettable that an Institution which is capable of such excellent work, and which enjoys a thoroughly representative character and possesses the requisite influence and means, has not devoted a larger portion of its energies to the promotion and protection of the commercial prosperity of the industries which it represents, and I am quite sure that I am but expressing the feelings of a large number of the members of the Institution in saying that the Council would render the industry an inestimable service if they would at this juncture provide for the electrical industries in this country the much-needed organisation to be constituted either entirely within the Institution or partly within and partly outside the Institution, so that steps may be taken with a view to improving the general industrial conditions under which electrical undertakers, manufacturers, and contractors are working."

CORRESPONDENCE

THE INSTITUTION LIBRARY.

To the Editor of "ELECTRICAL ENGINEERING."

SIR,—The Institution of Electrical Engineers possesses a library which contains the most complete collection of electrotechnical books in this country. The membership of all classes of the Institution, including students, amounts to no less than 6,000, of whom, probably, not more than 1,700 or 1,800 live near London, and yet only these London members have access to the library, because as I found recently, to my intense surprise, no arrangement has been made to permit of books being loaned to country members.

In view of the fact that the Institution, unlike many societies, does not reduce the subscription of the country members, I trust that you, Sir, will use your influence with the Council so that the concession may be granted at an early date.

ASSOCIATE MEMBER.

COMBINED LIGHTING AND POWER METER.

To the Editor, ELECTRICAL ENGINEERING.

SIR,—Apart from the statement that we amused him, which we cannot contradict, there is scarcely anything in your correspondent's reply to our letter of 18th ult., appearing in your issue of 20th ult., that is relevant to what we said.

We pointed out that the "ingenious system" is nothing new in principle; this has since been corroborated by others. Further, that no special meter is necessary, assuming the ratio of lighting and power tariffs to be 2 to 1; this is undoubtedly the case in spite of your correspondent's remarks. Watt-hour meters have generally four terminals (at least Bergmann meters have), and it is an easy matter for the central station meter man to connect the meter up according to the diagram given in your issue of January 14th.

As to the difficulty of adjusting for the proper ratio, this, of course, is theoretically non-existing, but practically it would necessitate making and stocking a large variety of series coils so as to obtain the required ratio in every instance.

Here the shunted ampere-hour meter comes in to advantage, and we take the credit of having pointed this out.

Yours faithfully,

SIMPLEX CONDUITS, LIMITED.

116 Charing Cross Road, W.C. W. WAHL,
February 3rd, 1910. *Manager, Meter Dept.*

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THE ELECTRIC DRIVING OF REVERSING ROLLING MILLS

THE hearing of the action brought by the Donnersmarckhütte Oberschlesische Eisen- und Kohlenwerke Akt.-Ges. of Zaboze, Germany, against the Electric Construction Co., of London and Wolverhampton, for alleged infringement of the fundamental patent for the Ilgner system of electric driving of reversing rolling mills, was concluded on Wednesday last, but Mr. Justice Parker has reserved judgment.

The plant at Messrs. Alfred Hickman, Ltd., which, it is alleged, infringes this patent, consists of a large motor-generator set which includes one motor, two cast-steel flywheels each weighing 32 tons, and two continuous-current generators. Motor, generators, and flywheels are all mounted on one shaft, and run at a speed of 300 r.p.m. One generator supplies current to a motor driving a 36-in. cogging mill, and the other to a motor driving a 24-in. finishing mill.

Although the capacity of the gas-driven generating sets which supply power to the motor is only about 1,000 h.p., the kinetic energy of the flywheels enables as much as 12,000 h.p. to be developed for short periods. The mills are reversed by altering the direction of the current supplied to the motor, and are controlled by varying the excitation of the generators. It is stated that they can be reversed in about six seconds, from the full speed of 120 r.p.m. in one direction to full speed in the other direction. The drop in the speed of the flywheel motor which is necessary in order that the flywheels may give up energy to the dynamos, is produced by means of an automatic regulator. This comprises a rheostat in the motor field circuit, the weighted arm of which is fixed to the spindle of an auxiliary motor. The field coils of this auxiliary motor are in series with the motor armature of the flywheel set, and when the current taken from the main supply exceeds a certain predetermined amount, the torque on the armature of the auxiliary motor is such that it rotates and moves the rheostat arm, cutting out resistance. This effects an increase of the motor field of the flywheel set, and consequently a drop in speed, and the flywheel therefore gives out energy to the dynamos, which is thus passed on to the rolling-mill motors to supplement that supplied directly from the mains. The flywheel gives out 49,000 h.p. seconds for a drop in speed of 20 per cent., and the amount supplied direct from the mains is 2,300 h.p. If the maximum load on the generator is 9,000 h.p., the flywheel will thus supply the difference of 6,700 h.p. for 7·3 seconds.

An abstract of the patent in question, the general facts of the case, and a report of the first two days' proceedings were given on page 77 of our issue of February 3rd.

It will be remembered that the E.C.C. do not deny that the Ilgner principle is embodied in the Hickman set, but assert in defence that the patent is invalid for want of subject-matter. In support of this assertion, various previous publications are quoted, including a description of a Ward-Leonard motor-generator traction equipment, in which a flywheel effect is referred to, and a patent by Ferranti for a flywheel motor-generator for use in lighting stations to smooth out the fluctuations of a power load. After Mr. Walter had stated the case for the plaintiffs, interesting evidence as to the working of electric rolling-mills was given on Thursday, January 27th, by Mr. J. Swinburne and Mr. Ablett, of Siemens Bros. Dynamo Works, and this concluded the case for the Donnersmarckhütte Ges.

On February 4th, Mr. BOUSFIELD opened the case for the defendants, asserting that, without any special device to reduce the speed, the Ilgner arrangement was no different to the previous flywheel combinations, and that there was, therefore, no subject-matter for a patent. It was essential, he said, that there should be a regulator; in the case of the Hickman 2,000 h.p. primary motor, the speed-drop without the regulator was only 2 per cent., and more than 5 per cent. could not be safely obtained with any shunt motor. He held that the Ilgner idea was only the application of a flywheel in an obvious way. Mr. Justice Parker here expressed the opinion that Ilgner had meant that the drop of speed could be obtained either by means of a special design or by the addition of some suitable automatc device; but Mr. Bousfield held that the specification did not even suggest the use of a regulator. Continuing on the following Monday, Mr. Bousfield said that the E.C.C. regulator was set so that it did not act until there was a greater demand than 2,300 h.p. If they had series windings only, they would get an increase in back E.M.F. of only about 2 per cent., with an increase in load of 10 per cent., whereas with the regulator they could get anything they liked. He claimed that the Ferranti specification already referred to described an apparatus for use in cases where the load was fluctuating, and where it was desired not to interfere with the regularity of the ordinary supply; and that it could be applied to a rolling-mill. He claimed that there was no invention in the Ilgner system, inasmuch as there was no novelty in the manner in which the known principles had been put together. The introduction of the special regulator in the E.C.C. equipment, however, was in itself subject-matter for a patent.

The first witness was Mr. F. W. BRAY, managing director of the Trafalgar Colliery Co., who produced a drawing and gave particulars of a main and tail haulage plant which had been in use at his pit since 1894 for hauling trains of coal up an incline. This was worked electrically, and water resistances were used for regulating the field of the generator. There was no resistance in the motor circuit. Mr. JUSTICE PARKER said he did not see how this could be regarded as anticipation. It was simply the application of regulation in the field of the dynamo, which was a perfectly obvious thing to do after Ward-Leonard.

Mr. H. F. PARSHALL expressed the opinion that in the application of electricity to the driving of rolling-mills, the Ward-Leonard system was the only one which could be used. In 1893 Kapp suggested the use of a reversible machine for equalising the load on tramway feeders, and he had been rather astonished that Kapp should think there was anything novel in the application of a flywheel to an electrical machine. The use of flywheels on electrical machinery had become common since the introduction of traction loads. Reading the Ilgner specification by itself, he could not understand it without reading into it the Ward-Leonard and Ferranti systems. Cross-examined by Mr. Walter, Mr. Parshall agreed that nothing was said about a regulator for producing a drop-in speed in the Ferranti specification, but it described the use of a non-synchronous motor which had a certain range of speed variation in itself. He did not think there was any invention in the Ferranti patent, because he had had the same thing submitted to him in America two years previously. The Ward-Leonard system and flywheels were used in America several years before the Ilgner patent.

Professor BERTRAM HOPKINSON agreed with Mr. Parshall's evidence as to the use of the Ward-Leonard system in the driving of rolling-mills. In 1902, the date of the Ilgner patent, he was perfectly familiar with the only possible way of driving rolling-mills, viz., to vary the field of the generator supplying the motor, and, had a proposal been put before him, he would have been forced to adopt such a method in combination with a flywheel. In cross-examination, Professor Hopkinson said that although the Ward-Leonard system was normally a constant speed one, yet Mordey and Jenkin had referred in their Paper to speed variation. He admitted that, personally, he might have rejected the ordinary Ward-Leonard system, or have devised some other way of getting a motor with a larger variation in speed for rolling-mill work. It would not have been a difficult problem in 1902. It was true that the Ferranti patent was primarily for preventing fluctuations on the lighting plant, but the principle could be applied to rolling-mills and other purposes, and this fact, in his opinion, did not detract from the question of validity or anticipation.

Mr. S. Z. DE FERRANTI said that his patent No. 4,065 of 1895 was taken out really for the working of lifts on the City & South London Railway without there being any injurious effect upon the rest of the system. In view of the small generating plant of the railway company, the working of electric lifts was a very difficult problem at the time, and the company would not add to the very small number which they had in use. At the time he took the patent out, he was very doubtful about the subject-matter, and he therefore tried to show all sorts of useful combinations with a view to getting something patentable. The primary idea was flywheel storage. The machines shown in his specification were, in principle, exactly the same as those used at Messrs. Hickman's works; they showed exactly the right proportions with an enormously heavy flywheel. Mr. Ferranti also referred to the driving of printing presses in London on the Ward-Leonard system.

Mr. W. M. MORDEY said the Ilgner system was an ordinary application of the flywheel, and no new result was obtained from it. He had used flywheels on motors for driving large shops for a long time, and he regarded the flywheel as one of the tools in the designer's tool basket. It was all familiar before 1902. In his Paper he arrived at the conclusion that the Ward-Leonard system was very much the best one for dealing with a variable load, but he did not think he had made any discovery or invention in that. Ilgner merely accentuated

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the natural flywheel action of a motor-generator set, *i.e.*, the flywheel effect of the armatures. Under cross-examination, Mr. Mordey said the regulator at Messrs. Hickman's works only came into operation when the current exceeded 1,500 amperes. Mr. Walter suggested that the speed of the motor could be varied as much as 10 per cent. without the regulator, and not only 2 per cent., as stated by Mr. Bousfield, but Mr. Mordey said such a variation would affect the source of supply, which it was the aim of the system to avoid. The maximum demand for the installation at Messrs. Hickman's was 9,000 h.p., and without the regulator the primary motor would be overloaded. Mr. Walter contended that a simple series winding would be suitable, but Mr. Mordey disagreed.

In summing up for the defendants, Mr. Bousfield claimed that the Ilgner idea was merely the application of Ward-Leonard control to the Ferranti flywheel set, and an application which was bound to suggest itself. It was undoubtedly an analogous use of an old contrivance, and there was, therefore, no subject-matter. There was, he said, no interaction between the Ward-Leonard control and the flywheel effect, and therefore a patent could not be taken out for the combination. Mr. Justice Parker here mentioned that he was satisfied that there had been no anticipation of the combination; it remained, however, to be decided whether the combination was subject-matter.

Mr. Walter then finally addressed his Lordship, pointing out that the Ilgner patent was for a method of obtaining and utilising a drop in speed of an intermediate flywheel machine without causing thereby any drop in speed of the working motor; this effect was the result of the combination of the Ward-Leonard and Ferranti ideas, and the combination was, therefore, subject-matter for a patent.

IMPROVED POWDER PROCESS FOR PLATING METALS

AT the Royal Society of Arts on Wednesday of last week, Mr. A. Rosenberg described a novel process whereby metals of all kinds may be coated with any other metal, including nickel. The process, which is the outcome of five years' experimental work, consists in the use of a mixture of pulverulent materials to which has been given the trade name of "Galvanit," and the deposition is accomplished by the application of a particular powder, according to the metal to be deposited, by means of a rag or brush, and rubbing the object to be coated, in the presence of moisture. No preliminary chemical treatment is required, provided the objects are reasonably clean and bright.

For the deposition of each particular metal there is required a corresponding powder, containing the appropriate ingredients, and all metals generally deposited by ordinary electroplating can be deposited by "Galvanit" powders. The powder consists of 5 parts by weight of ammonium sulphate, 1 part of magnesium, 10 parts of chalk, 2·5 parts soapstone, and 15 parts of the metal to be deposited. The magnesium prevents the mixture from absorbing moisture, and the chalk acts as a diluent and polishing agent.

The new process is said to depend upon the reaction which ensues between one ingredient (the electro-positive metal), and the other ingredient (the metallic salt) on the addition of moisture to the mixture. In this reaction the electro-positive metal constitutes the anode, and the object treated the cathode. The finely-powdered electropositive metal in the mixture makes innumerable contacts with the cathode surface, and acts as so many minute anodes. These set up local circulating currents, and as these currents leave the liquid they throw down a deposit on the cathode from the metallic salt in solution. Mr. Rosenberg states that a probable explanation is that the water is decomposed, the salts in contact with the cathode are reduced to the metallic state by the nascent hydrogen, and the acid thus formed is prevented from corroding the deposited metal, both by the motion applied and by being immediately removed into the liquid by diffusion. It is possible to increase the thickness of the deposit by the aid of heat, although this is not necessary. An interesting and unexpected result is that aluminium surfaces may be coated by the "Galvanit" process. Another interesting possibility is its application for "tinning" joints.

In the discussion on the Paper Prof. SILVANUS P. THOMPSON, F.R.S., who presided, said that he was satisfied that real electrolytic films of metal were deposited, and that none of the metal of the article treated was lost. He was particularly astonished that the author was able to accomplish nickel-plating by this means. Dr. H. BORNS asked for information as to the thickness of the deposit, and also as to the behaviour of the deposits under mechanical strains. Dr. F. MOLLWO PERKIN pointed out that nothing had been said with regard to the cost of the process; magnesium, which entered into the composition of the powders, was by no means cheap. Mr. C. H. WOOLF spoke as to the lasting qualities of the powders. Samples of zinc and silver powders, which came into his hands early last year were still practically in the same state of efficiency. He had found the deposits of metal lasted for a very long time. In reply, Mr. ROSENBERG said that the films withstood mechanical strains quite well, pieces of covered metal being bent backwards and forwards without injury to the deposit. He admitted the powder process might be a little more expensive than ordinary plating, but the speed and convenience of the process more than compensated for this. From the ordinary user's point of view the price worked out favourably, for a shilling tin of powder contained sufficient to coat a surface of six square feet with a fairly thick deposit. The amount deposited could easily be ascertained by weighing; he had proved that each application increased the weight of the deposit.

WIRELESS TELEGRAPHY

The annual report of the Liverpool Underwriters' Association, which was presented at the annual meeting on Friday, expresses approval of the agreement by which the entire system of wireless telegraphy employed in the United Kingdom for communication with ships has been acquired by the Government. The report expresses the hope that the work which remains to be done of establishing a complete system of electrical communication with the light vessels and outlying lighthouses around our coasts will now be proceeded with.

A Reuter telegram from Berlin states that, in consequence of the favourable results of experiments in wireless telegraphy in Germany and the colonies, and between individual colonies, wireless stations will be erected in German East and South-West Africa, the Cameroons, and the German South Sea colonies, so as to establish wireless communication between the motherland and the colonies.

It is announced that about one dozen Allan line steamers are to be fitted with Marconi wireless telegraph apparatus.

A white paper had been issued giving the terms of the agreement between the Postmaster-General and Marconi's Wireless Telegraph Co., Ltd., and the Marconi International Marine Communication Co., Ltd., under which the company surrender their wireless stations at Liverpool, Withernsea, Caister, Lizard, Rosslare, Niton, North Foreland, Crookhaven, and Holyhead, to the Postmaster-General for a consideration of £15,000. The details of the agreement were published in our columns at the time the Postmaster-General made his first statement on the subject, and the official document now issued adds little to the information then made public. It will be remembered that the Marconi Co. retain their high power stations at Poldhu and Clifden. One of the conditions of the transfer is that the Postmaster-General may use the patents of the company for a period of fourteen years from the date of the agreement without having to pay royalties. The use of the patents provided for in the agreement extend to communication between ship and shore, and also for inland transmission in the United Kingdom. Provision is also made for the use of the company's patents between the United Kingdom and British possessions, or a foreign country. The official document also includes an agreement between the Postmaster-General and Lloyd's, under which the Lloyd's wireless telegraph stations at North Foreland, Mallin Head, and Browhead (or Crookhead) are to be transferred to the Postmaster-General in the same way as the Marconi stations. The sum total to be paid is £2,400, and the Postmaster-General undertakes during a period of 15 years to furnish to Lloyd's, all maritime intelligence received at any shore station under his control. In the event of the Postmaster-General, within a certain period, deciding to discontinue wireless communication at these stations, Lloyd's are to have the option of repurchasing them.

A feature of the Electrical Exhibition held last month in Chicago was a complete wireless telegraph installation shown in action on a Wright aeroplane suspended from the roof. The exhibit was in charge of the U.S. Signal Corps.

Help has been rendered to the Alaska-Pacific liner *Kentucky* in consequence of the receipt of a wireless message to the effect that the steamer was sinking 240 miles off Cape Hatteras.

The *Australian Mining Standard* gives some details taken from the report of the conference recently held in Melbourne regarding the wireless telegraph scheme for linking up British possessions in the South Pacific. The recommendations of the conference are that the stations should be established at or near Sydney (Australia), Doubtless Bay (New Zealand), Suva (Fiji), and Ocean Island. It is estimated that the cost of construction will be about £70,000, to which the Imperial Government would contribute £23,334, New Zealand £16,333, Fiji £3,500, and the Commonwealth Government £26,833. The maintenance charges are put at £24,820 per annum, the Imperial Government contributing £7,716, New Zealand £6,248, Fiji £1,112, and the Commonwealth of Australia £9,734. These estimates are for high-power stations. For a more restricted service the total cost of maintenance is estimated at £17,170. In our issue for January 13th, page 26, we notified that tenders were being invited for the construction of some of these wireless telegraph stations.

Railway Electrification in Vienna.—It has been decided, says the Vienna correspondent of the *Financial News*, to convert the Vienna Metropolitan Railway to electric traction. The work will be carried out by Siemens-Schukert Werke, with the financial assistance of the Austrian Länderbank.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Feb. 3rd, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

693/09. **Exciter for Asynchronous Machines.** MILES WALKER (BRITISH WESTINGHOUSE CO.) In order to enable large induction motors to work at unity power factor or to take a leading current, the rotor winding is supplied with current from an auxiliary machine. Such a machine can also be used to excite an asynchronous generator. The armature has a number of windings in star connection, the free ends being connected to the bars of a commutator. The field system comprises a number of poles equal to, or a multiple of the number of phase circuits of the rotor of the motor or generator to be excited, and a corresponding number of brushes are provided for collecting the current from the commutator. The field system is energised by windings in series with the armature, and compensating windings are provided in the pole faces. Five claims, two figures.

7,706/09. **Protected Cable.** W. SCHMAHL and ARMORDUCT MANUFACTURING CO., LTD. A protected flexible cable for use with portable lamps, tools, radiators, &c., consists of two or more conductors braided with rubber-covered cord. This cord is formed of twisted cotton or yarn, surrounded with one or more layers of rubber. Before braiding, a layer of rubber is put over the insulated conductors, and finally, the whole is vulcanised. One claim, one figure.

9,971/09. **Conduit Inspection Fitting.** W. SCHMAHL. To render an inspection box water-tight, it is provided with a grooved packing rim filled with a permanently plastic packing material, which protrudes above the face of the rim, and is squeezed out between the rim and the cover when the latter is screwed on. Two claims, four figures.

12,477/09. **Line Insulator.** BULLERS, LTD., and H. DAGNALL. This comprises a porcelain head, into which is screwed the pin, and an oil cup supported by projections on the pin just below the head. The hole through the cup is provided with slots. When the slots and projections are caused to coincide by rotating the cup, the latter can be lowered for cleaning or filling. Three claims, three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: WITTGENSTEINER [Feeding mechanism] 7,508/09; SIEMENS-SCHUCKERTWERKE GES. [Lamps] 15,605/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: W. T. HENLEY'S TELEGRAPH WORKS CO. and NICHOLS [Underground cable disconnecting boxes] 1,800/09; STRATTON and CLAREMONT [Manufacture of cables] 6,151/09; ALLGEMEINE ELEKTRICITÄTS GES. [Transformer distribution system] 6,313/09; LINKE [Fixing wires to insulators] 13,786/09.

Dynamos, Motors & Transformers: ALLGEMEINE ELEKTRICITÄTS GES. [Power transmission systems] 11,339/09; LE TALL (*Westinghouse Electric & Manufacturing Co., U.S.A.*) [Machines] 19,393/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Motor control] 20,246/09; JOHANNET [Equalising torque of motors] 22,317/09; TUCH [Power transmission gear] 25,217/09.

Electric Ignition: BOUSFIELD (*Nightingall Gas Control Co.*) [Control of gas lamps] 1,264/09; DONALD [Engine ignition] 1,755/09; STUART-BAILEY and STOREY [Mine cartridges] 7,714/09; BUCKLEY [Apparatus for igniting miners' lamps] 8,112/09; R. BOSCH [Engine ignition] 18,457/09; MILTON [Interrupter] 21,962/09.

Electrometallurgy & Electrochemistry: AKTIEBOLAGET SWEDISH NITRIC SYNDICATE [Concentrating nitric acid] 10,592/09; BINGHAM [Furnace electrodes] 14,858/09; SOC. ELECTRO-METALLURGIQUE FRANCAISE [Manufacture of nickel] 14,946/09; SALTPETERSÄURE INDUSTRIE GES. [Arc furnace for treating gases] 19,466/09.

Storage Batteries: NYA ACKUMULATOR AKTIEBOLAGET JUNGNER and ESTELLE [Positive plates for alkaline cells] 8,195/09.

Switchgear, Fuses & Fittings: JENNER [Sign and switch] 1,132/09; ANDRÉ [Voltage and speed regulators] 1,157/09; SELBY, SANDERS and PRESTON [Switches] 1,662/09; SIMPLEX CONDUITS, LTD., WATERHOUSE and SHEPPARD [Water-tight switches] 3,106/09; LEA [Fuse] 3,345/09; "WATT"-INSTALLATIONEN FÜR STARK- UND SCHWACKSTROM CARL SCHULZ [Push-button switches] 23,526/09.

Telephony & Telegraphy: WEBB [Multiplex microphone transmitter] 12,473/09; FAIRWEATHER [*Aktiebolaget L. M. Ericsson & Co.*) [Common battery telephone system] 25,022/09.

Traction: IMBERY and CHAMEN [Tramcar brake] 925/09; COLEMAN [Signalling] 1,426/09; DAHLHEIM and VOGT [Operating points from car] 1,521/09; S. P. (SUCHOSTAWER PATENTS) SYNDICATE and SAYERS [Surface contact system] 1,875/09; WHITEHEAD and SMITH [Signalling] 6,816/09; MILLER and SPENCE [Signalling] 13,254/09; PRICE [Automatic block signalling] 15,099/09; NELSON, ORMSBY and NICHOLSON [Locking railway-carriage doors] 15,475/09; HARRINGTON and YOUNG [Automatic brakes] 16,067/09; SIEMENS BROS. & CO. (*Siemens & Halske Akt.-Ges.*) [Spring-switches for electrically setting points and signals] 19,662/09; LA BARRE [Automatic signalling] 21,665/09; SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*) [Overhead equipment] 28,024/09.

Miscellaneous: SOC. D'ELECTRICITE "NILMELIOR" and COLAS for every one of the main switch drum.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: HEIMANN and SCHAEFFER [Running arc and incandescent lamps in series] 747-8/10.

Electric Ignition: L. DUTHEIL, R. CHALMERS & Co. [Commutator] 1,130/10.

Switchgear: SOC. ANON. ATELIERS JASPAR & MELLER [Automatic electro-magnetic regulators] 1,087/10.

Telephony: STILLE [Telephone relays] 65/10.

Traction: GIFF [Signalling system] 25,196/09.

Miscellaneous: SOC. D'ELECTRICITE "NILMELIOR" and COLAS [Indicating and registering devices] 827/10.

Opposition to Grant of Patent

24,590/08. **Electric Smelting.** W. BORCHERS. Opposition has been entered to the grant of this patent, which is for a process of treating titaniferous iron ores in an electric furnace. The slag produced by the regular operation is transformed into a reducing agent, consisting of iron, titanium, carbon, and silicon by raising the temperature to 2,000° C., and adding carbon. New charges of iron ore are added in such limited quantities that all the iron oxides and the silica are reduced, with the exception of a small quantity which forms with the titanic acid the reducing agent for the next charge of ore.

Application for Revocation

15,978/09. **Electric Block Signalling System.** J. D. TAYLOR. Application has been made for the revocation of this patent under Section 26 of the Patents Act, the applicant having failed to enter opposition before the grant of the patent. The patent is for an automatic block signalling system, in which electrically continuous rails are used. Sources of supply for the signalling currents are so connected to the rails as to produce points of equal or zero potential midway between adjacent points of supply, and the relays controlling the signals are connected to the rails at suitable distances.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

3,093 of Feb. 11th, 1896. **Motor Controller.** J. DEVONSHIRE (*W. H. Knight and J. W. Darley, U.S.A.*). In a series-parallel motor controller the change-over from series to parallel connection of the two or more motors is effected in a number of stages, and resistances are inserted and removed successively when the changes are made. The controller contains a rheostat drum geared to the main drum, and making several revolutions for every one of the main switch drum.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: CROMPTON & Co. and E. W. ABBOTT [Suspension device] 22,362/04; J. M. WELLINGTON and W. F. DANIEL [Feeding mechanism] 22,522/04.

Dynamos, &c.: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Cooling of rotors of induction motors] 20,990/05; E. ARNOLD and J. L. LA COUR [A.-C. commutator motors] 21,034/05.

Electric Ignition: A. H. NICHOLSON [Ignition System] 21,173/05.

Storage Batteries: A. J. FIPPARD [Cell covers] 21,279/05.

Switchgear, &c.: SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) [Plug fuse] 22,573/03; E. F. MOY and P. H. BASTIE [Resistances] 22,647/04; OTIS ELEVATOR CO. (*Otis Elevator Co., U.S.A.*) [Control gear] 20,950/05; BRITISH THOMSON-HOUSTON CO. and E. B. WEDMORE [Switch for measuring instruments] 21,439/05.

Telephony, &c.: I. B. BIRNBAUM and F. G. BELL [Fire alarm circuits on C.B. telephone systems] 10,400A/05.

Traction: SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) [Electro-pneumatic brakes] 21,067/05.

Miscellaneous: F. EASTERFORD [Fire alarm] 22,538/03; O. MESSTER [Running phonographs and cinematographs synchronously] 22,566/05; E. A. CAROLAN (*General Electric Co., U.S.A.*) [Insulation of strip conductors] 22,906/03.

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LOCAL NOTES

BARKING: *Position of Electricity Undertaking.*—A proposal that an independent expert should be called in to report upon the position of the electricity undertaking has been referred to the Electricity Committee.

BURSLEM: *Mixed Pressure Turbine.*—A 600-kw. mixed pressure turbine has recently been put into service. Messrs. Bellis & Morcom supplied the turbine and Messrs. Siemens the generator. An additional Babcock & Wilcox boiler, capable of evaporating 10,000lb. of steam per hour, has been erected, making the fourth of its size at present erected in the works. A CO-2 recorder and a Lea recorder have also been installed.

DARLINGTON: *Exhaust Steam Turbine.*—A 550-kw. exhaust steam turbo-generator set has been installed at the Council's electricity works. Exhaust steam from the reciprocating engines in the power-house is made use of.

DUBLIN: *Cavehill and Whitewell Tramways.*—A draft Bill has been approved for mutual running powers between the Corporation and the Cavehill and Whitewell tramway systems.

DUNDEE: *New Plant.*—Owing to the increased demands which are being made on the electricity department for current since the inauguration of the new high-tension system, it has been necessary to install at the Lochee sub-station another 250-kw. rotary converter set. This set is being supplied by the British Westinghouse Co., and the switchgear by the British Thomson-Houston Co.

EDINBURGH: *Electric Lighting Accounts.*—The report of the Electric Lighting Committee for the year to May 15th, 1909, states that owing to the introduction of metal filament lamps, the increase in the maximum load was only 296 kw. The total connections amounted to 992,392 eight c.p. lamps, the connections during the year being 53,478. The motor load was increased by 601 h.p. The net profit amounted to £2,071, after meeting all expenditure and capital charges. This has been applied to the relief of rates.

FIFESHIRE: *Opposition to Tramways.*—The Fife County Council will oppose the proposed extension of the Dunfermline & District Tramways Co. system to Rosyth.

GILLINGHAM: *Wiring and Fitting Premises.*—The Council have been provided with a list of Corporations who are supporting the proposal of Mr. E. E. Hoadley (Maidstone) to promote a Bill conferring electric wiring and fitting powers upon municipalities. As a consequence, they have agreed to contribute £10 towards the expenses of promoting the Bill. The Association of Municipal Corporations is to be asked to support the measure.

HASTINGS: *Wiring and Fitting of Premises.*—The Electrical Contractors' Association have been informed that the Council have inserted in the clause, contained in the Bill which they are promoting in the next session of Parliament, for giving them power to supply electrical fittings, lamps, motors, &c., the words, "through a contractor but not otherwise." This will dispose of the opposition of the Electrical Contractors' Association to the Bill.

LEITH: *Cost of Tramways.*—Sir Alexander Kennedy, Consulting Engineer to the Edinburgh Corporation, has written to the Council stating that the cost of the extension of the Leith electric tramway system to Granton appeared very much in excess of the normal cost of such work. The Leith Borough Surveyor has replied that the total cost was £18,274 18s. per mile of double track. The superintending and engineering fees accounted for £2,897; altering gas and water pipes, £4,400; and chilled blocks in order to prolong the life of the paving, £2,371. If the cost of these special items were deducted, the cost of the tramway per mile worked out at £14,766 per mile of double track, which he did not think unreasonable.

LONDON: *London County Council: Trailer Cars.*—The Board of Trade has agreed to the use, as an experiment, of single-deck trailer cars on the Euston Road to Hampstead Heath tramway route, on the understanding that the Commissioner of Police concurred in the proposal, and that the trailer cars should not be run on any part of the route between the hours of 10 a.m. and 5 p.m. The Board reserves the right to withdraw its consent at any time.

Hammersmith: Advertising Electricity.—In connection with the joint advertising scheme of the Associated Municipal Electrical Engineers of Greater London, the Council is to purchase from them £50 worth of literature, to be supplied during one year as ordered.

Paddington: Tramways.—The Council have decided to oppose the construction of a tramway by the L.C.C. from Marble Arch to Cricklewood.

MACCLESFIELD: *Electricity Supply.*—The Corporation Electric Lighting Order will shortly expire, and the Board of Trade have intimated their intention of not renewing it unless the Council show that they are taking steps to put the Order into force. At their last meeting, the Council decided not to exercise the powers but to offer facilities for the company to put them into force.

REDDITCH: *The "Norwich" System of Charging.*—The Council are giving a trial to the Norwich system of charging for electrical supply upon the basis of the rateable value of the premises supplied.

ROTHERHAM: *Electric Supply.*—The Town Clerk reports that the Sheffield Corporation has decided not to proceed with their application for a provisional order to supply electricity to the parish of Tinsley.

STRETFORD: *New Plant.*—At the last meeting of the Lighting Committee, the chairman and the resident electrical engineer directed attention to the approaching necessity for extensions of plant to deal with next winter's load. Consideration of the matter was postponed until the next meeting.

TORQUAY: *Metal Filament Lamps.*—The engineer has been instructed to fix a 1,000-c.p. metal filament lamp to one of the arc-lamp standards as an experiment.

WEST HARTLEPOOL: *Proposed Purchase of Tramways.*—At the last meeting of the Council it was decided to promote a Bill for the purchase of certain portions of the undertaking of the Hartlepools Electric Tramways Co. The decision was arrived at by a majority of one.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BRADFORD.—Mains are to be laid at an estimated cost of £1,578.

CANADA.—Application has been made for the incorporation of the Ottawa & Montreal Transmission Co., Ltd., with a capital of £3,000.

EASTBOURNE.—The Electrical Engineer reports that the cooling plant will have to be enlarged at an approximate cost of £250.

GRAYS.—A Local Government Board inquiry was held last week concerning a loan for extensions of the electricity works.

HANLEY.—The Electrical Engineer has been instructed to prepare plans and estimates for extensions at the electricity works.

HECKMONDWIKE.—Tenders are invited for an evaporative condensing plant capable of dealing with 20,000 lbs. of exhaust steam per hour. Particulars from the Borough Electrical Engineer, and tenders by February 16th.

INDIA.—The Secretary of State for India invites tenders for electric cranes. Particulars from the Director-General of Stores, India Office, Whitehall, S.W., to whom tenders by February 15th.

KETTERING.—The Council require 1,440 positive battery plates for a 360-ampere-hour battery at the electricity works. Particulars from the Borough Electrical Engineer, and tenders by February 14th.

SOUTH AFRICA.—The New Modderfontein Gold Mining Co. propose to issue 50,000 new shares of £4 each at £11 per share to provide for, among other things, the complete electrical equipment of their plant.

WIMBLEDON.—Tenders are invited for the supply and erection of pipe-work, valve, &c., at the electricity works. Particulars from the Borough Electrical Engineer, and tenders by February 28th. (See an advertisement on another page.)

Miscellaneous

AUSTRALIA.—Captain R. Muirhead Collins, representative of the Commonwealth in London, has received tender forms, specifications, &c., in connection with the supply of a dust extractor, required by the Postmaster-General's Department, Brisbane, Queensland. Tenders will be received by the Deputy Postmaster-General, Brisbane, until March 30th, 1910.

BACUP.—The Town Council have approved a scheme for electric tramways from Bacup to Shawforth at an estimated cost of £25,000. An inquiry was held last week by the Light Railway Commissioners. An arrangement will be entered into with the Rochdale Corporation for the working of the line when constructed.

BLACKBURN.—The Electricity and Tramways Department require general stores, including insulating material, fuse-boxes, switches, motors, motor-starting switches, and conduit. Particulars from the Borough Electrical Engineer or Tramways Manager, and tenders by February 16th.

DONCASTER.—An inquiry was held last week by the Light Railway Commissioners respecting a proposal to extend the Doncaster tramways to Bentley Colliery. The proposed line has a length of 4 furlongs 4½ chains, and is estimated to cost £5.050, in addition to £2,550 for equipment.

GLASGOW.—Tenders are invited for three electric motors, &c., for the workshop at the Shieldhall Outfall Works of the

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Corporation. Particulars from the Office of Public Works, 64 Cochrane Street, and tenders by February 16th.

HORNSEY.—Meters and cables are required by the Borough Council. Particulars from the Borough Electrical Engineer, and tenders by February 19th.

ILFORD.—Tenders are invited for the supply of electrical goods, including meters, lamps, cables, carbons, fuse-boxes, joint-boxes, &c. Particulars from the Borough Electrical Engineer, and tenders by February 22nd.

LEEDS.—Tenders are invited by February 28th for the annual supply of stores including india-rubber covered cables, mains, boxes, and fittings, jointing and insulation materials, electric lamps, fittings, and accessories. Particulars from Mr. H. Dickinson.

LONDON: *Bermondsey.*—Tenders are invited for arc lamp carbons, cable and joint materials, conduits, meters, main fuses, meter boards, joint-boxes, &c. Particulars from the Borough Electrical Engineer, and tenders by February 14th.

Hammersmith.—The Council require electrical stores. Particulars from the Borough Electrical Engineer, and tenders by February 16th.

St. Pancras.—A supply of arc lamp carbons is required. Particulars from the Electricity Department, and tenders by February 28th.

MEXICO.—It is stated that the Chapala Hydro-Electric & Irrigation Co. is considering the question of constructing an electric railway about 120 miles long between Guadalajara and Aguascalientes.

NEWPORT.—A scheme for extending the tramways to the Eastern Dry Docks is contemplated.

SOUTH AFRICA.—*The British and South African Export Gazette* states that orders for a quantity of electrical plant may be anticipated in the near future from the Pigg's Peak Development Co., Ltd. The Johannesburg Municipality are about to give out contracts for 12,800 yards of cable.

WOLVERHAMPTON.—Tenders are invited for electrical stores, &c., for the two years ending March 31st, 1912. Particulars from the Tramways Manager, and tenders to the Twon Clerk by February 12th.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

S.W.—Building, Regent Street, and Kingley Street, S.W. Architects, Woodward & Sons, 13 Southampton Street, W.C.

Building, rear of 33 Sloane Street, Chelsea, S.W., abutting upon Hans Crescent, Chelsea, S.W. Architect, W. R. Lore, 10 Basinghall Street, E.C.

N.W.—Alterations and additions to Great College Street School, St. Pancras (£4,541). Builders, C. F. Kearley, 4 Great Marlborough Street, W.C.

N.E.—Shops in front of Dalston Junction Railway Station, N.E. A. Whitelaw, London & North-Western Railway Company, Euston, N.W.

PROVINCES.

BIRMINGHAM.—Premises for Best & Lloyd, Ltd. Builders, G. Webb, Soho, Birmingham.

BURSLEM.—Rink (£1,840). Architects, E. T. Watkins & Adams, Swan Chambers, Burslem.

DUNFERMLINE.—Swimming baths. Clerk to Town Council.

EDINBURGH.—Tenders are invited by the 14th inst. for an electric lighting installation at the New Slaughter Houses, Gorgie. Particulars from the Corporation Electrical Engineer, and tenders to the Town Clerk.

GLASGOW.—Offices and warehouses, Ingram Street (£35,000). Architects, J. W. & J. Laird, Hope Street, Glasgow.

Extension to Samaritan Hospital (£12,000). Architects, McWhannel, Rogerson & Reid, West Regent Street, Glasgow.

HUDDERSFIELD.—Presbyterian Church. Trustees, Huddersfield.

HENDON.—Entertainment Hall. Architects, Barnes & Burton, Jesmond Road, Newcastle.

LEEK.—Drill Hall (£3,000). Builder, T. Godwin, Hanley.

NOTTINGHAM.—Pavilion, Bulwell Hall Park (£2,000). A Brown, Borough Surveyor.

PORTSMOUTH.—Secondary school (£6,000). Builders, H. Jones & Son, Portsmouth.

ROTHERHAM.—Tenders are to be invited for the completion of the electric wiring at the High School.

SHEFFIELD.—United Methodist Chapel, Stubbins Lane, and new road, for the trustees.

SHREWSBURY.—Alterations and additions to Vaughan's Mansion, College Hill (£1,160). Architect, A. E. Williams, County Chambers, High Street, Shrewsbury.

WEST HAM.—Milling room and label store, Ward Road, Stratford, for Cadas, Ltd., chemists and druggists.

TENDERS RECEIVED AND ACCEPTED

BIRKENHEAD.—The tender of the Brush Electrical Engineering Co., Ltd., has been accepted at £795 for fitting ten small cars with top covers. In reply to a complaint that the work was not kept in Birkenhead, the Chairman of the Tramways Committee states that the lowest local tender was over 6 per cent. higher than that of the Brush Co.

BRADFORD.—The tenders of the Edison & Swan United Electric Light Co., Ltd., and Pope's Electric Lamp Co., Ltd., have been accepted for the supply of incandescent lamps.

BRIGHTON.—The Council have accepted the tender of Messrs. Richardsons, Westgarth & Co., Ltd., for a double-cylinder Parsons-Brown Boveri turbine, and a Siemens' alternator of 3,500 kw. capacity, at £11,370.

The following tenders have also been received for a 1,300 h.p. induction motor:—General Electric Co., Ltd. (accepted), £1,076 10s.; Brush Electrical Engineering Co., £1,210; Bruce Peebles & Co., Ltd., £1,225; Crompton & Co., Ltd., £1,280; British Westinghouse Co., Ltd., (*a*) £1,343, (*b*) £1,367; Siemens Bros. & Co., Ltd., £1,390; Britsh Electrical Plant Co., Ltd., £1,425; British Thomson-Houston, Co., Ltd., £1,467; Lancashire Dynamo & Motor Co., Ltd., £1,535; Dick, Kerr & Co., Ltd., £1,609; Phœnix Dynamo Manufacturing Co., Ltd., £1,635; Electrical Construction Co., Ltd., £1,643.

For 300-kw. balancing set:—General Electric Co., Ltd. (accepted), £930; Bruce Peebles & Co., Ltd., £950; British Westinghouse Co., Ltd., (*a*) £1,072, (*b*) £1,445; Electric Construction Co., Ltd., £1,078; Phœnix Dynamo Mnfg. Co., Ltd., £1,090; Brush Electrical Engineering Co., £1,100; British Electric Plant Co., £1,136; Crompton & Co., Ltd., £1,250; Lancashire Dynamo & Motor Co., Ltd., £1,270; Siemens Bros. & Co., Ltd., £1,315; British Thomson-Houston Co., £1,403; Dick, Kerr & Co., Ltd., £1,461.

Thirteen tenders were received for high-tension switchgear, ranging from £277 to £572. That of the British Westinghouse Co., at £393, has been accepted.

DERBY.—The tender of Messrs. C. A. Parsons & Co., Ltd., for a 1,000-kw. turbo-alternator at £5,203 has been accepted, subject to the consent of the Local Government Board to the necessary loan.

EASTBOURNE.—The following tenders were received for condensing plant and pipe-work for the electricity works:—Willans & Robinson, Ltd. (accepted), £1,888; E. Scott & Co., Ltd., £3,150 10s.; Davenport Engineering Co., £2,640; Prockter & Kenyon, Ltd., £2,607 7s.; Belliss & Morcom, Ltd., £2,500; Richardsons, Westgarth & Co., Ltd., £2,463 12s.; J. P. Hall & Sons, Ltd., £2,450; Browett Lindley & Co., £2,365; Worthington Pump Co., Ltd., £2,348; Mirrlees, Watson & Co., Ltd., £2,340; Westinghouse Electric Manufacturing Co., Ltd., £2,280; Midland Engineering Co., Ltd., £2,198; W. H. Allen & Son, Ltd., £2,140; I. Storey & Sons, Ltd., £2,137 12s.; Brush Electrical Engineering Co., Ltd., £2,014; J. Thompson, £1,779 10s. Not to specification:—C. A. Parsons & Co., Ltd., £1,959; Michael Pal & Co., Ltd., £2,173.

ECCLES.—With reference to our note under this heading last week, Messrs. Browett, Lindley & Co., Ltd., inform us that they, and not the Westinghouse Co., have the order for the generating set referred to. The engine is of Messrs. Browett, Lindley's manufacture, the generator is by the Westinghouse Co., and the condenser by Messrs. Korting Bros., Ltd.

LONDON: *London County Council.*—The tender of E. Newbold & Co., Court Road, Sutton, has been accepted at £133 for the installation of electric lighting and bells at the Poplar Educational Divisional Offices.

The tender of John Mowlem & Co., Ltd., at £39,792, for the roadwork and platelaying (exclusive of rails and special trackwork) in connection with the reconstruction, on the conduit system, of the tramways from Brockley Road to Forest Hill, has been accepted.

The following tenders have been received for the supply, delivery, and erection at the central car repair depot in Woolwich Road of four electric travelling cranes: S. H. Heywood & Co., Ltd., £2,285; Applebys, Ltd., £2,412 10s.; Ransomes & Rapier, Ltd., £2,490; Thos. Broadbent & Sons, £2,536; Royce, Ltd., £2,576; Babcock & Wilcox, Ltd., £2,585.

An offer, amounting to £410, of the British Thomson-Houston Co., Ltd., for fitting a pair of equipments for coupling two single-deck electric cars has been accepted.

Chelsea.—The Council have accepted the tender of Messrs. Rawlings Bros. & Co. at £58 10s. for overhauling and rewiring where necessary the electrical installation in the Town Hall.

Stepney.—The Council have received the following tenders: Turbo-generator and accessories, converting machinery, switchgear, &c., at Blyth's Wharf—C. A. Parsons & Co. (Bruce Peebles alternator), £18,978 10s. and £19,091 (the latter accepted), (Westinghouse alternator), £19,198 and £19,403 (Dick, Kerr alternator), £19,518 (Parsons alternator), £19,614; Richardsons, Westgarth & Co. (Bruce Peebles alternator), £19,279 and £19,394 (General Electric alternator), £19,405 (Siemens alternator), £19,527 (Electric Construction alternator), £19,601; British Westinghouse Electric & Manufacturing Co., Ltd. (Westinghouse alternator), £19,500, £19,450, £18,920, and £19,070; J. Howden & Co. (Bruce Peebles alternator), £19,410 and £19,466 (Siemens alternator), £19,600 (Dick, Kerr alternator).

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£19,689 (Brown, Boveri alternator), £19,800; Brush Electrical Engineering Co., £19,682 and £19,582; Willans & Robinson, Ltd. (Bruce Peebles alternator), £19,966, £19,506, and £19,506; British Thomson-Houston Co., Ltd., £20,509; Lahmeyer Electrical Co., Ltd., £20,759; G. Braulik (Maffer-Schwartzkopff Werke), £20,824.

For supply and delivery of cable for period ending December 31st, 1912: Henley's Telegraph Works Co., Ltd. (accepted), £8,095 10s.; British Insulated & Helsby Cables, Ltd., £8,237 15s.; W. T. Glover & Co., Ltd., £8,268 10s.; Siemens Bros. Dynamo Works, Ltd., £8,287 10s.; St. Helen's Cable Co., Ltd., £8,335; Callender's Cable & Construction Co., Ltd., £8,352 12s. 6d.; Western Electric Co., Ltd., £8,574 5s.

For conduits, troughs, and covers for the period ending December 31st, 1912: Siemens Bros. Dynamo Works, Ltd. (accepted), (*a*) conduits, £2,280 13s. 4d.; (*b*) troughs and covers, £878 3s. 4d.; Henley's Telegraph Works Co. (*a*) £2,363 3s 4d., (*b*) £878 3s. 4d.; Albion Clay Co., Ltd., (*a*) £2,379 13s. 4d.; W. T. Glover & Co., Ltd., (*a*) £2,645 10s., (*b*) £949 13s. 4d.

For boilers and accessories: E. Danks & Co., Ltd., £13,761 10s. (accepted); Clarke, Chapman & Co., Ltd., £16,382; Babcock & Wilcox, Ltd., £16,960.

For the supply and delivery of 1,000 fuse-boxes: Reason Manufacturing Co., Ltd. (accepted), 50 amp., 1s. 6d.; W. Lucy & Co., 50 amp., 1s. 6d., and 25 amp., 1s. 3½d.; Crompton & Co., Ltd., 50 amp., 1s. 7d.; Johnson & Phillips, Ltd., 50 amp., 1s. 8½d.

APPOINTMENTS AND PERSONAL NOTES

The salary of Mr. A. D. Chalmers, electrical engineer to the Gillingham Town Council, has been reduced from £350 to £300 per annum, plus 1 per cent. on the gross profits.

Mr. T. D. Clothier, Borough Electrical Engineer of Bootle, has been granted an honorarium of £50 in view of the satisfactory condition of the electricity undertaking, and the additional responsibility in connection with the proposed alterations at the power station.

Sir Clifton Robinson has retired from the managing-directorship of the London United Tramways, Ltd., and will be succeeded by Mr. A. Stanley, General Manager of the Underground Electric Railways Co., of London, Ltd. Sir Clifton Robinson left London on Tuesday to undertake a tramway project for Messrs. Speyer Bros. in the Phillipines.

The salary of Mr. L. L. Robinson, Electrical Engineer to the Hackney Borough Council, is to be increased by annual increments of £50, instead of £25, until the maximum of £750 per annum is reached.

British Association.—This year's meeting of the British Association for the Advancement of Science will be held at Sheffield on August 31st and following days, under the presidency of the Rev. Prof. T. G. Bonney, Sc.D., LL.D., F.R.S. Among the sectional presidents are:—Section A (Mathematical and Physical Science), E. W. Hobson, Sc.D., F.R.S.; Section B (Chemistry), J. E. Stead, F.R.S.; and Section G (Engineering), Prof. W. E. Dalby, D.Sc.

The Paris Floods.—A note in *l'Electricien* gives some particulars of the damage done by the Paris floods to the electrical undertakings of Paris. Some galleries of the Edison Co.'s substation in the Rue Bergère were flooded, and both accumulators and transformers were submerged, in spite of the efforts of a pair of powerful pumps. The substation of the same company in Rue Trudaine, however, continued to be available, but the water reached that of St. Denis in the afternoon of January 29th. The supply to the Clichy section was also insufficient, as the plant in the station in the Rue des Dames does not suffice for the needs of the district, and the three-phase station at Asnierès, which normally provides most of the supply, was entirely flooded out. The municipal station at the Halles was seriously handicapped, and a total stoppage in a station, and the situation became very critical in the Champs Elysées district, owing to damage to the cable system. As regards the left bank of the river, the large station at Issy les Moulineaux was put out of action on January 28th, and the underground Palais Royal station was entirely under water. The damage in all cases is serious, and no definite date can be given for the resumption of supply. The relative positions of the above stations were explained in an article on "The Paris Electricity Supply," ELECTRICAL ENGINEERING, Vol. V., page 719 (August 12th). All the five telephone exchanges of the Telephone Co. were inundated, and some 1,600 employees thrown out of work. They are, however, all being paid a sum of 1 franc per day, and 50 centimes for their wives and each child or aged relation depending on them for support. According to *La Lumière Electrique*, great trouble was experienced at the Central Post and Telegraph Office in Rue Grenelle, and it was only by the most energetic pumping that the water was kept from the accumulators, motor-generator, &c., which supply various small motors working telegraph and other apparatus. The general telegraphic service, however, was not interrupted. The military wireless telegraph station at the Eiffel Tower was flooded, and it is feared that much of the apparatus has been irretrievably spoiled. A certain amount of communication was maintained with the nearer military stations by means of a 3-kw. portable military equipment.

MISCELLANEOUS CITY NOTES

MONTREAL LIGHT, HEAT, & POWER CO.—A dividend at the rate of 7 per cent. per annum has been declared for the quarter to December 31st.

WESTMINSTER ELECTRIC SUPPLY CORPORATION.—A dividend at the rate of 10 per cent. less tax is recommended for the December half-year.

METROPOLITAN DISTRICT RAILWAY CO.—A dividend at the rate of £4 per cent. per annum is recommended on the 4 per cent. guaranteed stock for the December half-year. Last year the dividend was £1 15s. per cent. The directors propose to set aside £10,000 as reserve for renewals.

NATIONAL TELEPHONE CO.—A dividend at the rate of 6 per cent. on the deferred stock is recommended for the December half-year, less tax, carrying £170,000 to reserve, and £11,000 forward.

ST. JAMES & PALL MALL ELECTRIC LIGHT CO.—A balance dividend on the ordinary shares of 5s. per share, making 10 per cent. for the year 1909, is recommended.

DUNDEE, BROUGHTY FERRY & DISTRICT TRAMWAYS CO.—An interim dividend at the rate of 6 per cent. has been declared upon the preference shares.

SOUTH LONDON ELECTRIC SUPPLY CO.—A dividend of 5 per cent. per annum is announced for 1909.

CHELSEA ELECTRICITY SUPPLY CO.—After paying 4½ per cent. for the year on the ordinary shares for 1909, a balance of £1,362 is carried forward.

CITY OF LONDON ELECTRIC LIGHTING CO.—A dividend at the rate of 7 per cent. per annum on the ordinary shares is recommended for the December half-year, carrying forward £24,000.

PROVINCIAL TRAMWAYS CO.—It is proposed to write down the company's capital by £124,560, by converting the £10 ordinary shares in five shares of £1 each.

BRITISH ALUMINIUM CO.—Mr. A. W. Tait, the receiver and manager, has published details of the proposed scheme of reconstruction, which involves a voluntary winding up of the company, and the registration of a new company to take over the assets. Under the scheme, provision will be made to pay off existing liabilities, and to provide further working capital. The following will be directors of the new company: Mr. A. W. Tait, Mr. R. W. Cooper, Mr. George Flett (Messrs. Dick, Kerr & Co.), Captain Stephen H. Pollen, Mr. W. B. Rommel, Mr. E. E. Sawyer, and Mr. J. Taylor (B. I. & H. Cables, Ltd.). Mr. W. M. Morrison will be general manager.

Black Smoke Prosecution.—The City of London Electric Lighting Co. were fined £5 and 2s. costs at the Tower Bridge Police Court last week for allowing black smoke to issue from a chimney shaft at the Bankside Power House. For the company it was stated that every known smoke prevention appliance had been tried by them, and that they used the best coals. The magistrate said he only fined the company a nominal penalty in view of the fact that they had done everything in their power to prevent a nuisance.

Telegraph Traffic and Movements of Cable Ships.—A new telegraph office has been opened at Cassinga in Angola, and wireless communication has been established with the Comoron Islands and Madagascar, but as the connection is to be regarded as an extension of the telegraph system, a charge for the wireless service will not be made.—A similar connection has been made between the Caroline and Palaos Islands, only in this case the wireless service must be paid for.—The lines of the Indo-European Telegraph Co. were restored to working order on the 31st ulto., and the "*via* Makassar" route was working normally on 1st inst. On the following day the line between Bagdad and Bassorah failed, and the El Arich route beyond Gaza broke down on the 2nd inst. for a short period.—The French cables in the West Indies are still giving trouble, for, now that the C.S. *Pouyer Quertier* is at the western end of the West Indian system to repair the Nedle St. Nicholas—Cape Haiti cable, the cable at the Eastern end between Paramaribo and Cayenne has broken down. As a result, telegrams for French Guiana must proceed *via* Salinas in Brazil.—Now that the floods in Paris have happily subsided, it will be possible to effect repairs to the telegraph system.—The wireless station at Bowden, Jamaica, belonging to the Direct West India Cable Co., is open to the public.—On the 5th inst. communication between Singaradja and Ampenan was interrupted; telegrams for the latter place are being posted from Singaradja.—On the same day the cable between Sevakopmund and Mossamedes failed, as well as that between Lagos and Bonny, and the line between Saigon and Bangkok.—On the 6th inst. the line between Bagdad and Bassorah was again working, and on the 7th inst. success attended the efforts to repair the cable between Lagos and Bonny.

A Safety Gate-end Switchbox for Mines.—We regret that in our report of the discussion on Mr. H. J. Fisher's Paper before the Newcastle Local Section of the Institution of Electrical Engineers on page xxi. of our supplement on ELECTRICAL ENGINEERING IN MINES last week, Messrs. Wood and Morton were incorrectly described. Mr. Wood is with Messrs. Ernest Scott & Mountain, and the Mr. Morton who spoke was Mr. W. R. Morton, of W. T. Glover & Co., Ltd., who were the makers of the trailing cable in question.

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COMPANIES' MEETINGS AND REPORTS

POWER GAS CORPORATION.—The report to the year ended Sept. 30th, shows a total profit of £6,440, including £2,660 brought forward. The directors propose to create a reserve fund of £750, carrying forward the balance. Regret is expressed at the death of the vice-chairman, Dr. Ludwig Mond.

At the annual meeting the above report and accounts were adopted. Mr. Alfred Mond, the chairman, referred in his speech to the utilisation of peat in gas plants, and stated that there was now in Tuscany a Mond-peat plant with sulphate of ammonia recovery, which was being used to supply a large area with electricity, the dynamos being driven by gas engines. The German Mond Co. also had a plant at work, and was putting up another large installation. The Power-Gas Corporation had erected a plant which had been successfully run in England, and he thought recent developments in this direction opened up a considerable scope for the company for future years.

MEXICAN LIGHT & POWER CO.—Resolutions have been passed authorising an increase of the capital of the company by the creation of 36,000 additional preference shares and 54,000 ordinary shares of $100 each. The new capital is mainly required for extensions of the transmission line to Pachuca, and for the purchase of an electric power company in that district. The company have now under construction 50,000 h.p. additional plant at their Necaxa works.

CENTRAL LONDON RAILWAY CO.—The report for the December half-year shows a gross profit of £62,359. A dividend at the rate of 3 per cent. per annum on the undivided ordinary shares is recommended, 4 per cent. per annum on the preferred ordinary shares, and 2 per cent. on the deferred ordinary shares, leaving a balance of £35,281. A balance of £33,241 is carried forward.

At the meeting on Thursday, Sir Henry Oakley, the chairman of the company, stated that the company's engineer has in hand the final plans and basis of the contract for the construction of the extension to Liverpool Street.

GREAT NORTHERN & CITY RAILWAY CO.—The accounts for the December half-year show a net revenue of £17,304, which is insufficient, however, to meet the fixed charges. Consequently the sum of £5,709 has been provided from outside sources to enable these to be met. The report states that the directors, after careful consideration have, with great reluctance, felt compelled to abandon the hope of constructing the extension to Lothbury in view of the financial position of the company, and its present restricted traffic. The Earl of Lauderdale presided at the half-yearly meeting on Friday. For the first time since 1907 the traffic has shown a slight increase. Negotiations with the Great Northern Railway Co. with a view to making the terminus of the Great Northern & City Co. the City terminus of the Great Northern Co. have been dropped owing to the terms asked by the latter being prohibitive.

LONDON, BRIGHTON & SOUTH COAST RAILWAY CO.—Speaking at the half-yearly meeting last week, the Earl of Bessborough (chairman) stated that the electrical train services between London Bridge and Victoria had met with immediate and considerable response on the part of the public, particularly in the populous districts of Denmark Hill, Peckham Rye, and Queen's Road. In the very first week there was an increase of over 40,000 passengers, and during the two months since the line was opened there had been a steady and continuous gain week by week. The increase in passengers during the two months, as compared with the corresponding period of 1908-9, amounted to the large figure of 440,536, or just on 63 per cent. The increase in the first month was 189,000, or 55 per cent., and in the second month 251,000, or 71 per cent. Every credit must be given to the principal contractors, the Allgemeine Company of Berlin, for the very thorough and careful manner in which the constructional work has been done and the equipment installed. The traffic results showed that the company had got back nearly the whole of their lost traffic on that section, and these results had led the Board to think of the advisability of extensions. The A.E.G. had readily accepted the conditions of the contract, that, with the exception of the motors, which are the patents of Drs. Winter and Eichberg, and not made in this country, the whole of the plant and work should be English. It was satisfactory to know that the President, Dr. Rathenau, and the managing director, Mr. Hamspohn, of the Allgemeine Company, are most appreciative of the way in which the work has been carried out by their sub-contractors, Messrs. R. W. Blackwell & Co., and have testified to the excellence of the overhead structure, to the perfection of the electrical work, and the solidity, comfort, and smooth running of the rolling stock, for which latter the Metropolitan Amalgamated Carriage Co. of Birmingham, was responsible. It had only been possible to obtain these results by the co-operation of the whole of our executive staff, but special mention must be made of the company's consulting electrical engineer, Mr. Philip Dawson, who had supervised the work throughout. Thanks were due to him for the capable way in which he had carried out his duties, and had dealt with and solved many difficult problems presented by the peculiar conditions of the line. He believed he was right in saying that this was the first recorded instance where electric traction established on an ordinary steam railway had worked from the commencement so smoothly and uninterruptedly, and in this connection it was only fair to acknowledge the ready co-operation and help of the London Electric Supply Corporation, and the efficiency and regularity with which their part of the task had been performed.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £61 15s. to £62 5s. per ton (last week, £62 to £62 10s.).

SIMPLEX CONDUITS TELEGRAPHIC ADDRESS.—Messrs. Simplex Conduits, Ltd., have registered the telegraphic address, "Siconduliim," for their office at 116 Charing Cross Road, London, W.C., and all telegrams intended for the attention of Mr. Waterhouse, purchasing department and publicity department, should be so addressed.

CANADIAN AGENCIES WANTED.—A North of England firm, manufacturing overhead electric cranes, electric jib cranes, electric capstans and winches, electric transporters, &c., is anxious to get into touch with a large manufacturing firm in Canada open to co-operate with them in extending their Canadian business.

A London firm manufacturing arc lamps, metal filament lamps, automatic transformer switches, transformers, carbons, globes, reflectors, and other accessories, is open to appoint agents at Montreal, Toronto, Ottawa, and Winnipeg, and in British Columbia.

Further particulars may be obtained from the High Commissioner for Canada, 17 Victoria Street, London, S.W.

INCREASE OF PRICE OF RUBBER TAPE.—We are informed by Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W., that the prices of the rubber tapes contained in their lists Nos. 510 and 510A have been increased by a further 10 per cent., making a total increase of 20 per cent. since these lists came into operation.

CHANGE OF ADDRESS.—Owing to increase in business, the London offices of Messrs. Everett, Edgcumbe & Co., Ltd., are to be removed from 87 to 117 Victoria Street, Westminster, where all communications should be addressed in future. Telephone numbers and telegraphic address remain unaltered.

National Industrial Education League.—It is proposed to form a National Industrial Education League with the object of initiating some measure of instruction in technical matters during the last two years of ordinary elementary school training. A large number of trade societies and manufacturing companies have given their support to the proposal, and a conference will shortly be held. The offices of the League are at Craig's Court House, Charing Cross, London, S.W.

Metropolitan Tramway Managers' Association.—The annual dinner was held at the Trocadero Restaurant on Wednesday last week. Sir Clifton Robinson, who was in the chair, said that after fifty years' experience of tramway working he felt the time had come when, with more freedom and less responsibility, he might be able to do even better work than he had done in the past. For this reason he was retiring from the managing directorship of the London United Tramways Co., Ltd. Mr. Edgar Speyer subsequently made the announcement, reported elsewhere in this issue, that Sir Clifton Robinson was going to the Philippines.

Electrically Driven Hose Weaving Machinery.—Messrs. Merryweather & Sons, Ltd., inform us that their Greenwich fire engine works are driven electrically throughout, and that their weaving sheds, which adjoin the fire engine factory, are fitted with special electrically driven looms and other machines for making canvas hoses. They state that they produce a much stronger web by the use of electrically driven looms, as, owing to the great pull exerted upon the yarn by such machines, a light or inferior yarn will not stand the strain; consequently only the best yarn can be used. These weaving sheds are, we understand, the only ones existing in London.

Submarine Cable between Italy and Sardinia.—In January the laying of a new cable between Italy and the Island of Sardinia was completed by Messrs. Pirelli & Co., of Milan. The first cable between Italy and Sardinia was laid in 1875, and its upkeep entrusted to the Eastern Telegraph Co. until 1905, after which date it passed into the care of Messrs. Pirelli & Co., to whom the contract for the supplying, laying, and maintenance for five years was allotted. The core of the new cable is completely armoured with a brass tape as a protection against the teredo. A peculiar condition of the specification was, that the sag was to be not less than 5 per cent. in depths up to 55 fathoms, nor less than 10 per cent. in depths of more than 55 fathoms. The maximum depth reached by the cable is about 700 fathoms.

The Telewriter.—The Postmaster-General has granted a twenty-one years' lease to the Telewriter Syndicate for the establishment of telewriter exchanges in London.

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ELECTRICAL ENGINEERING

NO. 164 [VOL. VI., NO. 7] THURSDAY, FEBRUARY 17, 1910. [PRICE ONE PENNY.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

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Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON AND WESTMINSTER BANK (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

BINDING "ELECTRICAL ENGINEERING." — Vol. V. of "Electrical Engineering" (Jan.—Dec. 1909) closed with our issue of Dec. 30. An index for the volume is now ready, and copies may be ordered from any newsagent or bookseller at the price of 1d. each (or post free, 2d.). Binding Cases, including index, are also ready, price 2s. each, post free 2s. 4d. (Abroad 2s. 6d.) Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to us, carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad.

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SUMMARY

THE principal feature of the power station which has been put down for the electrical driving of the G.W.R. Carriage and Wagon Works, Swindon, is the pair of 250-h.p. Campbell suction gas producers, each supplying a vertical four-cylinder gas engine. Electric motors are gradually being introduced throughout the works, which will ultimately be practically entirely electrically driven. Continuous current at 250 volts is employed and overhead feeders are used. (Page 107.)

A DESCRIPTION is given of the recently installed electrical equipment of the Brunswick Mills, of the Bannerman Mills Co., at Manchester. Power is taken at 6,500 volts three-phase from the mains of the Manchester Corporation, and transformed down to 400/415 volts in the mill sub-station. Induction motors are used throughout; in some cases placed in towers outside the walls of the mill. Thirty-seven motors are used, aggregating 1,640 h.p. (Page 110.)

A NEW method of planing machine drive by reversing motors has been introduced by the Lancashire Dynamo & Motor Co., which presents considerable advantages over belt drive. The power is supplied through a small motor-generator, which enables a variable voltage to be applied to the main motor, and the control to be effected entirely on the generator field. Considerable economy of power is obtained by regenerative action at the end of each stroke, and very high cutting speeds are possible. (Page 113.)

MESSRS. DICK, KERR & Co. announce that they have made arrangements to manufacture steam turbines under the Bergmann patents in England. The turbine which they will build is of the impulse type, with initial velocity stages. (Page 115.)

IN a Paper read before the Institution of Electrical Engineers in London, Mr. E. A. Watson described some experiments made to determine the amount of the loss by brush discharge off wires charged to high D.-C. pressures, and the critical voltage at which that loss commences. He concludes that the critical voltage for direct current is the same as the maximum value of the critical voltage for alternating current, so that there is an advantage of 41 per cent. for direct current. It was found that the presence of water vapour considerably increased the loss off dirty wires, although it did not affect clean wires, and the author concludes that a factor of safety of from 1·5 to 2 should be allowed after calculating the critical voltage in the usual manner. The actual mechanism of the loss is also considered. In the discussion, Mr. J. S. Highfield gave some interesting figures relating to a H.T. direct-current transmission line, and Dr. Alexander Russell criticised some of the author's conclusions. Mr. E. H. Rayner described similar experiments made with a H.T. wattmeter, confirming the author's results. Mr. H. M. Hobart welcomed the disproof of the contention that, with regard to the critical pressure, there was an advantage of 2 to 1 in favour of direct current. It was now proved to be only 1·41 to 1, as he had always held. (Page 117.)

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MR. YERBURY'S Paper on equitable charges for tramway supply has been further discussed at Glasgow. The majority of the speakers disagreed with the author in the matter of relative prices charged for traction and power supply, and thought that in most circumstances it was perfectly fair to charge large power consumers at a lower rate than tramways. (Page 118.)

A PAPER by Mr. A. G. Cooper, read last week before the Manchester Section of the Institution of Electrical Engineers, dealt with the balancing of three-wire systems, both by motor-generators and compensators or "static" balancers connected to slip-rings on the generator. (Page 119.)

AN interesting lecture on protection from lightning was delivered last week by Sir Oliver Lodge in Birmingham. (Page 120.)

AN action by the "Z" Electric Lamp Manufacturing Co. against Messrs. Marples, Leach & Co., as agents for the Bergmann Elektricitätswerke, for alleged infringement of their patent No. 21,654 of 1906, was commenced in the Chancery Division before Mr. Justice Parker on Thursday. The patent in question relates to the use of phospham as a means of preventing the blackening of metal filament lamps by removing the carbon remaining in the filaments after manufacture. The defendants allege that although they use phospham in a similar way, it is for quite a different purpose, viz., as a carrier for red phosphorus for the purpose of improving the vacuum and so preventing a disintegration of the filament. (Page 120.)

IN the Appeal Court on Saturday, judgment was given in the appeal of the British Westinghouse Co. against the decision of Mr. Justice Joyce that the Bremer flame arc lamp patent was invalid on the ground of want of subject matter. The Court of Appeal decided that the lamps sold by Mr. G. Braulik were an infringement of the Bremer patent, and also that the objections to the latter on the grounds of anticipation and want of subject matter failed. The patent was therefore restored, an injunction being granted against the sale of the infringing lamp, and also an inquiry as to damages, the latter being stayed for a month with a view to an appeal to the House of Lords. (Page 122.)

AT a meeting of the Illuminating Engineering Society on Tuesday, a discussion took place upon the question of glare in relation to artificial illumination. The Council are considering the desirability of forming an international committee to gather information from all parts of the world and to publish a report upon the subject. (Page 122.)

THE makers of the Foster metal filament lamp have written to us concerning the efficiencies of their lamps. A suggestion is made that the Institution of Electrical Engineers should loan books from their library to provincial members. (Page 123.)

THE proposal to convert the Isle of Wight railways to electric traction does not receive the support of the railway companies.—The Bury St. Edmunds Corporation propose to hire out high candle-power metal filament lamps for exterior shop-lighting.— Professor J. A. Ewing, F.R.S., will open the new power station of the Dundee Corporation.—A scheme for the lighting of Lucknow is to be prepared.— The Local Government Board have sanctioned a portion only of the loan of £103,000 recently applied for by the Dublin Corporation.—Electric heating and cooking apparatus is to be hired out at Dublin, a month's trial being allowed. (Page 123.)

EXTENSIONS are contemplated at Bridlington (£2,699); Dundee (£60,000); and Nuneaton (£2,105). Two 500-kw. generating sets are required at Carlisle, and electrical accessories and stores at Gillingham, Watford, Swindon, Bristol, Birmingham, and Dublin. (Page 124.)

THE accounts of Messrs. Bruce Peebles & Co. show a loss of £5,683 for 1909. The scheme for reconstructing the British Aluminium Co. has been sanctioned by the shareholders. The capital of the Provincial Tramways Co. is to be reduced from £400,000 to £275,440. (Page 126.)

AMONG the specifications published by the Patent Office on Thursday last was one by Siemens Schuckertwerke for an enclosed flame arc lamp with a receptacle above the globe, in which the fumes are cooled and the chemical particles deposited.—A construction for radial commutators, with provision for a radial circulation of air from the shaft along the working faces, is covered by the American Westinghouse Co.—The Saltpetersäure Industrie-Ges. describes an arc furnace for treating gases, with a device to restart the arc if it should be blown out.—A method of reversing traction motors to effect braking is covered by the British Thomson-Houston Co.—Opposition has been entered to the grant of three patents. The first is that covering the paper-film plate discharger employed in the Lepel system of wireless telegraphy, and the second is for wireless apparatus, including a similar discharger, by the Ges. für Drahtlose Telegraphie. The third patent opposed is by R. Hopfelt, and relates to a process for removing hydrocarbons from metal filaments.—Application has been made for the restoration of a lapsed patent covering a spring-clip terminal. (Page 128.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, FEBRUARY 17TH.

Royal Institution.

3 p.m. Afternoon Lecture I., "Illumination: Natural and Artificial," by Prof. S. P. Thompson, F.R.S.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London, "Electric Clocks," by F. Hope-Jones.

FRIDAY, FEBRUARY 18TH.

Tramways and Light Railways Association.

7 p.m. Annual General Meeting at the Gaiety Restaurant, London.

7.30 p.m. Annual Dinner at Gaiety Restaurant.

SATURDAY, FEBRUARY 19TH.

Royal Institution.

3 p.m. Lecture II., on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson, F.R.S.

General Electric Co.

6 for 6.30 p.m. Annual Dinner at the Trocadero.

Birmingham and District Electric Club.

7 p.m. Annual Dinner at Colonnade Hotel, New Street.

TUESDAY, FEBRUARY 22ND.

National Electrical Manufacturers' Association.

2.30 p.m. Annual General Meeting at Balfour House Finsbury Pavement, London.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "The Present Aspect of Electric Lighting," by H. W. Handcock and A. H. Dykes.

WEDNESDAY, FEBRUARY 23RD.

Institution of Electrical Engineers: Leeds Section.

7.15 p.m. At the University. "Notes on Overhead Lines," by W. B. Woodhouse.

Electrical Trades Benevolent Institution.

7 for 7.30 p.m. Festival Dinner at Hotel Metropole.

THURSDAY, FEBRUARY 24TH.

Royal Institution.

3 p.m. Afternoon Lecture II., "Illumination: Natural and Artificial," by Prof. S. P. Thompson, F.R.S.

Electrical Driving of Textile Mills from the Manchester Corporation Mains.—We publish on another page a full description of the electrical driving of the Brunswick mill of the Bannerman Mills Co., Manchester. In connection with this, Mr. S. L. Pearce (Chief Electrical Engineer to the Manchester Corporation) has very kindly given us the following list of other mills also supplied by the Corporation mains: Butler Street Mill of the Fine Cotton Spinners' Association, 1,000 h.p., consuming approximately 1,500,000 B.T.U. per annum; portion of the McConnell Mill of the Fine Cotton Spinners' Association, 400 h.p., consuming approximately 500,000 B.T.U. per annum; the Carruther Street Doubling Mill of Messrs. Andrew & Bramhall, 400 h.p., consuming approximately 900,000 B.T.U. In addition to the above, which are actually at work, an 800-h.p. installation, consuming about 1,250,000 h.p., is definitely arranged for Messrs. G. Byrom & Sons, Victoria Mills, Droylsden, and negotiations are in progress for a further 2,500 h.p.

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ELECTRICAL EQUIPMENT AT THE G.W.R. CARRIAGE AND WAGON WORKS, SWINDON

ALTHOUGH a considerable amount of electric driving has been a feature of the Locomotive Works of the Great Western Railway at Swindon for some time, it is only recently that a beginning has been made in the use of electric power in the adjoining Carriage and Wagon Works. The arrangements at the latter works, however, which include a new power station equipped with a large suction producer gas plant, are of considerable interest even if the number of motors installed is not yet very large. The older station at the locomotive works is also equipped with gas engines, but these run on lighting gas. The last engine to be put down there, a 250 h.p. vertical engine, supplied by the Campbell Gas Engine Co., of Halifax, is of similar type to those described below in connection with the new station and running on producer gas, so that when these have been running a while an interesting comparison will be able to be made. The older engines at the Locomotive Works, also of 250 h.p., are six in number, and were supplied by the British Westinghouse Co. It is, however, more particularly the purpose of this article to describe the equipment of the Carriage and Wagon Works.

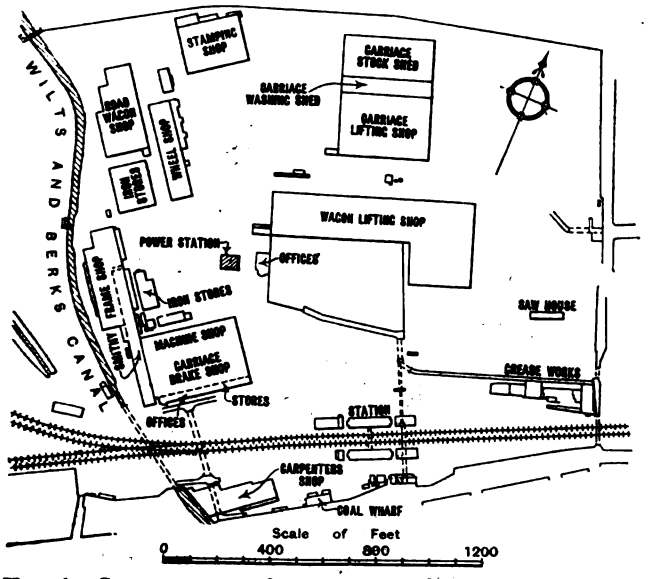


FIG. 1.—SKETCH PLAN OF CARRIAGE AND WAGON WORKS, SHOWING POSITION OF POWER STATION.

The position of the new power house, which has now been running for some months, is shown on the sketch plan in Fig. 1. It consists of a compact building divided into producer room and engine room, and with fuel storage accommodation at one end. The present equipment is of 500 b.h.p., but the building will accommodate a further 250-h.p. set. The station is primarily intended for the needs only of the Carriage and Wagon Works, and should be sufficient for the demand for some time to come, but interconnection between it and the power station at the Locomotive Works at a future date is contemplated.

A section of the power house is given in Fig. 2. The fuel storage stage is sufficient to hold a several weeks' supply. Only the best anthracite is used, the price paid at present being 21s. per ton. An elevated firing platform enables the fuel to be shovelled direct into the charging hoppers of the producers. At present one charge of about 2 cwt. every three-quarters of an hour is sufficient to deal with the light load. Only one producer is kept going at a time, and the plant usually works considerably below half load.

The producers themselves are interesting as being among the largest which the Campbell Gas Engine Co. have yet put to work. Each is rated at 250 b.h.p., and they are entirely independent, having even separate chimneys for blowing off. It will be noticed from Fig. 5 that ample ventilation of the producer room is secured by one side being open to the air. Each producer is 6 ft. 3 in. in height and 3 ft. 9 in. internal diameter, and is provided with two scrubbers, each 16 ft. high by 3 ft. 6 in. diameter. A section showing the arrangement of the producer is given in Fig. 3.

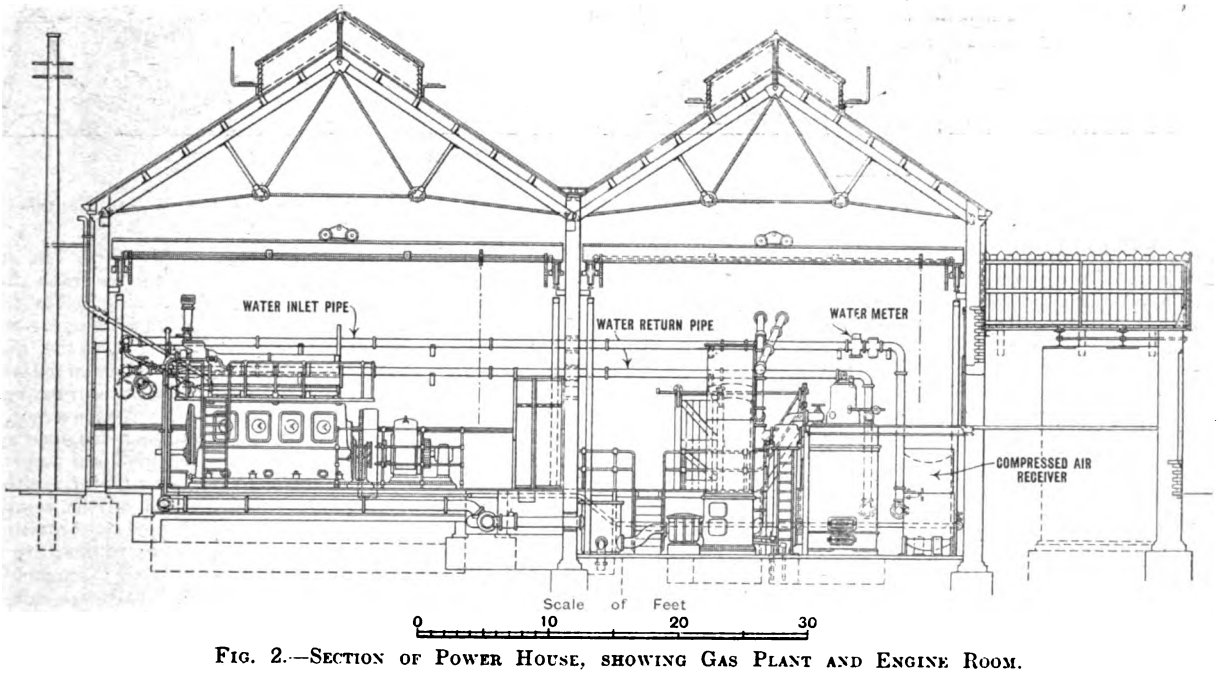


FIG. 2.—SECTION OF POWER HOUSE, SHOWING GAS PLANT AND ENGINE ROOM.

The essential parts of the Campbell suction producer are the actual producer where the gas is generated, the vaporisor or evaporator where steam is produced, the superheater where the air and steam are further heated before entering the producer,

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and the coke scrubber where the gases are cooled and purified. These parts are all clearly shown in Fig. 3, together with the charging hopper, ashpan, and arrangement of piping. The generator body is made of rivetted steel plate, and has doors on either side to facilitate the clearing away of ash and clinker. The lining is of special firebricks, with a packing of sand between them and the generator body. The ashpan is separate, and is of cast iron, as this resists corrosion better than steel. The vaporisor is placed directly on the top of the generator, and is arranged to allow for expansion and contraction, and to be easily opened out for cleaning. The superheater is between the producer and the scrubber, and also acts as a separator, removing a large proportion of the dust from the gas before it enters the scrubber. The scrubbers in the Campbell producer plants are of particularly large size in order to ensure the thorough purification and cooling of the gas without frequent changing of coke. As in the ashpan of the generator, the lower part is made of cast iron on account of its better ability to resist corrosion, as the water which falls to the bottom of the scrubber is slightly acid. All controlling valves are of the screw-down type, as it has been found that plug cocks have a tendency to stick. The gas-box from which the engine draws its supply is provided with a safety test cock to enable the quality of the gas to be tested before starting the engine.

variation of speed. The mechanical efficiency of each engine is given as 85 per cent., and the following are the guarantees of consumption and thermal efficiency:—

Consumption:—

Full load ...	...	0·9 lb. of anthracite per b.h.-p. hour.
¾-Load	...	0·97 lb. " " "
½-Load	...	1·1 lbs. " " "

Thermal Efficiency:—

Engine and producer at full load,	I.H.-P.	22·8	per cent.
" " " " "	B.H.-P.	19·3	"
Engine only	I.H.-P.	30	"
" "	B.H.-P.	25·5	"

The engines work on the ordinary four-stroke cycle, and are single acting; a section through one cylinder is shown in Fig. 4. The cylinders are entirely independent of one another, so that in case of accident the engine may be run with one or more cylinders idle. An important point in the arrangement of the valve gear is that this is quite clear of the cylinder covers, which can be removed and replaced in a few minutes. The engines are provided with two cam shafts, one inside the crank chamber for the exhaust valves, and the other running across the top of the cylinder, and operating the magneto ignition gear and the inlet valves. Governing is effected entirely on the quantity system by acting on a throttle valve, and hand adjustment enables small changes in speed to be made while running. No variation of the air adjustment is made by the governor. The ignition of these engines is on the low-tension magneto system, and each cylinder has its own separate magneto and tappet gear. An adjusting gear is provided, so that the time of ignition can be varied while the engine is running, and on the erection of the engines the utmost care was taken in synchronising the ignition of all the cylinders to ensure steady running by taking indicator cards. Forced lubrication is used throughout, and the pressure is produced by a submerged valveless ram pump driven by eccentrics on the crankshaft. The water circulation is taken direct from the mains. The exhaust valves are water cooled, and at times of heavy load a water spray can be turned on in each cylinder, and in the exhaust pipe. Starting up is effected by compressed air in one cylinder in the usual way.

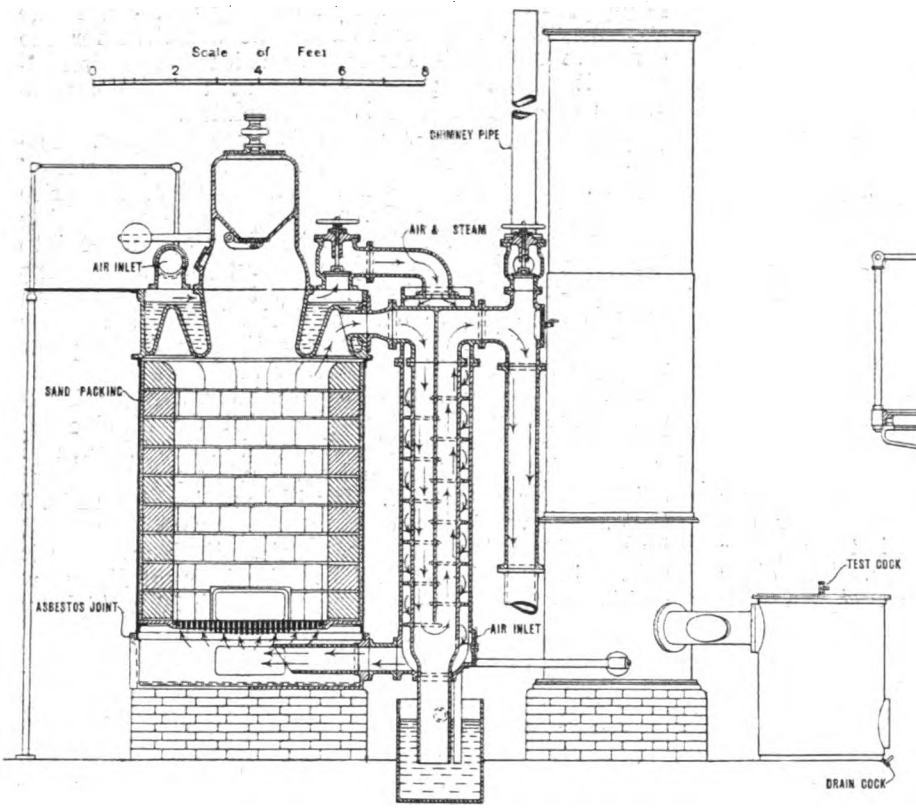


FIG. 3.—SECTION OF GAS PRODUCER.

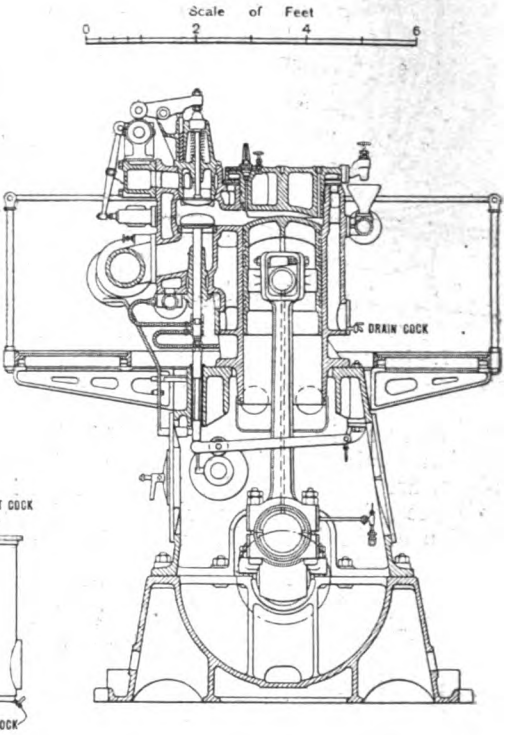


FIG. 4.—SECTION OF GAS ENGINE.

A view of part of the interior of the engine-room is seen in Fig. 6. The generating sets are also two in number. Normally each engine works off its own producer, but cross connecting pipes are provided so that either or both engines may be supplied from either producer if necessary.

Each engine is designed for a normal load of 250 b.h.p., but is capable of a maximum load of 290 b.h.p., and is of the Campbell Gas Engine Co.'s vertical four-cylinder type, running at 225 r.p.m., a speed considerably lower than Messrs. Campbell's standard speed with this class of engine, but adapted so that they could run at the same speed as the existing engines in the Locomotive Works. Each cylinder is 17-in. bore by 20-in. stroke. The crank-shaft is 8½ in. diameter, with a total length in bearings of no less than 57 in. Each engine is fitted with a 5-ton flywheel 7 ft. 6 in. diameter, and the guaranteed coefficient of fluctuation per revolution is 1/150. The governing is guaranteed to be within 5 per cent. from full load to light load, and within 2½ per cent. as regards permanent

Each engine is coupled directly to a six-pole continuous-current generator of the General Electric Co.'s standard type, made at their works at Witton, Birmingham. The armatures of these machines are bolted right

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up to the engine flywheels without intermediate bearings. Each machine is capable of an output of

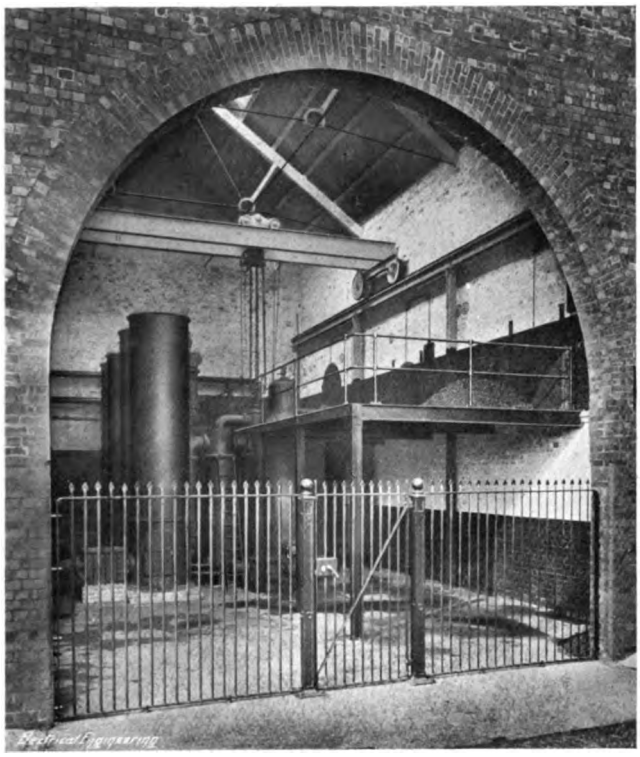


Fig. 5.—View of Gas Producer Plant.

150 kw. at 250 volts when driven by the engines at 225 r.p.m., and is compound wound. They have not been fitted with commutating poles, as they are amply large enough for the work under the conditions of speed and voltage, and can work with constant position of the brushes at all loads.

The General Electric Co. have also supplied recently a similar machine for the station of the Locomotive Works.

The switchboard, part of which can be seen in Fig. 6, was constructed by the Great Western Railway Co.'s own staff, and is of very simple, straightforward design. At present only two generator panels and two feeder panels, giving accommodation for four feeders, are equipped, but blank slate panels are in place for one further generator and four additional feeders. There is a single pair of 'bus-bars, and the transmission is on the two-wire system at 250 volts. Each generator panel has a three-pole automatic circuit breaker, supplied by Messrs. R. W. Blackwell & Co., which acts as combined double-pole main switch and equalising switch for the compound winding. No fuses are used either in the generator or feeder circuits, so that the feeder panels only contain double-pole automatic cut-outs, of the British Thomson-Houston Co.'s design, and the necessary ammeters. The shunt-regulating rheostats are worked by hand wheels on the lower part of the board, where there is also a total output meter. An Evershed leakage indicator with push buttons for testing the insulation of the two sides of the circuit separately is mounted on the wall near the board.

Four two-wire 250-volt overhead feeders, consisting of covered cable supported on messenger wires from wooden poles, leave the power station, and are taken direct to the following departments: the carriage fitting shop, the carriage lifting shop, the road wagon shop, and the wagon lifting shop. In the first three of these, motors are already at work, as will be seen below, and the electrical equipment of the last is to be proceeded with shortly. The introduction of electrical driving is being made gradually as occasion offers. It is intended ultimately to adopt electric motors prac-

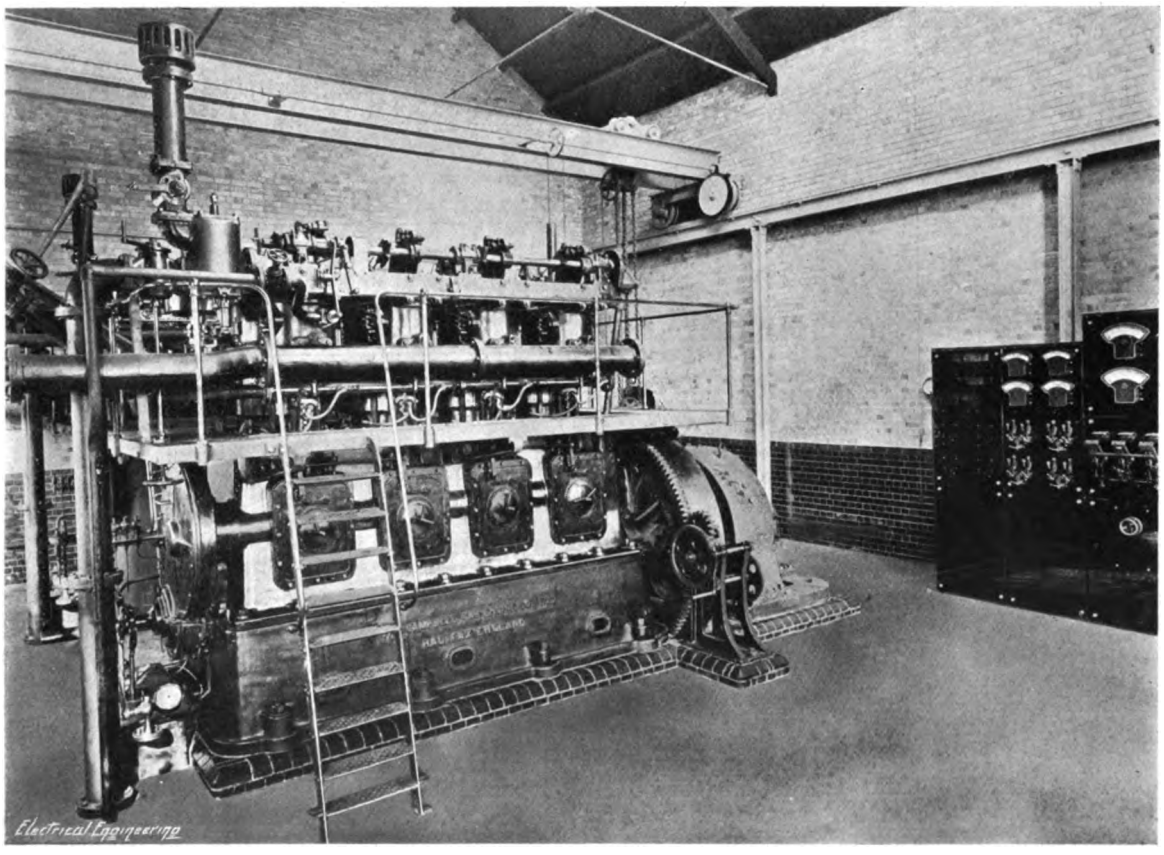


Fig. 6.—View of Engine-room, showing Generating Sets and part of Switchboard.

tically throughout the works, except for such machinery as is already hydraulically actuated or in such special cases as in the stamping shop, where steam is obtained from waste heat from the furnaces.

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In the carriage fitting shop, which has five commodious bays, the machinery of the underframe and bogie section is now mainly electrically driven, but most of the remainder of the shop is still driven by steam. Various different arrangements of motor drive are used; in two cases short lengths of shafting are driven through belting by motors supported on brackets a few feet from the floor, but independent drive is used for the larger machines. An example of this is a large double-headed slotting machine driven by two motors placed in pits under the floor at either end of the machine, mounted on slide rails and driving through short belts entirely covered in. An adjoining large milling machine is driven by a motor similarly placed. The above-mentioned motors were supplied mostly by Messrs. Greenwood & Batley (Leeds), and are of the semi-enclosed type. One of the short lengths of shafting, however, is driven by a Crompton motor. As a rule, the starting panels are of the ironclad type, placed on the wall or affixed to a stanchion near the motor in question. The feeders are brought to distributing boards with tubular fuses. From the distributing boards to the motors all wires are in screwed Simplex conduit. Several bays of this shop are served by 10-ton electric travelling cranes, supplied by Messrs. Craven Brothers, of Manchester. In another part of this shop a row of five large grindstones and four emery wheels are driven from a shaft by a single motor. In this case a short section has been detached from a length of shafting running all along one side of the shop under the floor and a motor belted to it.

In the carriage lifting shop, to which another feeder runs, there is a 25-h.p. Greenwood & Batley motor running at 650 r.p.m., which drives the saw-mill, and a 40-h.p. Royce motor running at 400 r.p.m. driving a long row of about a dozen wheel lathes and a wheel-balancing machine. A motor is also being installed to drive the paint mill in this shop, which is at present driven by a gas engine running day and night continuously. In the road waggon shop the only application of electric power at present is a 25-h.p. Greenwood & Batley motor, which drives a group of wood-working machinery through the original shafting. As already stated, a feeder is also provided to the wagon lifting shop, but no motors have as yet been put in.

In conclusion, we wish to express our thanks to Mr. G. J. Churchward (Locomotive Superintendent to the Great Western Railway) for permission to visit the works and for putting drawings and photographs at our disposal; and to Mr. C. S. Wilson, one of the assistant managers, for conducting our representative round the works. We should also acknowledge the assistance given to us by the Campbell Gas Engine Co.

ELECTRICAL DRIVING AT THE BRUNSWICK MILL, MANCHESTER

THERE has been a considerable amount of controversy recently in regard to the electrical operation of textile mills, but it is instructive to note that during the last five years, since the first electrically operated mill was set to work, the Acme Spinning Co.'s mill at Pendlebury, electrical driving to the extent of some 50,000 b.h.p. in alternating-current induction motors has been installed in the United Kingdom, and that to date there is in the region of 300,000 b.h.p. of motors installed in similar mills in the United States alone. The Continent also is responsible for the installation of motors to a considerable extent. This is conclusive evidence of the remarkable progress electrical driving has made since its introduction in the United Kingdom. It is also instructive and significant that of the 50,000 b.h.p. in operation in the United Kingdom, approximately 20,000 b.h.p. are driven by current supplied from outside sources.

One of the latest electrical installations to be set to work in the United Kingdom is the Brunswick Mill of the Bannerman Mills Co., Ltd., Bradford Road, Manchester. This mill is one of a very old-established concern, and has been run for many years in the ordinary way, having been driven from steam engines and the power transmitted to the various mill rooms by means of belt, rope, and gear drives. The mill has for several generations been continuously and successfully driven in this manner, and it required, on the part of the mill authorities, considerable confidence in the reliability and commercial economy of electrical transmission to depart from their time-honoured

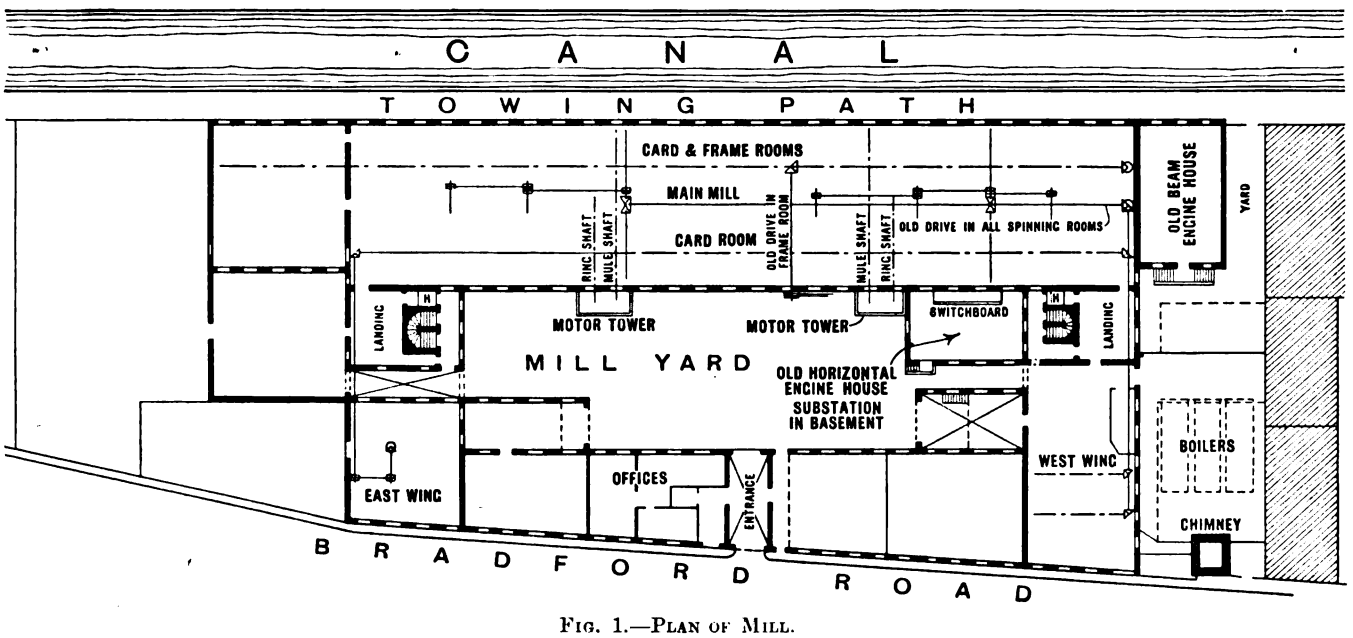


FIG. 1.—PLAN OF MILL.

Full lines indicate old transmission (shafts, &c.) dispensed with. Dotted lines indicate present transmission by electric drive.

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method of driving. It is, however, characteristic of the enterprise and foresight which have invariably distinguished the career of the managing director of this company, Mr. C. W. Macara, the well-known President of the English Federation of Master Cotton Spinners' Associations, and of the International Federation of Master Cotton Spinners' and Manufacturers' Associations, that, after exhaustive investigations had been made, it was decided to place the continuity of the running of the mill in the hands of an outside source of power, viz., the electricity department of the city of Manchester. The installation now completed has, we understand, amply justified the confidence shown in the electricity department, and the arrangement between the two parties may be cited as an example of the enormous influence a centralised electric power supply may exert in the industrial development of a district.

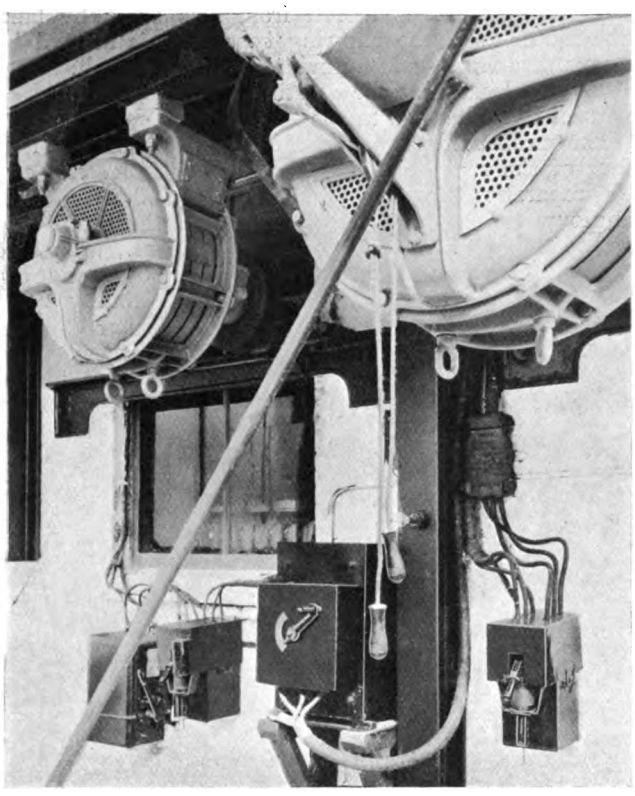


Fig. 2.—Arrangement of Motors in Tower.

The installation, carried out by the British Thomson-Houston Co., Ltd., electrical engineers and manufacturers, of Rugby, under the general supervision of the City Electrical Engineer, Mr. S. L. Pearce, is one of the largest single-mill equipments at present working electrically in the United Kingdom. The mill contains both mule- and ring-spinning spindles, and on the Federation basis is rated as equal to 100,000 mule spindles, spinning from 36's to 72's counts from American and Egyptian cotton. The whole of this machinery was originally driven by means of a two-crank beam engine and a single-crank horizontal steam engine with a combined power of 1,600 i.h.p. For transmitting the power from these engines to the various rooms in the mill, spur and bevelled gears and upright shafts from the large beam engine were adopted, and rope driving with bevelled gears from the small horizontal engine. By adopting the electrical drive, practically all of these gears and upright shafts were dispensed with, and to-day there remain in the mill only two small pairs of bevelled gears, one at the foot and the other at the top of an upright shaft, which, for purely local reasons, have been allowed to remain for driving a small amount of light machinery in the east wing of the mill. The mill to-day is driven throughout from the mains of the Manchester Corporation by means of three-phase induction motors, working on a 400-415-volt supply at a frequency of 50 cycles per second. The current for driving the mill is supplied from the Corporation mains at 6,500 volts; a duplicate set of mains being carried to a sub-station arranged in the basement of the original small engine house. It is there transformed from 6,500 volts to a working pressure of 400-415 volts for the motors, and to 220 volts for lighting purposes. The mill contains in all

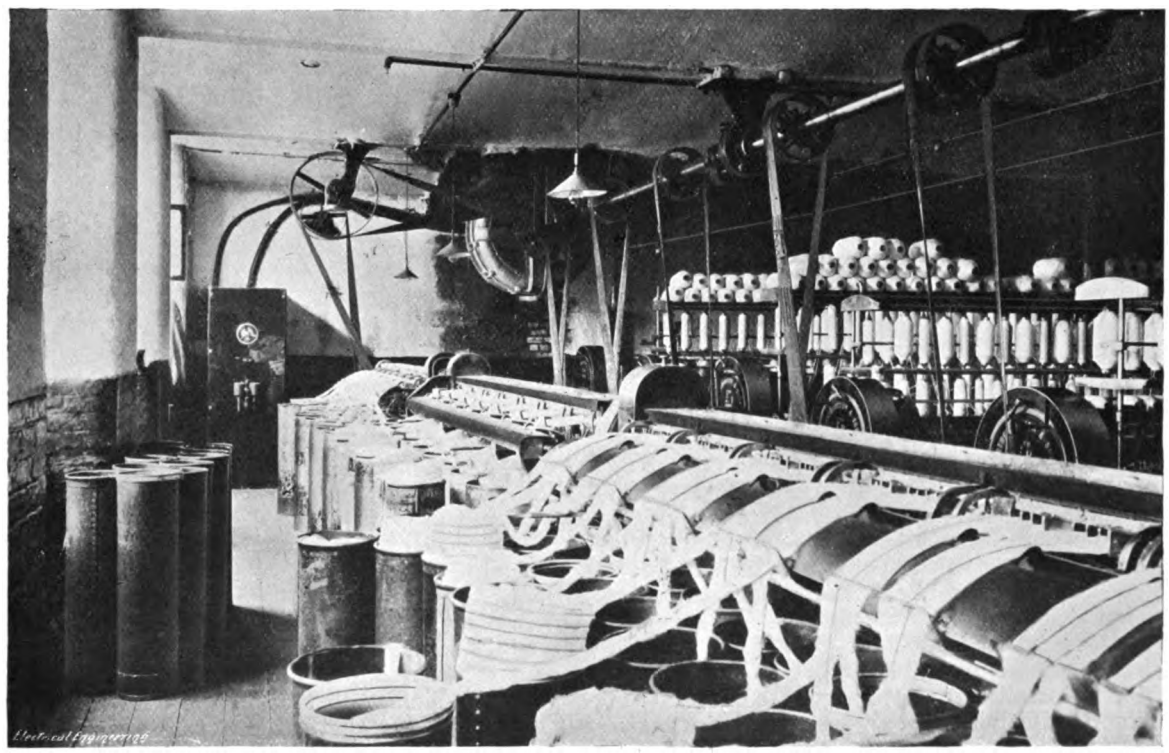


Fig. 3.—View of Frame Room.

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thirty-seven motors aggregating 1,639½ b.h.p. The capacity of the two E.H.T. feeders is ·15 sq. in. each, and they are connected through non-automatic oil switches straight on to the sub-station bus-bars. For the power supply, four Westinghouse 500-k.v.a. oil-cooled three-phase transformers have been installed, and for the lighting supply one similar unit of 90-k.v.a. capacity. The H.T. and L.T. switchgear is of the British Thomson-Houston Co.'s own manufacture, one panel—on which is mounted the operating gear for mechanically remote-controlling the H.T. oil switches, as well as for the direct operation of the L.T. switchgear—being allocated to each unit.

Fig. 1 shows a general plan of the mill, and indicates the position of the two engines which originally drove it, together with the methods in use up to the time of the installation of the electrical drive for transmitting the power from these engines to the various main rooms. It will be noted that the problem of converting the mill from the mechanical to the electrical drive presented some unusual features, probably unique, and it is interesting to record that the methods adopted have proved very satisfactory to all concerned.

In describing the methods adopted for driving, it is proposed to commence at the point at which the raw cotton is received in the mill and follow it through the various manufacturing processes until it is ready for despatch as the finished product. The bale hoist is situated in the west wing, and for driving this hoist a small motor is installed inverted on the ceiling of the blowing room, and driving by belt on to the hoist shaft. There is therefore no current consumption at this point, except at those times when the hoist is actually working.

For driving the bale breaking, mixed lattices, and blowing-room machinery a special motor of 45 b.h.p. is installed in the blowing room directly connected by flexible coupling to the line shaft, from which the blowing-room machinery is driven. This line shaft now runs at 480 r.p.m., having been speeded up from its original speed and the line shaft pulleys altered accordingly. The line shaft driving the bale-breaking and mixing room is driven from this shaft by belt. The motor is of the slip-ring type, and is started by means of a triple-pole automatic trip oil switch, and a totally enclosed metallic starting rheostat mounted on a panel erected close to the motor.

The main card room, which is situated on the first floor of the main mill, and containing 112 cards and 16 preparation frames, is driven by a 150-b.h.p. slip-ring type motor, directly connected to the main card line shaft, which is running at 290 r.p.m., a flexible coupling being installed between the motor and the line shaft. In this room there were originally three main lines of shafting. By the installation of electrical driving one of these lines was dispensed with, and two rows of cards driven from one shaft placed between the two rows, the remaining line shaft being driven from this by ropes. The starting apparatus for this motor is a triple-pole automatic trip oil switch, and totally enclosed metallic starting rheostat mounted on a suitable panel placed close to the motor.

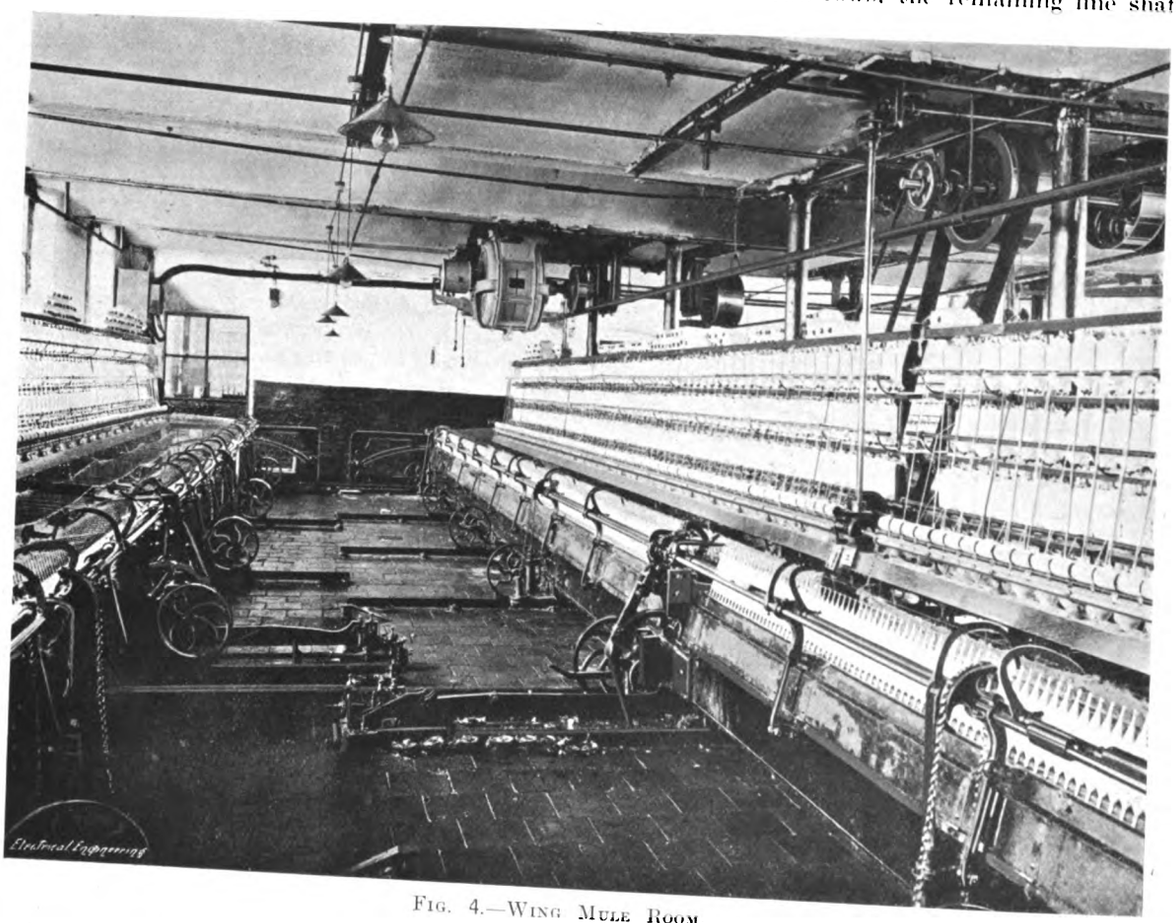


FIG. 4.—WING MULE ROOM.

The speed frame room, containing 64 drawing, slubbing, intermediate, and roving frames, is situated on the second floor of the main mill. This room is driven by means of a 130-b.h.p. slip-ring type motor, directly connected to the main-line shaft by a flexible coupling, running at 485 r.p.m., the installation being generally similar to that in the card room mentioned previously. In both these cases, since the rooms driven contain preparation machinery, and the atmosphere is often charged with cotton dust, it has been found advisable to cover in each of the motors with a sheet-iron case connected by shallow air trunks with the outside atmosphere, a small electrically driven fan being installed for drawing air from the outside of the mill on the one side through the motor, and out again to the other side of the mill. Two small roving rooms,

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one in each of the two wings, are each driven by one 18-b.h.p. squirrel-cage type motor, directly connected by a flexible coupling to the line shaft running at 475 revolutions per minute; each of these motors is started by an oil-immersed star-delta starting switch, situated close to the motor.

The ground floor, and the third, fourth, fifth, and sixth floors in the main mill, each containing four pairs of mules and ten ring frames, presented one of the most difficult problems for solution, and the method adopted for driving these rooms is undoubtedly one of the most interesting features in the entire installation. The positions of the machines in the various flats rendered it practically impossible to group more than two pairs of mules on each motor. This in itself was a somewhat difficult requirement, inasmuch as the power demand for driving this particular class of machine varies to a considerable degree, the maximum demand being at the very least twice the minimum, and the cycle of operations being comparatively rapid. A further serious consideration affecting the method of procedure to be adopted was the necessity for such an arrangement as would enable the mill to continue its ordinary working during the change over. The method adopted, therefore, to drive these flats was to build two motor towers, one at each end of the mill on that side of the mill nearest the courtyard. The towers, which are independent of the main mill structure, are built entirely of steel framing and glazed casing, no brickwork being used. In each of these towers two motors per floor are installed for driving each spinning room, there being in all ten motors per tower. Fig. 2 shows the arrangement of a pair of such motors, together with their switchgear. Each of the motors for driving the mules is of the slip-ring type, rated at 75 b.h.p., running at 485 revolutions per minute, and coupled directly to the mule line shaft by means of a flexible coupling. Each of these line shafts runs the full width of the mill, and drives by belt the four countershafts for the mules, special pulleys being provided on the line shafts to suit the increased speed. The ten ring frames, which are situated in the two lines along the middle of each spinning room, are divided into groups of four and six, and, owing to the fact that it was necessary to provide that the mill authorities could conveniently alter the speed of these frames to suit the various counts to be produced, a novel and ingenious system of rope transmission, which provides for three changes of speed at the spinning frame, was adopted. The six frames on each floor at the western end of the mill are driven from a line shaft carried half-way across the room and running at 725 revolutions per minute (probably the fastest running line shafts in the world driving ring spinning frames), a squirrel-cage type motor of 45 b.h.p. capacity being directly coupled to the line shaft by means of a flexible coupling. Rope pulleys of special design to provide the three changes of speed required are installed on the line shaft, the frames being driven by ropes over adjustable gallows pulleys. The four ring frames on each floor at the eastern end of the mill are driven in a similar manner from a line shaft running at 725 revolutions per minute, directly coupled to a 30 b.h.p. squirrel-cage type motor, there being in all five floors driven in this manner. A view of one of the frame rooms is given in Fig. 3, and one of the wing mule rooms is seen in Fig. 4.

The starting apparatus for each of the motors in the two towers is arranged in the towers on the same floor as the motor, as shown in Fig. 2, and a special arrangement of emergency push-buttons is fitted in each room, so that in case of necessity any motor may be stopped from the inside of the mill.

The winding and beaming machines situated on the various floors of the east wing are driven by means of an 18 b.h.p. motor, 475 revolutions per minute, squirrel-cage type, driving by belt on to a line shaft, the power being transmitted to the various floors by means of a light upright shaft and two pairs of bevelled gears. The mill hoists throughout the mill are each driven by separate motors, as also is the mechanics' shop.

Advantage has been taken of the alterations carried out to equip the mill throughout with sprinkler apparatus, the sprinkler tank being arranged on the top of the eastern motor tower. The supply of water to this tank is by means of an electrically-driven high-lift turbine pump, provided with special starting apparatus, which automatically starts up the motor, in order to keep the tank filled when any of the sprinklers in the mill are in operation. The pump continues to run and supply water until it is shut off by hand.

The main mill switchboard is arranged on the first floor of the original small engine-house directly over the Corporation sub-station. There are in all ten main motor feeder circuits on this board, and one incoming feeder circuit, also one main lighting board. Each of the motor feeder circuits is fitted with a triple-pole oil switch having automatic overload cut-outs. Each circuit has polyphase indicating and integrating wattmeter, and the information obtained in this manner forms a complete check on the operation of each department.

The distributing mains and branch cables between the mill switchboard and the various motors are of the three-core steel tape armoured type throughout, and are carried along and fixed to the mill walls and ceilings. Where more than one motor is fed from the same circuit, enclosed distributing fuse-boxes are installed, each of the three phases being in a separate box. The whole of the distributing boxes for the main mill motors are erected on a steel framework on the first floor level of the western motor tower, from which separate cables are run to each motor. The distributing boxes for the two wings of the mill are erected on the landings by the staircases.

The mill is lighted by about 1,000 carbon filament 220-volt lamps, a separate three-phase lighting transformer being installed to provide this lighting current, and the mill circuits being arranged so as to preserve the balance of load between phases. The wiring throughout is carried in heavy gauge steel screwed tubing fixed to the mill walls and ceilings, the whole being in strict accordance with most recent practice and requirements of the fire insurances offices.

As a result of the experience to date, the mill management are able to make a definite pronouncement that they are obtaining from the same machinery a larger production, and they are of opinion that the more regular turning obtained gives an improved quality of yarn. This statement, coupled with the fact that the manufactures of this company have always been of the highest grade, is eloquent testimony to the advantages which accrue from the application of electrical power to the textile industry.

We should not conclude this article without expressing our appreciation of Mr. Macara's readiness in allowing a description of the equipment to be published, and recording our indebtedness to Mr. S. L. Pearce (Chief Electrical Engineer to the Manchester Corporation), and also to the British Thomson-Houston Co., who kindly put full particulars with drawings and photographs of this important contract at our disposal.

Faraday House.—We are informed that the annual dinner of the Faraday House Old Students' Association will be held at the Queen's Hotel, Leicester Square, on Thursday, March 17th (St. Patrick's Day). The President for the year, Mr. Reginald S. Downe (General Manager, Brompton & Kensington Electricity Supply Co., Ltd.), will be in the chair. All Faradians who wish to be present should communicate with Mr. Foulds, Faraday House.

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ELECTRICAL DRIVING OF PLANING MACHINES

A NEW system of electrical planing machine drive by reversing motors has been brought out under the name of the "Lancashire" system by the Lancashire Dynamo and Motor Co. (Trafford Park), Manchester, for which considerable advantages, especially in the direction of higher speed and more perfect control are claimed, as against the ordinary method of reversing by shifting belts. Owing to the slip of the belts when reversing, their life is very short, and also a certain amount of

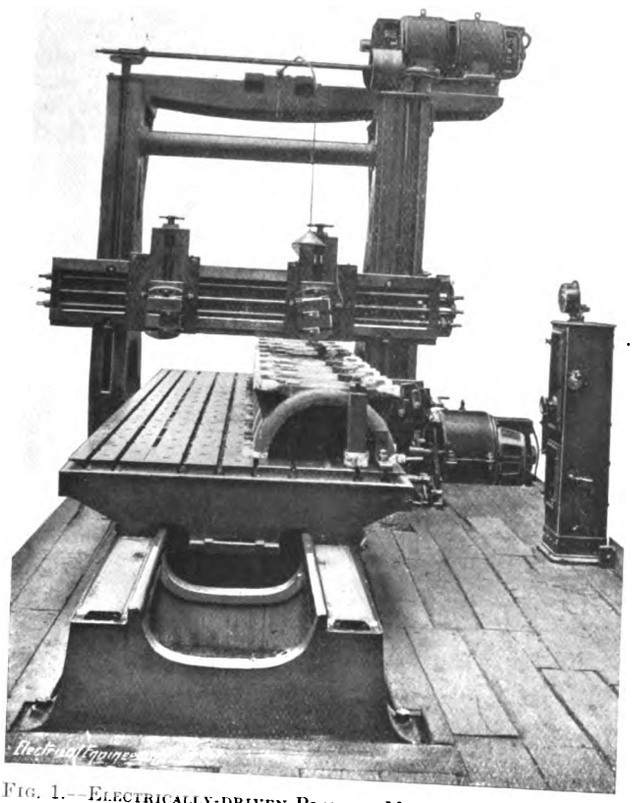


FIG. 1.—ELECTRICALLY-DRIVEN PLANING MACHINE, "LANCASHIRE" SYSTEM, SHOWING MOTOR GENERATOR.

time is lost at each reversal. Again, variation in cutting speed is hard to obtain without elaborate gear boxes or complicated mechanism. Further disadvantages are want of accuracy in the point of reversal, a certain liability in spring planers for the table to jump on intermittent work, and waste of power owing to the large amount of energy stored in the heavy belt pulleys which have to be reversed, also in many cases the tool is only actually removing metal during a small portion of the cutting stroke, but the table only runs at the same speed whether the tool is cutting or not. Again, owing to the design of the belt-driven high speed planer, strokes of less than 3 ft. are not possible for any length of time, due to burning of belts and heating of pulleys. The Company claim that their new system avoids these disadvantages, and thereby tends to a diminution of production costs by reducing charges for maintenance and depreciation.

The principal feature of the system is the use of a motor generator running at a high speed, mounted in any convenient position on the machine, and supplied with power from the electricity supply available. Either alternating or direct current may be employed, and if no current is available, the special generator may be driven from a line shaft instead of by a motor. The generator is connected electrically direct to the planer motor, which is coupled or geared to the planer driving shaft. This generator and motor are direct current machines and wound for any convenient voltage. A reversing switch is actuated by a tappet rod from the reversing gear of the planer, and when this is thrown over it reverses the direction of the current in the field winding of the generator, thus reversing the direction of rotation of the planer motor, and at the same time it so regulates the voltage of the generator by which the speed of the planer motor is decided as to cause the planer motor to run at the speed required according to whether it is on the cut or return stroke.

The cutting speed may be varied by hand to suit the work being done, by means of a regulating resistance in the generator field, this resistance being put in circuit by the reversing switch on the cutting stroke only. This gives a constant return speed, but, if desired, the return speed can be varied also. By this means the speed of cutting may be varied by turning one handle from 15 ft. per minute, or even less if desired, to the full return speed of the planer, and any number of intermediate speeds are obtainable. Of course, the maximum speed of cutting is limited by the speed the tool will stand. The system is a truly regenerative one, as the energy stored in the planer table and its load, as well as that stored in the revolving parts of the planer and motor, is returned to the circuit at each reversal, by causing the planer motor to become a generator at this instant, and to give out energy through the motor generator to the line. This not only results in a considerable saving in power, but a very powerful braking effect which causes the motor to reverse instantaneously. The switchgear required is simply that for an ordinary variable speed motor, and is made in ordinary starting panel form. The only switch moving at each reversal of the planer is the reversing switch, which only deals with the field current of the generator, this being equivalent to the current required by a few incandescent lamps. There are no switches or resistances in the main circuit except the ordinary starting switches, which are operated only when starting or stopping the machine for the day. If it is desired to control the planer from various points round it, small switches for the field circuit will be supplied by means of which the planer may be instantly stopped and started from any point at which one of these switches is fixed. The arrangement of the various parts of the equipment is clearly shown in Figs. 1 and 2.

The reduced loss of time per cycle obtained by this system, as against belt driving, is seen in the following table, which

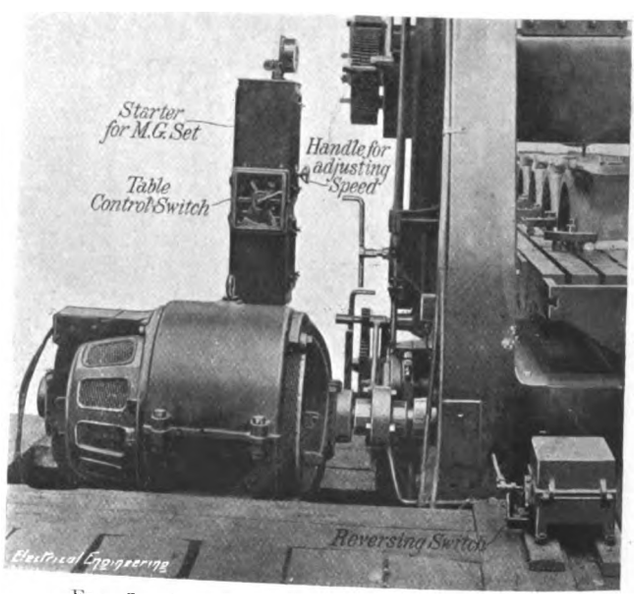


FIG. 2.—ARRANGEMENT OF CONTROL APPARATUS.

shows the result of a trial on a planer recently electrified on this system.

Test of 6′ 0″ × 6′ 0″ × 18′ 0″ *Planer.*

Weight of table ... ... = 8·5 tons
" " castings on table ... = 2·5 "
Total ... = 11·0 "

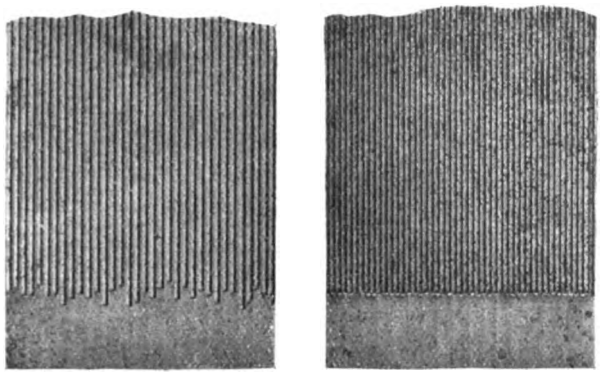
Size of planer under test.	Length of stroke taken.	Time of 10 cycles. m. s.	Speed of cutting ft. per min.	Speed of return ft. per min.	Waste time per cycle.
18′ × 6′	15·16′	3 56	54	176	1·8 secs.
18′ × 6′	10·25′	2 41	54	176	1·3 "
18′ × 6′	5·00′	1 98	54	176	1·5 "
18′ × 6′	2·16′	0 49	54	176	1·7 "

Any cutting speed may be obtained by turning one handle between 15 ft. per minute, or less if required, and the maximum

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speed the tool will cut at. This gives not only a wide variation, but twenty or more intermediate speeds.

Owing to the true regenerative working of this system, there is absolute control at the reversal. This control is not by springs or anything which can become fatigued or change its properties. At any given speed, and with the table loaded or



Block planed on belt-driven machine. Block planed by the "Lancashire" drive.

Fig. 3.—Samples of Work to show Accuracy of Stopping at End of Stroke.

unloaded, a planer fitted with this system will plane up to a line. This is strikingly shown in Fig. 3.

Fig. 4 gives a power diagram from a recorder chart, from which it is seen that the stored energy in the moving parts is returned to the circuit at each reversal and not wasted. This makes a considerable saving in the power used. The return speeds obtained are higher than have been obtained with any other system. By a simpler and inexpensive attachment the table can be speeded-up to the full return speed during those portions of the cutting stroke when the tool is not actually cutting, and at the same time the control is so perfect that the tool starts to cut again at the proper rate of cutting. This system permits of strokes as short as 2 in. if the mechanical design of the planer is suitable, or it can be reversed by hand if necessary. This makes it possible for work to be done at high speeds which would formerly have had to be done on a slow-speed planer.

The switchgear is little more than that required for an ordinary motor. The panel illustrated here is an ordinary starting panel; the hand-wheel in the centre regulates the

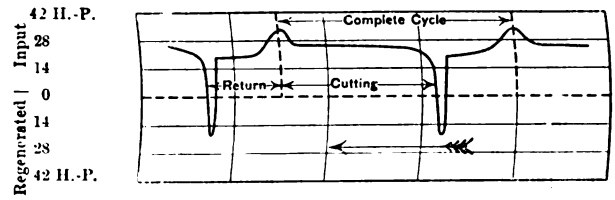


Fig. 4.—Diagram showing Power taken by Motor of Motor-Generator Set from Recorder Chart.

Cutting speed	80	ft. per min.
Return ,, ...	160	,, ,,
Stroke	18	,,

Two $\frac{1}{2}$"×$\frac{1}{16}$" cuts (mild steel).

cutting speed, and the case at the side contains the switch referred to before for starting and stopping the planer motor for changing tools, etc. The reversing switch is not in the main circuit and does not have to deal with any heavy current.

It may, perhaps, be objected that the cost of this system is high. This is not so as the variable voltage-control permits the use of a motor with a much smaller frame than the usual variable-speed constant-voltage machine, and as the motor generator may be a high-speed machine, its cost is small. The switchgear is simpler and less expensive than any other system.

This system claims to save the cost of renewal of belts and the cost of renewal of springs; also broken tools and spoilt work, and a considerable portion of the power bill; and, most important of all, to save *time* and to reduce production cost.

THE DICK, KERR–BERGMANN STEAM TURBINE

FOLLOWING their success in the construction of high-speed generators for turbine drive, Messrs. Dick, Kerr & Co. (Preston) have decided to extend their sphere of action to include complete turbo-generator sets by undertaking the manufacture on a large scale at their own works of steam turbines also. They have accordingly arranged with the Bergmann Elektricitäts-Werke to manufacture turbines under their patents and designs, so that the machines will in no way be experimental, but will embody the result of very extended experience.

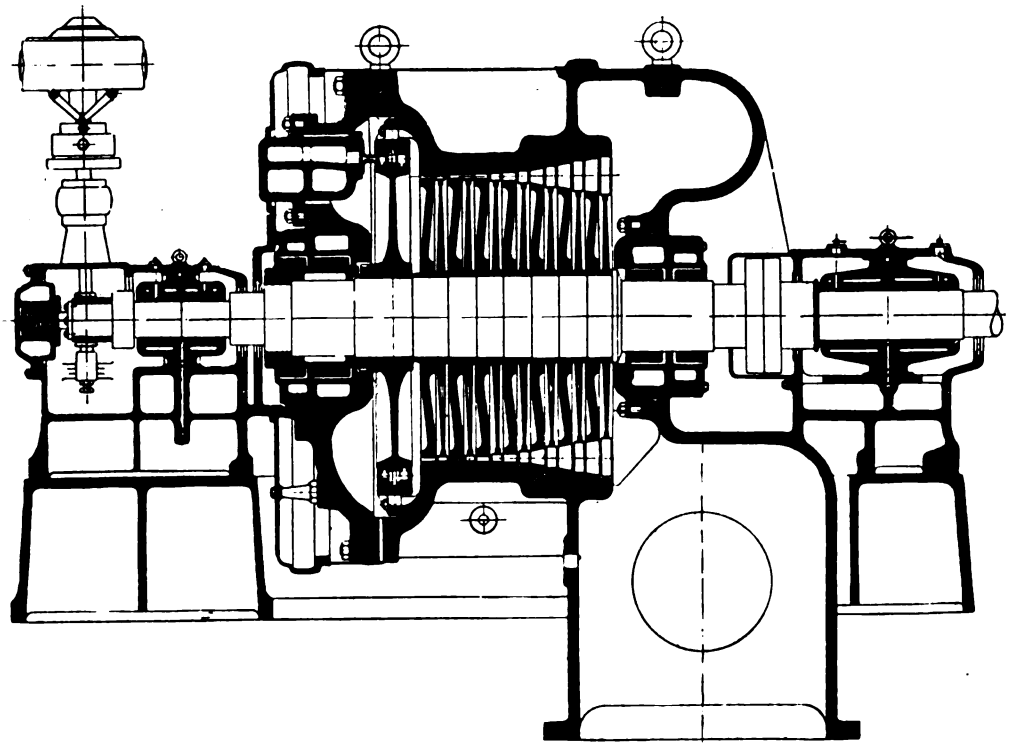


Fig. 1.—Section of Turbine.

The Dick, Kerr–Bergmann machine can be classed as an

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impulse turbine with velocity stages, and the firm sum up the advantages of this type over the reaction turbine as greater

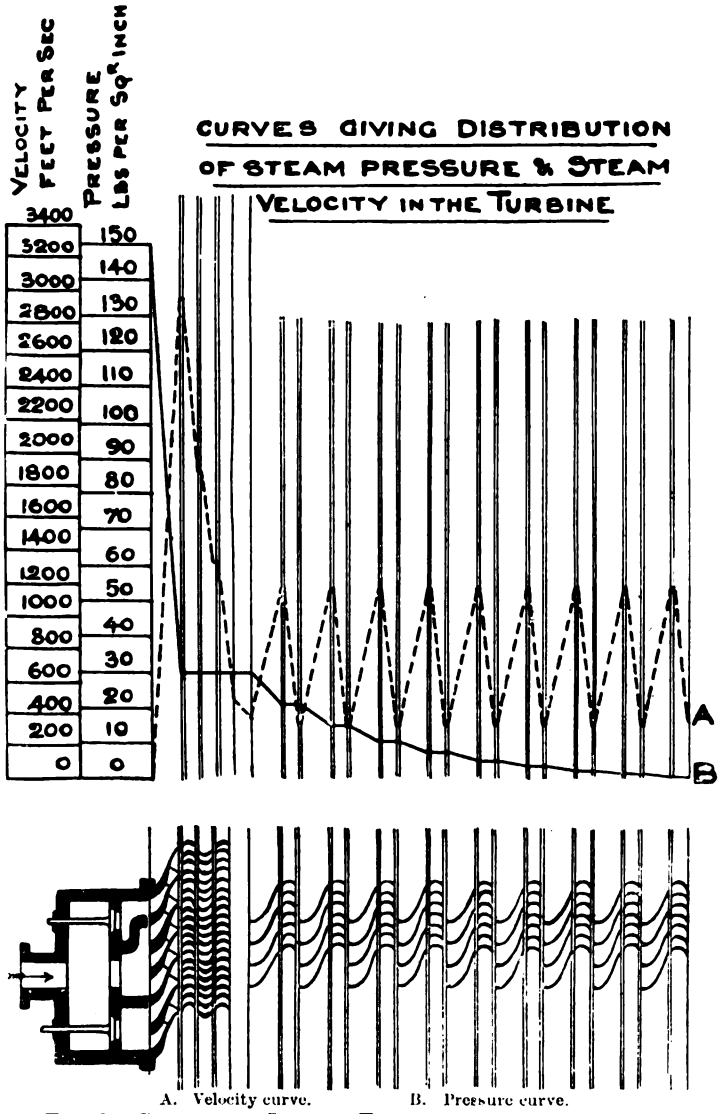


FIG. 2.—CURVES FOR IMPULSE TURBINE WITH VELOCITY STAGES.

security due to larger possible clearances, reduced number of stages, with the possibility of using partial admission, and entire absence of axial thrust. In the first or "velocity" stages, the steam in the same pressure stage is led, after leaving the first set of blades, to sets of neighbouring blades, under such conditions that its velocity is not entirely destroyed until it has passed all the blades of the same stage. The advantage of these velocity stages lies in the possibility of economically utilising a considerable fall of pressure in one stage without excessive increase in the peripheral speed.

This principle of velocity stages is used for the first wheel which carries two series of blades, between which are the reversing guide blades carried on the turbine body. After the steam has passed through the first series of blades, it is deflected by the reversing vanes back to its original direction, and then loses the remaining velocity in the second series of blades. Curves A and B (Fig. 2) show the varying pressure and velocity at different stages. The construction adopted is that of a short impulse turbine, with from 5 to 15 pressure stages. Owing to the conversion of a large fall in pressure in the first stage, high pressures and temperatures are kept away from the turbine body.

Up to the largest sizes, the body consists of a single cast-iron cylinder split horizontally. At the admission end, the cylinder is closed by a cover in one piece, made in the smaller sizes of cast-iron, and in the larger machines of cast-steel. A special cover on the exhaust end is not required. The body is supported freely on one support, which surrounds the vacuum end of the lower cylinder and the exhaust flange. This pedestal takes the entire weight of the cylinder, and is at the same time utilised to support the turbine and generator bearings. The outer bearing pedestal is provided with a flange bolted to the end cover near the centre, which ensures accurate alignment without restricting expansion. The end-bearing pedestal also carries the governor, oil pump, and guide block.

The interior of the cylinder is divided by diaphragms carrying the guide blades. These guide wheels are built in two halves with an annular space in the middle through which the turbine shaft passes. At this point special sealing rings (in two parts) of white metal are fixed which enclose the shaft without rubbing, and are provided with grooves to reduce the steam leakage between the neighbouring chambers to a minimum.

As the steam expands in the first set of guide vanes from the working pressure down to a pressure of from 15 to 45 lbs., the sealing of the body from the atmosphere only requires to provide against this pressure, and is provided by a simple labyrinth device.

The physical conditions which govern the expansion of steam in the first set of guide blades necessitate nozzles, the section of which increases from the narrowest part to the end. From ten to twenty such nozzles are placed together to form a nozzle segment, and this segment forms the first set of guide blades which is situated immediately behind the throttle valve and regulates the admission to the velocity wheel. By means of control valves, a certain number of the nozzles can be opened and closed, thus regulating the area of the steam passage.

The guide blades for the remaining stages are of a much simpler construction. The steam channels have the same section throughout their length, and are made of vanes of sheet nickel cast into an iron ring which forms the periphery of the guide wheel. The guide wheels are in halves, fitted together with a steam-tight joint. There is an opening in the centre of each guide wheel through which the rotor shaft passes. The rotating wheels of all stages are complete discs of Siemens-Martin steel, cast with a thickened hub bored to provide a firm seating on the shaft. The first wheel is provided with a bulb-shaped rim in which two slots are turned to carry the two series of blades. The slots are dove-tailed to fit the base of the blades (Fig. 3), which are composed of special nickel steel.

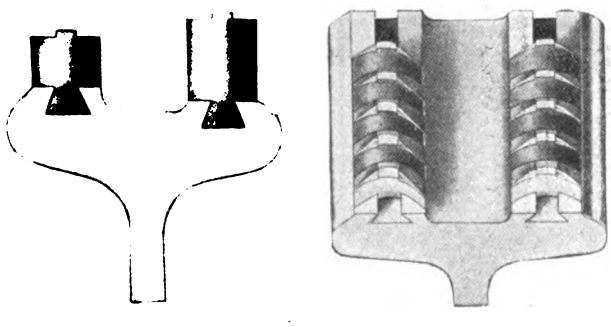


FIG. 3.—METHOD OF CARRYING BLADES IN VELOCITY WHEEL.

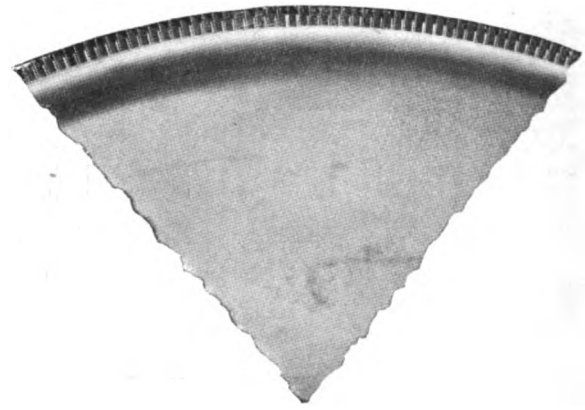


FIG. 4.—SEGMENT OF VELOCITY WHEEL.

The high-steam velocity in the first stage necessitates a channel of constant area in order to avoid wasteful steam eddies. This is attained by the blades having a special profile. In the case of the following stages (the normal pressure stages) this is not required. In Fig. 3 are seen the first and second series of blades upon which the steam impinges after leaving the nozzles. The reversing vanes come between the two series of blades. As,

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however, the velocity wheel has only partial admission, the reversing vanes are only necessary on the corresponding segment. A segment of the velocity wheel with blading completed is shown in Fig. 4. The ends of the blades are closed by means of a band, consisting of several short pieces of thin plate riveted to the blading, which forms a confined passage. The wheels of all other stages have blades also of nickel steel. The blading is standard for all sizes of machines, and in consequence gives complete interchangeability for all wheels and turbines. Very substantial construction is obtained by riveting the roots of the blades to the discs. A band similar to that used for the velocity wheel is carried on the ends of the blades. The shaft is of nickel steel.

The bearings are provided with water-cooled oil pressure lubrication. The oil supply is kept in circulation by means of a small geared pump driven direct from the turbine shaft. The oil leaves the pump with a pressure of from 15 to 30 lbs. per square inch, and flows through the whole length of the bearings and thence to an oil reservoir, in which it is cleaned and cooled.

It has been possible in the case of the smaller units to use only three bearings and a rigid coupling between the generator and turbine shaft. The larger units have four bearings, two for the turbine, and two for the generator. In this case a flexible coupling, consisting of a number of fine steel wires, is used.

The spring-controlled governor is of the "Hartung" type, driven by a worm from the shaft. It controls a guide valve which directs the flow of the pressure oil into one of two channels. From here the oil passes either into the top or bottom of a relay cylinder, the piston rod of which is connected to the throttle valve. As, after each process of governing, the valve is moved back to the neutral position, there is no fear of the governing being carried too far. The operation of governing is entirely independent of the pressure of the steam supply. It is therefore possible, in special cases, to run the turbine without adjustment with a steam pressure which is much less than the normal. Every governor is provided with an arrangement allowing the speed to be adjusted 4 to 5 per cent. above and below the normal. To improve the steam consumption at light loads, the first set of guide blades is divided into several groups, each of which is controlled by means of a hand operated valve, which can be opened and closed according to the load.

A safety device is provided which closes the steam inlet valve as soon as normal speed is raised more than 10 per cent. The arrangement is carried direct on the main shaft without the use of any intermediate gearing, in order to secure the reliable working of the device under all circumstances. It should be noted that the steam supply in such cases is not cut off by means of the throttle valve, but by means of the main stop valve, which is entirely closed. In order to prevent the valve seat being damaged by sudden closing, an air cushion is provided. The operation of the safety device does not depend upon the will of the driver. The main stop valve cannot be opened until the safety device is in the correct working position. This safety device can be also arranged to come into operation in case of failure in the oil circuit.

Exhaust and mixed pressure turbines have been standardised on exactly the same lines as the high pressure, and follow the same details of construction. The chief difference in the construction of a purely exhaust turbine would be in the suppression of the velocity stage, and a slightly different form of bearing at the steam admission end. Interchangeability of parts, which is so distinct a feature of this form of construction, applies equally to the exhaust type as to the high pressure.

LOSSES OFF TRANSMISSION LINES DUE TO BRUSH DISCHARGE

A PAPER entitled "Losses off Transmission Lines due to Brush Discharge, with Special Reference to the Case of Direct Current," was read before the Institution of Electrical Engineers in London on Thursday last by Mr. E. A. Watson, of Liverpool University. The author described the results of experiments made with 6-ft. lengths of wire of various diameters, which were mounted in a long metal cylinder, and connected to an electrically driven influence machine capable of working up to 70,000 volts. Tests were also made on parallel wires, 12 yards long, and 1 yard apart. The Paper also contained some suggestions as to the mechanism and amount of the loss off lines worked at such a high pressure that the critical voltage is exceeded and a corona or brush discharge formed.

The author's experiments showed that there is a definite critical stress at which a loss begins from a direct-current line just as for an alternating-current one, and that the D.C. voltage required to produce this stress is the same as the maximum value of the A.C. stress. Thus, for a given wire, the critical voltage for D.C. working will be 41 per cent. higher than that for A.C. working with a sine wave. The frequency will make no difference to the critical voltage, but will affect the losses considerably if the critical voltage is exceeded. The value of the critical stress appears to be substantially the same, whether the wire is positive or negative, provided it is clean, but for dirty wires the stress at which loss begins is much lower for the negative than for the positive wire. Other experiments showed that the critical stress is greater the smaller the diameter of the wire, and that the critical stress is reduced by reduction of the pressure of the surrounding air, but not proportionately. Further, it was found that the presence of water vapour in the air does not affect the loss or the critical stress for a clean air. An actual transmission line does not, however, says the author, behave like a clean wire, and it is found that a factor of safety varying from 1·5 to 2 should be allowed after calculating the critical stress in the usual manner from the diameter and distance apart of the wires. This factor depends somewhat on the conditions of the district in which the wire is situated, and is probably less for a line in a clean mountainous region than for one in an industrial district. The loss is also affected by the presence of water vapour in the atmosphere, especially for low values of the electric stress, and a considerable loss takes place before the wire is uniformly enveloped in a corona or becomes noticeably luminous.

After comparing the results obtained by other experimenters, Mr. Watson proceeds to consider the various theories for the actual cause of the loss in the corona. He doubts the usual assumption that the diameter of the corona is the same as that of the wire for which the voltage considered is the critical one, and suggests that the dielectric strength of air is not a constant, but is much greater near the surfaces of conductors than it is in bulk. This would cause the corona to have a greater diameter, and a method of determining this diameter is given. It is shown that the resistance of the corona offered to the capacity current flowing to its outer boundary is not sufficient to account for the actual loss, and the author doubts the accuracy of the assumption that the loss is due to the movement of charged layers of air from the wire under the influence of the electrostatic stress, although the formula derived on this assumption gives, in certain cases, a loss of the right order of magnitude. The author concludes that the loss which occurs with direct current when the critical stress is exceeded is due to the production of gaseous ions at the surface of the wire, and that the actual current lost depends partly upon the amount by which the stress at the wire exceeds the critical value, and partly upon the disposition of the wires. Further, he suggests that with A.C. lines part of the loss may be due to the energy stored in the layers of air surrounding the wire, and which, upon breakdown, becomes converted into heat, but that this is insufficient to account for the whole loss which is observed, and that part of the loss is probably due to the same cause as that for direct currents.

The results of the author's experiments are plotted in a series of curves, giving the loss in milliamperes per km. plotted against the electric stress in kilovolts per cm. for various wires. One set of curves shows the variation of apparent electric strength of air with the diameter of the wire and for different atmospheric pressures, and the values obtained from these agree well with the results of previous experimenters. Another set shows that the electric strength for a given wire varies in proportion with the atmospheric pressure between ½ and 1 atmosphere, but not for lower pressures. The experiments made with parallel wires in the open gave critical stresses considerably lower than those obtained from the tests of the same wire in a cylinder, the explanations being, it is thought, that the wires were dirty. For a 0·7 mm. wire, the loss commenced at 53 kilovolts per cm. when wet, and 65 kv. per cm. when dry (in the cylinder the figure was 81·4 kv. per cm. for the dry wire), and increased up to a loss of approx. 11 milliamps. per kilometer in both cases for a stress of 110 kv. per cm. The reason for the loss being approximately the same at high pressure appears to be that the loss prior to the formation of the true corona, which alone is affected by the presence of water vapour, would become relatively of less importance after the corona had formed. Further, it was found that a given increase of voltage above the critical voltage produced a much smaller increase in the value of the current lost per kilometer of line in the case of parallel wires than in the case of the wire in a cylinder, for the same voltage and wire.

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DISCUSSION.

The discussion was opened by Mr. J. S. HIGHFIELD (Chief Engineer, Metropolitan Electric Supply Co.), who stated that, so far as he could see, the losses given in the Paper were high as compared with those which occurred in actual practice. Thus Mr. Thury had informed him that on a 180 km. double-wire line with a 7 mm. wire working at from 50,000 to 60,000 volts direct current and carrying 75 amperes, the current loss was negligible. Again, on the Lausanne line with 72 km. of wire and over 3,000 insulators, the total current loss was only 1/10 amp. The author's results showed that the critical pressure for A.C. had a maximum value equal to the critical pressure for D.C., and this meant that the stress on the insulators would be the same with 140,000 D.C. as with 100,000 volts A.C. assuming a sine wave in the latter case. He hoped the author would make further tests with parallel wires in the open.

Dr. ALEXANDER RUSSEL (Principal, Faraday House) thought that the D.C. voltage required to produce the critical stress would be not exactly equal to, but within 4 or 5 per cent. of, the maximum value of the corresponding A.C. voltage. He suggested that a wrapping of a material with a higher electric strength than air might be placed round overhead wires to increase the critical pressure. Dr. Russel then criticised certain formulæ in the Paper, but said that they might be taken as substantially correct.. He did not agree with the author's theory that the air near the wire had a higher electric strength than that of air in bulk; the electric strength of air was, he thought, a definite constant figure, and he preferred to think that the results obtained were due to the fact that the stress near the wire was not that given by the formula on account of ionisation effects.

Mr. E. H. RAYNER (National Physical Laboratory) stated that he had recently carried out similar experiments to those described in the Paper, with the aid of an electrostatic watt-meter. The latter had been devised in the first place for measuring the watt losses in insulation, and could work at 15,000 volts or higher pressures. His results agreed remarkably well with Mr. Watson's. With regard to the relative effect of D.C. and A.C. voltages, it appeared that ionisation and the consequent loss began at the same maximum stress.

Mr. J. S. COOPER (British Westinghouse Co., Manchester) suggested that the nature of the wire used might have an effect on the results. Experiments by Mr. Mershon had shown a greater loss from aluminium than from copper with wires of the same diameter and at the same pressure. He did not think it was a physical effect, but it might be due to difference in the surface texture. If, as the author stated, the brush discharge loss was an important limiting factor to the voltage which might be employed, it would often be advantageous to substitute aluminium for copper, as the former gave a 30 per cent. larger diameter for the same conductivity, and the corona limit might therefore not be reached.

Mr. H. M. HOBART welcomed the confirmation by Mr. Watson, Mr. Rayner, and by Dr. Russel (within 4 or 5 per cent.) that the handicap of A.C. against the D.C. working with regard to the breakdown voltage was of the order of 40 per cent. only. At the meeting at which Mr. Highfield's Paper on the Thury H.T. transmission systems was read, the opinion was almost unanimous that the ratio was 2 to 1, even Lord Kelvin concurring though expressing surprise that it should be so. He, however, had analysed the figures given in Mr. Highfield's Paper, and had arrived at the lower ratio, and he was glad to see his results confirmed. He still considered that the A.C. system was the best for transmission purposes, and it was important that all engineers should soon arrive at a definite conclusion.

Mr. J. T. IRWIN (Central Technical College) questioned whether the voltage applied in the experiments was a constant one, and showed some interesting oscillograph curves of breakdown across an air condenser.

Mr. WATSON reserved his full reply for the *Journal*, but pointed out with reference to the A.C. *v.* D.C. controversy, that though the 1·41 to 1 ratio was correct for air, it might not be when considering insulators, as the porcelain might be weakened by the heating due to dielectric hysteresis, and by the incipient breakdown stresses at sharp edges.

EQUITABLE CHARGES FOR TRAMWAY SUPPLY

THE Paper on this subject, by H. E. Yerbury (Chief Electrical Engineer, Sheffield Corporation Tramways), on which we have already reported discussions by the Institution of Electrical Engineers in Manchester, Sheffield, and London (see ELECTRICAL ENGINEERING, January 27th, page 64, and February 3rd, page 73), was further discussed at Glasgow on Tuesday, February 8th.

In the Paper, Mr. Yerbury had criticised the usual methods of allocating the relative proportions of generating costs in combined lighting, power, and tramway stations when determining the charge to be made for energy supplied to tramways. He contrasted the figures of 0·865d. charged at Manchester, with the 0·371d. obtained at the Sheffield independent station, and denied that the difference was justified by the expense of extra plant for the peak and conversion. He would base the charge on capital and running costs for the tramway plant only with a profit of from 3 to 5 per cent.

The discussion at Glasgow was opened by Mr. H. RICHARDSON (Chief Electrical Engineer, Dundee), who pointed out that the conditions differed between traction and power consumers. In spite of the shorter hours, large power consumers had a better load factor than tramways with their large variations of load, and were often considerably cheaper to handle. Also the occasional coincidence of the tramway and lighting peaks had to be allowed for. The traction charge at Dundee was 1·125d. per unit.

Prof. F. G. BAILY (Heriot Watt College, Edinburgh) did not agree with Mr. Yerbury that power rates were generally too low, and pointed out that cost of production was often lowered by getting into a new market at under ordinary cost. It was not unfair that power should be charged at a lower rate than lighting.

Mr. A. H. BURBRIDGE (Burgh Electrical Engineer, Kilmarnock) thought that the maintenance of the cables should not be in the hands of the tramway department unless they employed a qualified electrical engineer. He also complained of difficulties in keeping tramway supply meters in order. He thought that the spare plant kept for tramway supply in small combined stations was excessive.

Mr. W. W. LACKIE (City Electrical Engineer, Glasgow) was sorry that Mr. Yerbury had not come to any definite conclusion. He did not agree with his allocation of the fixed charges, and thought that the interest, sinking fund and depreciation charges allowed for at Bradford were too low for present-day requirements. There was a great difference between a tramway and an ordinary power supply of the same dimensions; as to the former, special plant was required on account of the earthed return, whereas the power consumers were served by the same plant as the lighting consumers. It was possible that at Glasgow, combined stations would now give reduced costs, but in the early days the tramway demand had been far in excess of that for lighting. If interest, sinking fund, and depreciation were added to the figure given for Glasgow, the total price came out about 1·227d. per unit.

Mr. J. MCMAHON (Tramway Manager, Dumbarton) thought that no definite answer had been given to Mr. Yerbury's query why the costs were usually less than for power from a combined station. At Northampton, with a plant costing about £17,000, they turned out 876,000 units per annum at a total cost of 0·62d. per unit. Mr. McMahon proceeded to make some comparisons between the tramway and lighting and power stations at Glasgow, but Mr. Lackie intervened and said that these should be regarded as separate, as there were trunk interconnecting mains over which more than a million units passed per annum.

Mr. J. ROBERTSON (Burgh Electrical Engineer, Greenock) pointed out that comparisons were useless between very cheaply equipped stations and those built to last. There was no reason why power should not be supplied at a charge below that for traction if the reduction in cost occasioned by the extra load compensated for the reduced price. The maximum demand system took no account of the time at which the peaks occurred. He then showed some curves of the fluctuations of the supply at Greenock, where the tramway load factor was 12·3 per cent., the combined load factor 18·0 per cent. and the load factor for the power supply 25 per cent.

Mr. C. CAMPBELL MCMILLAN (Glasgow) thought that the question was a commercial rather than an engineering one. When both parties were departments of one municipality, the matter had not the importance that it had when one party was independent.

Mr. R. M. NEILSON remarked that each case should be considered on its own merits.

Mr. A. W. DRYER (Electric Control, Ltd.) said that at Chicago, the old generating stations had been scrapped and the supply was now taken from another company at a rate of £3 per kw. per annum of highest load demand for one hour plus 0·25d. per unit. This had worked out to about 0·4d. per unit—a 4,000 kw. battery was used to take care of the peak.

Mr. P. F. ALLEN (Clyde Valley Electric Power Co.) considered that selling prices depended partly on manufacturing price, partly on the salesman's ability, and to a large extent on local and trading conditions.

Mr. YERBURY, in reply, expressed the view that where increase of load had led to reduced costs, the old consumers should share in the benefits. It was a kw. charge plus a small unit charge that he advocated. It was usual that traction came to a station which had already a lighting load, and the traction supply should get the benefit of any reduction in price. Mr. Yerbury also took up a number of other points raised at some length, and the discussion was protracted to a late hour.

Long Distance Telephony.—Telephonic communication was recently successfully established between the Royal Palace in Stockholm and the Ducal Palace in Karlsruhe, Baden, Germany. The Egner-Holström heavy current microphone was employed, and the route was *via* Helsingborg, Copenhagen, and Hamburg.

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BALANCERS FOR THREE-WIRE SYSTEMS

A PAPER on "Balancers for Three-wire Systems" was read by Mr. A. G. Cooper on Tuesday, February 8th, before the Manchester Section of the Institution of Electrical Engineers. The author first reviewed the principles of the ordinary continuous-current balancer, which usually consists of two shunt machines mechanically coupled together, with their shunts cross-connected, and of such capacity that they are capable of continuously carrying a little more than half the observed out-of-balance current. (This subject was dealt with at some length by Mr. W. A. Ker in a Paper read last December before the Glasgow Section of the Institution—see ELECTRICAL ENGINEERING, Vol. V., page 1077.)

Some tests of a set of this kind were referred to which gave a voltage regulation within 3 per cent. on full load.

The usual double balancer starter and potentiometer regulator were described.

An improvement on the above figure, viz., 3 per cent., could, he said, be obtained by putting on some series turns to compensate for the armature drop, but to get the best effect and to avoid other complications in case of a heavy short, these coils should also be cross-connected. By over compensating the armature drop by additional series turns the out-of-balance side can be even raised above the opposite side.

Another form of balancer is a machine with a single shunt field connected across one of the outers and the middle. This has a double-wound armature with a commutator at each end, but is rather a poor balancer, and really only a middle wire former. In another modification, the double commutator armature is wound with one set of windings shorter than the other, so that the longer set come under the influence of auxiliar on field in series with the middle wire. This type of machine has been in use for a number of years at Blackburn, and has given every satisfaction. It will maintain the voltage equal within 1 per cent. over the whole of its range.

A description was then given of the application of Messrs. Crompton & Co.'s "C.M.B." auto-converter to balancing. This machine was fully described in ELECTRICAL ENGINEERING, July 8th, 1909, Vol. V., page 629.

The later part of the Paper was devoted to the so-called "static" balancers, the use of which in this country has mostly been in connection with rotary and motor-converter installations by making use of the secondary coils of the transformer, connecting the middle wire of the system to the star-point of the secondary coils of the transformers which are supplying the rotaries. This has been shown to be bad from an efficiency point of view. It is better to have a separate static balancer than to use the secondary coils. The static balancer consists of a choking coil with only one winding on each limb according to the number of phases used. The terminals are connected to equally spaced connections round the armature of the dynamo to give the selected phase proposed to be used. From the slip-rings an alternating E.M.F. is obtained which is connected to the terminals of the choking coil, while the star-point is connected to the middle wire. When the system is balanced, there will be a strong choking action which will prevent any large flow of alternating current from the slip-rings. When an out-of-balance current flows through the balancer and the armature, there will be a drop in volts due to the resistance, but this is practically no greater than in most balancers, if the static balancer is suitably designed. The greater the number of phases, the better is the regulation.

For single-phase, Dr. Garrard has given a difference of voltage worked out on an assumed internal drop in the armature on a 10 per cent. out-of-balance as 0·66 per cent., 3-phase 0·58 per cent., and 6-phase 0·49 per cent. In practice, however, it is not usually convenient to fit more than three slip-rings to the generator. In the event of using a static balancer with a compound wound, or a machine with commutating poles, the series winding must be split, half being connected in the negative side and half in the positive side of a generator.

The author gives some results of tests of a 360-kw. 8-pole, 500-volt, provided with three slip-rings, and a static balancer designed for an out-of-balance current of 170 amperes, showing a regulation method from 0·2 to 0·5 per cent., with out-of-balance currents from 10 to 80 amperes. If very heavy out-of-balance currents have to be dealt with, in proportion to the size of the static balancer and generator, then a middle wire booster can be attached to the machine to boost the out-of-balance side.

DISCUSSION.

The discussion was opened by Mr. J. S. PECK (British Westinghouse Co.), who could not see the objection to using the secondary coils of the transformers for balancing in rotary converter installations unless a three-phase connection was used. He also pointed out that where the frequency was low, perceptible flickering of the lamps could be caused by a static balancer. This was less, however, with two-phase connections.

Mr. H. GRAY (Borough Electrical and Tramways Engineer, Accrington) pointed out that, except where the balancer was under close supervision, there was some danger with crossed fields, owing to liability to run away if a heavy overload or short circuit occurred on one side. At Accrington they used a static balancer in connection with a 200-kw. motor-generator giving general supply from the traction circuit with ¾ load (300 amperes) on the outers, and 100 amps. taken from the static balancer (which totals to about full load on the plant), the percentage variation on either side of the middle wire from the normal was 2·4 per cent. He thought that a static balance took the shock of a short circuit better than a rotary set.

Mr. G. W. WORRALL called attention to the arrangement of the La Cour converter when supplying three-wire systems where the middle wire was connected to the neutral of the winding of the induction motor side, and a similar effect to that of a static balancer was obtained.

Mr. ATCHISON (Borough Electrical Engineer, Rochdale), however, thought that it was a mistake to employ auxiliary plant such as converters for balancing, and referred to the serious out of balance loads caused by cinematograph theatres, which were trying to a small undertaking. He had heard of very unhappy experiences with double commutator balancers.

Mr. C. F. SMITH (Manchester School of Technology) thought that in comparing the connection on static balancer with rotating balancers, it was sometimes forgotten that a static balancer has not the same functions as a motor-generator balancer. The former simply provides a return path for the out-of-balance, and it is compensated for in return.

Mr. C. L. E. STEWART (Borough Electrical Engineer, Rawtenstall) had had satisfactory experience with balancing rotary converters on the secondaries of the transformers, but in his case the supply was two-phase.

Mr. J. FRITH mentioned the old five-wire system in Manchester, and said that some of the customers were given a selecting switch, and they could take which of the four circuits they liked; presumably they would like the brightest. The balancing systems mentioned in the Paper were quite suitable for steady conditions, but for sudden fluctuations something with the quickness of action of the Tyrill regulator or the Highfield and Entz booster was required.

Mr. S. J. WATSON (Borough Electrical Engineer, Bury) considered that the best form of balancer for a power station was a battery divided into two parts across the three-wire system left continuously on the mains. He had got over the difficulty of balancing cinematographs by running a short middle wire direct from the generating station to which the services to the cinematographs were connected, so that the disturbance was entirely restricted to those users who actually cause the variation. Under the Cinematograph Act, which had recently become law, it was not allowed to take into the cinematograph room a pressure above 100 volts, so that if the inspectors insist on the regulations being carried out, motor-generators will have to be used in all cases where the supply pressure exceeds 100 volts. A disadvantage of any balancing arrangement is that you do not compensate for out-of-balances on any particular feeder, but only of the station balance as a whole.

Mr. COOPER replied briefly to some of the points raised. In small stations like his own they did not cater for sudden loads, and found ordinary balancing quite sufficient. There were two cinematograph theatres on his system, both with motor-generators.

Telegraph Traffic.—On the 8th inst. direct communication between Saigon and Bangkok was restored, while the line between Bagdad and Bassorah broke down on the same day.—On the 9th inst. the cable between Accra and Lagos failed, but a quick repair was effected on the 11th inst. Telegrams during this failure were handled without increase of rates.—Merchants trading with Uruguay will welcome the announcement that the censorship imposed recently has been countermanded.—The cables enumerated some time ago as being down have not yet been repaired.—The Western Telegraph Co. will soon be laying the new Argentine cable, manufacture of which is now proceeding.

Admiralty Wireless Secrets.—On Wednesday of last week R. S. Knowlden, a draughtsman on H.M.S. *Vernon*, appeared at the Winchester Assizes charged with stealing Admiralty wireless apparatus and drawings. The prisoner pleaded not guilty to the larceny indictments, but admitted an indictment under the Official Secrets Act. The Solicitor-General, on behalf of the Crown, accepted the statement that the prisoner took the apparatus and drawings home only to work up his knowledge of the subject, but pointed out that it was, nevertheless, an offence under the Official Secrets Act. Mr. Justice Lawrence agreed with the course taken by the prosecution not to go on with the larceny charges, and bound the prisoner over in £250, and one surety of the same amount.

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PROTECTION FROM LIGHTNING

A LECTURE was delivered on the 10th inst., by Sir Oliver Lodge (Principal of Birmingham University), to the members of the University Engineering Society on the above subject. He said that the old idea of protection from lightning was that there was a charge of electricity in the clouds which had to be conducted to earth by an easy path. It was thought that if a copper conductor were provided, that conductor would be chosen in preference to all inferior conductors. The problem is not really so simple as this, but is concerned more with the best method of dissipating the enormous energy contained in a lightning flash. It is not wise to get rid of the energy too quickly. From an electrical point of view, a thin iron wire is the best lightning conductor, although sometimes there is not time for a poor conductor to discharge the flash. Lightning flashes are oscillatory, as has been shown mathematically by Lord Kelvin, and the oscillations are of the order of 10 million per second. The ohmic resistance of the conductor is unimportant, but the impedance due to self-induction is very great. In all lightning conductors the current flows only on the surface; especially is this the case with iron conductors where the current penetrates to a depth of less than 1 millimetre beneath the surface. Experiments were performed to show how a lightning flash frequently prefers to discharge across an air-gap rather than travel round a loop of wire.

There are two kinds of flash—one the simple direct discharge between an electrically charged cloud and earth, and the other an induced charge, as when a cloud intervenes between the cloud carrying the primary charge and the earth, the two clouds practically form a condenser. When a discharge takes place from the first into the second, the charge on the earth side of the lower cloud is suddenly relieved, and the disruptive discharge from the latter to the earth may take such an erratic course that it is almost impossible to guarantee protection by lightning conductors unless the building to be protected is completely enveloped in a metal cage.

To envelop buildings as far as is reasonably practicable in this manner is what should be aimed at, and it is quite wrong to suppose that a conductor placed on the tallest part of a building will render it immune from lightning. The lecture was illustrated by lantern slides and by experiments. The most striking experiment was that which showed how, although flashes may be discharging between a cloud represented by a metal sheet and surrounding objects represented by metal balls, yet, when a pointed conductor is introduced, all flashes to the balls cease, and silent discharge occurs between the cloud and the pointed conductor, although the latter is no nearer the cloud than were the balls.

Wireless Telegraph Notes.—We are informed that the Compagnie Générale Transatlantique have given orders for two of their cargo steamers (the *Florida* and the *Caroline*) plying between France and the United States to be equipped with the Bellini-Tosi "Wireless Compass" system. The equipment consists of a diminutive directive receiving system on the Bellini-Tosi method, and by its means the direction from which signals are arriving is readily ascertained at distances up to about 15 or 20 miles. The apparatus is intended solely for navigational purposes, and is of special value in foggy weather. A greater range is not required, as the danger zone lies within these limits. The passenger liner *Louisiane* of the same company was temporarily fitted with the wireless "compass" some little time ago, and the experiments made have shown that time can be saved when entering New York Harbour in thick weather by the aid of signals received from the coast stations of known position, whose bearings can be directly determined by the wireless "compass."

The Metal Filament Lamp Trade in Germany.—The Deutsche Gasglühlicht Gesellschaft (Auer-gesellschaft), the makers of the Osram lamp in Germany, have announced that they are increasing their manufacture of metal filament lamps in order to make up for what will be lost on price reductions. Contrary to what was previously announced, the necessary extension of plant, &c., will be carried out without any increase of capital. The Allgemeine Elektricitäts-Ges., of Berlin, has without any warning reduced the prices of its metal filament lamps, which are now listed as follows: 25, 32, and 50 Hefner c.p., 100-130 volt, 2 m. (approx. 2s.), and 50 Hefner c.p., 200-250 volt, 3 m. (approx. 3s.). In consequence of the inconvenience of such a sudden reduction to dealers, the other principal manufacturing firms have come to an agreement not to reduce prices without previous arrangements with the dealers and other parties concerned. The firms include Siemens & Halske A.-G., Deutsch Gasglühlicht A.-G., Bergmann-Elektricitäts-werke A.-G., Julius Pintsch A.-G., Ehrich & Graetz, and the Wolfram-Lampen A.-G., of Augsburg.

THE "Z" METAL FILAMENT LAMP PATENT

Action for Infringement

THE action by the "Z" Electric Lamp Manufacturing Co. Ltd., against Messrs. Marples, Leach & Co. (now Adnil Electric Co., Ltd.), for infringement of their patent No. 21,654 of 1906 was commenced before Mr. Justice Parker in the Chancery Division on Thursday. The real defendants in the action are the Bergmann Elektricitäts-Werke of Berlin, for whom Messrs. Marples, Leach & Co. are agents in this country. Mr. A. J. Walter, K.C., and Mr. A. H. Colefax appear for the "Z" Co., and Mr. Terrell, K.C., and Mr. Maconachie for Messrs. Marples, Leach & Co.

The patent in question covers a process for removing the last traces of carbon in filaments manufactured from compounds of tungsten, by combining the carbon with the nitrogen in the ammonia given off by heating suitable phosphorous compounds in vacuo. Phospham is said to be particularly suitable, as, not only is the nitrogen released at a comparatively low temperature, but the phosphorus, which is at the same time set free, reduces any metallic oxide which might be present in the filament. The phospham may be included in the paste previous to squirting, or may be introduced into the vacuum furnace in which the filaments are sintered. Alternately, the phospham compound may be applied to the supporting wires or pedestal in the lamp, in which case the decarbonisation is effected when the filament is raised to incandescence after the lamp is sealed.

The defence to the action is that the invention in question is not useful in that the substances mentioned do not act as described. Further, insufficiency is alleged, and also want of subject matter. In addition, anticipation is alleged, and the following patents are cited:—British patents, No. 10,741 of 1890, granted to Messrs. Siemens Bros. & Co.; and No. 10,867 of 1901, granted to C. D. Abel; also German patents Nos. 133,701 and 137,569 of 1901, granted to Eberhard Sander.

MR. WALTER, in opening the case, detailed the process of manufacture of metal filaments, and said that it was the practice of the "Z" Lamp Company to paint phospham on the glass supporting-rod of their lamps, although as a matter of fact every method described in the specification had been tried successfully. The Bergmann Company used phospham in precisely the same way, and what answer there was on the question of infringement he did not know. The pleadings of the defendants seemed to infer that the patent in question was one for the manufacture of pure tungsten—in fact, that it was a chemical patent. The pleadings generally were so vague that he was a little in doubt as to what the real defence to the action was.

MR. JAMES SWINBURNE, on the question of validity, said that none of the specifications cited by the defence had anything to do with the use of phospham as described in the "Z" Company's patent. On the point that the complete specification was insufficient, he said he had had no difficulty in carrying out all the processes described. Phospham was purchasable before the date of the patent. The blackening of lamps was generally attributed to the particles of carbon remaining in tungsten filaments, but it was all largely surmise. His own theory was that there was a current crossing inside the lamp, through the gas, and that the presence of carbon in the filament assisted this. Whatever the facts, it had been proved that phospham prevented blackening, but whether this was by the removal of the carbon he could not say.

MR. SWINBURNE'S cross-examination by Mr. Terrell, K.C., was first directed to the fact that in their final state, before the application of phospham, the Bergmann lamps contained a considerably smaller percentage of carbon than "Z" lamps after treatment with phospham. It was stated that a 32-c.p. 100-volt Bergmann filament contained only 0·014 to 0·017 per cent. of carbon before treatment, against about 0·2 per cent. in the "Z" lamp after treatment. Mr. Swinburne agreed that the former quantity, if correct, which he doubted, could be regarded as negligible, and that the application of phospham would not have a very marked effect upon it. Mr. Terrell detailed the process of making the Bergmann filaments as follows:—A mixture of tungsten powder, nitro-cellulose, castor oil, and amyl-acetate, was rolled into a stiff paste and squirted through a diamond die. At this point the amount of carbon was 2·5 per cent. The filaments were then heated in a chamber at 1000° C., in vacuo, which was relieved to the extent of two or three millimetres of mercury by means of hydrogen. The carbon was then reduced to 0·78 per cent. The process of sintering was next gone through, current being passed through the filaments in an atmosphere of hydrogen, and this reduced the carbon from 0·014 to 0·017 per cent. Mr. Swinburne said the process was the same as that employed in the manufacture of the "Z" lamp, but he should have expected the carbon to be about 0·2 per cent.

MR. TERRELL, in the course of further questions, asserted that the defendants used phospham for quite a different purpose from decarbonisation. They did not accept the theory that

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blackening was due to carbon, but believed it was due to the tungsten itself and bad vacuum, and in proof of that produced a very much blackened lamp, a portion of the inside of which had been cleaned with chlorine water. This could not have been done, he said, had the blackening consisted of carbon. They therefore painted phospham on the glass stems of their lamps as a vehicle for carrying phosphorous in order to produce phosphene, which improved the vacuum and so prevented the tungsten being disintegrated and deposited on the glass.

A very lengthy discussion took place as to the composition of phospham. The latest edition of Watts' "Dictionary of Chemistry" gives it as PN_2H, but marks it as doubtful. Mr. Swinburne said he had experimented with four brands, but did not know the composition of any one. Mr. Terrell suggested that what the "Z" Company used was phospham treated with water. It was also stated that a substance was sold by one firm under two different names, one of which was phospham. Mr. Terrell claimed that PN_2H could not possibly decompose and give off ammonia except at a very high temperature, and if the substance used by Mr. Swinburne in his experiments decomposed and gave off ammonia, as it must do to get rid of the carbon, at less than 200° C., then he could not have been using phospham.

MR. H. BALLANTYNE said he had made phospham according to the methods laid down by Rose, Pauley, and Besson, and had also purchased samples from Shuckhardt and Karlbaum, and gave the following results of his tests:—Rose gave off 4·5 per cent. ammonia at 260° C., and 1·7 per cent. at 320° C.; Pauley, 2·04 per cent. at 260–270° C., and 2·21 per cent. at 350° C.; Besson, 2·63 per cent. at 270–280° C., and 5·78 per cent. at 350° C.; Shuckhardt, 4·29 per cent. at 200° C., 3·49 per cent. at 280° C., 1·95 per cent. at 350° C., and 0·94 per cent. at 450° C. He claimed that this substantiated the statement in the patent that phospham decomposed at comparatively low temperatures. He then described a method of making filaments which he said was that adopted by the defendants (but which Mr. Terrell said was not), in which the sintered filaments showed 0·225 per cent. of carbon, and not 0·014 to 0·017 as stated by Mr. Terrell. He used a mixture of 14 grammes of tungsten and 2·1 grammes of collodion, the latter consisting of 40 parts nitro-cellulose, 20 parts castor oil, and 110 parts amyl-acetate.

On Monday Mr. Ballantyne handed in lamps which he had made, some of the filaments of which contained phospham, and some did not. All the lamps had been run for one hour, and the globes of those not treated with phospham showed distinct blackening, whilst those treated with phospham did not. He had also made 15 lamps, the filaments of which had been painted with Karlbaum phospham, and on breaking a number of them they all gave off a phosphorus smell. The filaments in these lamps had been made according to the process described by Mr. Terrell, but without adding any phosphorus to the phospham. Very good results were obtained with regard to blackening, and in his opinion this experiment disproved the statement of the defence that phospham was merely an inert vehicle for carrying phosphorus. He had also proved by experiments that Karlbaum's phospham gave off a considerable percentage of ammonia during heating up to 400° C. Further, he had scraped off the phospham residue on the stems of 12 Adnil lamps, and on heating had found ammonia was given off. Other experiments carried out by him showed that the addition of 1 per cent. of phospham to the filament considerably reduced the amount of carbon in it. The suggestion of the defence that phosphoramide was used in the manufacture of the "Z" lamps could not be correct, because this gave off 28·5 per cent. of ammonia, whereas Shuckhardt phospham, the material used, only gave off 11·22 per cent., whilst the theoretical figure was 9·46 per cent. This phospham gave off ammonia up to 300° C., whereas phosphoramide did not begin to give off ammonia until a temperature of 220° C. was reached. During a long cross-examination, Mr. Terrell argued that it was impossible to get pure phospham, and quoted inconsistent theories of various authorities as to the constitution of the substance. Mr. Ballantyne said he made his phospham in accordance with the best knowledge on the subject, after having studied all the theories.

On Tuesday Mr. Ballantyne, in further cross-examination, admitted that phospham would not get rid of the last traces of carbon in a filament from the chemical point of view, although the amount remaining was negligible from the manufacturing point of view. The best result he had obtained by the use of phospham was 0·095 per cent. of carbon, and such a filament did not cause blackening. This was by painting phospham on the stem of the lamp. When including phospham in the tungsten paste, the best result was 0·22 per cent. of carbon. He agreed with Mr. Terrell that Karlsbaum and Shuckhardt phosphams were of totally different constitution, but their effect upon tungsten filaments was practically the same

In answer to Mr. Justice Parker, Mr. Terrell said his case was that the description in the specification was such as to lead a manufacturer to do things which would not, and did not, act, and, in fact, could not act. He agreed that the mere fact that the specification might be wrong in its chemical theory would not affect the validity of the patent, but if the instructions were not sufficiently clear to enable the result desired to be achieved, then the patent was not a good one. In the course of some further discussion, Mr. Terrell admitted that Messrs. Bergmann had used Shuckhardt phospham in precisely the same way as the "Z" Co.

Mr. Justice Parker said that this practically amounted to an admission of infringement if the patent were valid.

Mr. Terrell said this was not so, as the Bergmann Co. did not use phospham for the removal of carbon.

Mr. W. L. PAKENHAM gave evidence as to certain experiments carried out for Mr. Swinburne, the general effect of which was that the use of phospham greatly improved the filaments from the point of view of blackening. In fact, the "Z" Co. was formed with this object in view.

This closed the case for the plaintiffs.

Mr. OTTO HEHNER was the first witness called for the defendants, and confirmed the details of manufacture at the Bergmann Works and the results obtained in relation to the proportions of carbon already given by Mr. Terrell in his cross-examination of Mr. Swinburne. He stated that his experiments proved the impossibility of removing all the carbon from the tungsten filaments by means of phospham as described in the patent, and on this, in subsequent cross-examination, Mr. Walter suggested that the tungsten paste used by Mr. Hehner had not been sufficiently ground, a point which Mr. Swinburne had discovered and rectified in his own experiments. Another matter spoken of by Mr. Hehner was the temperature at which ammonia was given off by phospham. He directly contradicted the claim of the specification that ammonia was given off at comparatively low temperatures, and further stated that experiments had shown it to be given off at 130° C., and then to stop altogether. Since his interest in this case, he had suggested the use of silica instead of phospham for pasting on the stems of the lamps as a vehicle for red phosphorus, and this had been adopted with quite satisfactory results.

The case was still proceeding when we went to press.

Rugby Engineering Society.—The second conversazione of this society was held at Rugby, on February 11th, and was attended by over 400 members and friends. Among the exhibits was a full-size Blériot monoplane, and a large number of models were exhibited by members of the society. In addition, there were working models and demonstrations of gyrostats, the Brennan Monorail car, and many other things of scientific and engineering interest. A series of short lectures and music were also provided.

Central Technical College Old Students' Association.—The Annual General Meeting and Dinner of this Association was held on Saturday at the Trocadero Restaurant, London. Mr. H. A. Humphrey, the President, occupied the chair and responded to the toast of the Association proposed by Sir Philip Magnus, M.P. The toast of the visitors was given by Prof. A. Chatterton, who was one of the original students at the opening of the college, and who is now at home from India on furlough. Mr. W. H. Allen replied. Prof. W. T. Pope, F.R.S., who was at the College from 1887-1890, was elected President for the coming year. The dinner was well attended, and, in fact, more members were present than on any previous occasion. An excellent musical entertainment had been provided, and an item not on the programme, which met with a cordial reception, was a song with chorus by one of the guests, Mr. A. L. C. Fell (Chief Officer of the L.C.C. tramways). Old students of the College who are not yet members of the Association should communicate with the Hon. Sec., Dr. E. Frankland Armstrong (98 London Road, Reading). Attention of old students should also be directed to the Association's Employment Agency, of which Mr. Edw. Wheeler (Central Technical College, S.W.) is Honorary Secretary.

The Paris Floods.—*Le Génie Civil* contains a long article on the Paris floods, with some striking illustrations. In addition to the troubles experienced in the supply stations mentioned in a note on page 103 of our last issue, there has been a good deal of interruption to the electric traction systems. At Vitry, where a considerable area was under water, the Thomson-Houston station of l'Est-Lumière, from which supply is given to the East Parisian tramways, was flooded. The electrified section of the Orleans railway from the Austerlitz station to the terminus in the Quai d'Orsay, which is on the third rail system, was also interrupted owing to the flooding of the tunnel and the Quai d'Orsay station itself. The Métropolitain was affected by the flooding of its generating station at Bercy, which together with the large station of the Société d'Electricité de Paris at St. Denis supplies power to the line, extensive sections of the line itself were also flooded, and in some districts, more particularly in the neighbourhood of the St. Lazare station, the tunnels were entirely filled with water. The pumping out of these will be a work of considerable time. Our contemporary publishes an excellent map showing the areas affected and the lines interrupted.

The renewed rise of the Seine is considerably hindering the work of repairs necessitated by the recent floods, and it is stated that the authorities have been unable as yet to commence the repair of the damaged telephone lines. Some 14,000 subscribers are said to be still cut off.

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THE BREMER FLAME ARC LAMP

Patent Restored

JUDGMENT in the British Westinghouse Co.'s appeal against the decision of Mr. Justice Joyce declaring the Bremer flame arc lamp invalid, was delivered in the Appeal Court on Saturday.

It will be remembered that Mr. Braulik had first endeavoured to secure the revocation of the Bremer patent under Section 27 of the Patents Act, alleging that the lamps were manufactured mainly outside the United Kingdom. The Comptroller of Patents revoked the patent subject to appeal to the High Court, but on appeal the patent was restored. An action brought by the Westinghouse Co. against Mr. Braulik for infringing the patent was then heard, and resulted in Mr. Justice Joyce declaring that the Bremer patent was invalid for want of subject matter. We reported fully the proceedings before Mr. Justice Joyce in ELECTRICAL ENGINEERING, Vol. V., pp. 571, 617, and 909. The patent is No. 18,786 of 1902.

LORD JUSTICE FLETCHER-MOULTON said that the questions of insufficiency and infringement were hardly argued on behalf of Mr. Braulik in the appeal, and the substantial questions were want of subject matter, and anticipation by the Graham and Crosby specifications. If the former defences were still relied upon, then he decided that on both grounds they failed. With regard to the other two points, the Bremer patent claimed to have got over the difficulties of instantaneously adjusting the electrodes in order to compensate for irregularities in the feed, and to keep the light steady. He was of opinion that this claim was justified by the evidence. No lamp of the type described by Bremer was in successful use at the time of the patent, but since then 14,000 of them had been sold, apart from alleged infringements. This success had undoubtedly been due to the Bremer construction. He commented upon the fact that the defendant was repeatedly asked to produce a specimen of his commercial lamp, but did not do so, and this, combined with the fact that the plea of non-utility was abandoned, left no doubt in his mind that the Bremer lamp was a substantial advance in arc lamp manufacture. The element of novelty in the lamp was the floating electrode applied to the type of lamp specified in the patent. He was of the opinion that the claim was restricted to the use of a particular form of horizontal feed mechanism, and did not cover the use of any form of horizontal feed mechanism in the specified type of lamp. The question was whether such a combination was good subject matter for letters patent. On the point of anticipation, the Crosby specification could be dismissed, as the carbons were not clipped firmly. As a matter of fact, they were loose in their holders, and the downward feeding was due to the diminution of pressure on the side of the carbons, and therefore depended on the friction between them and their holders. This was an essential feature of the Crosby specification, and not a detail, as had been argued. This lamp did not come within the claim of the Bremer specification, and could in no way lead up to Bremer's invention. With regard to the Graham specification, which had been chiefly relied upon both on the point of subject matter and also anticipation, there was a pivoted electrode and downward feed working simultaneously, but there was no indication of any adjustments taking place in the intervals between feeding by reason of the varying resistance of the arc, and he was satisfied that the patentee had no idea of introducing such an adjustment. Nor did he think anyone making a lamp according to this specification would have produced one having such an adjustment, or, in other words, having a "floating feed." No evidence had been produced on behalf of Mr. Braulik as to the performances of this lamp, and it was against him that he had been unable to prove the suggestion that a lamp made according to the specification would work. It could not, therefore, be regarded as an anticipation. With regard to want of subject matter, he viewed with suspicion arguments to the effect that a new combination of known principles, bringing with it new and important consequences, in the shape of practical machines, was not invention. This was unfair to inventors, and in his opinion was not countenanced by English law. In none of the cases in which a floating feed was used was there any adjustment otherwise than in the line of the carbons, and the natural application of that would be to draw the carbon along the line of the electrode, an arrangement which would be different to and immeasurably inferior to Bremer's device, and was certainly not included in Graham's. He was, therefore, of opinion that there was good subject matter in giving to a lamp of the type mentioned in the claim of Bremer's specification a floating feed in the manner proposed. No one reading Graham's specification could read into it a floating feed, but arguments had been made that this was the intention, although not expressly stated. The English courts, however, had always been against this sort of argument. In his opinion the judgment of the Court below proceeded on too wide an interpretation of the claim of the Bremer's patent. It did not cover every mode of effecting the object, but was for a horizontal feeding mechanism of a certain definite type. In his opinion, therefore, the patent was valid.

The Master of the Rolls and Lord Justice Buckley concurred.

On the application of Mr. Walter, K.C., for the British Westinghouse Co., an injunction was granted restraining the defendant from selling the infringing lamp, and an inquiry was ordered as to damages. The latter was stayed for a month with a view to an appeal to the House of Lords.

GLARE

AT a meeting of the Illuminating Engineering Society on Tuesday the subject of glare in relation to artificial illumination was discussed. At the January meeting of the society the subject was discussed from a physiological point of view, but on Tuesday the engineering aspect was dealt with.

MR. A. P. TROTTER (Electrical Adviser to the Board of Trade) expressed the opinion that sources of light within the range of vision should be eliminated, although he admitted that indirect illumination was rather an expensive matter, especially for domestic lighting. It was convenient that the intrinsic brilliancy should not exceed one candle per square inch or thereabouts. The ordinary 16-c.p. metal filament lamp, he said, gave about 4½ c.p. per square inch, which was too bright, and in his own house he could not use such lamps without shades. He thought it was a mistake to measure the intrinsic brilliancy of a lamp by multiplying the length of the filament by its diameter and dividing the candle-power by the number of square inches obtained. He showed a specimen of a globe on the Holophane principle, which he had designed thirty years ago.

MR. J. S. DOW (Assistant Secretary to the Illuminating Engineering Society) read a large number of communications from foreign correspondents, and among these was one from Dr. Karl Stockhausen, of Dresden, in which he recommended the appointment of an International Committee to consider the question of glare from modern illuminants, and to collect evidence and prepare a report upon the subject.

MR. W. R. COOPER said he did not agree that glare depended simply upon intrinsic brilliancy. The question of contrast also came in. The eye had a difficulty in adapting itself to heavy contrasts between the source of light and its immediate surroundings. He regarded the tendency to use metal filament lamps completely unshaded as a great mistake. An example of bad illumination was at the Patent Office Library, where metal filament lamps had originally been placed upon the tables below the edge of the shades. This had, however, been remedied.

MR. W. M. MORDEY said a great deal of consideration had been given to the question of lighting the new building of the Institution of Electrical Engineers, and the Council had come to the conclusion that they must at all costs avoid the terrible whip-lash upon the eye of exposed lighting, viz., lamps without any form of shade. Perhaps by doing this they might give the appearance of having reduced the amount of light, but it would be one much more pleasant to read and work by. He thought makers of electric lamps and fittings might turn their attention to the development of methods of lighting, and applying lamps in a sense which he called comfortable seeing rather than brilliant illumination. It seemed to him that nature did not support the suggestion of Mr. Trotter that all forms of direct lighting should be dispensed with.

MR. HAYDN HARRISON also spoke on the question of contrast as an important factor in the question of glare. He had experience of this in connection with street lighting, and had greatly improved the effect by proper shades. With lights having a dark surface behind them the sensation of glare was very marked.

MR. L. GASTER referred to the recent regulation of the City Police that all lamps outside shops must, in the interests of street traffic, be shaded. He deprecated the tendency, which was very marked in London, of placing unshaded flame arc lamps outside shop windows. The society would be doing good work by taking examples of bad illumination and demonstrating their disadvantages to the people concerned.

MR. MACKINNEY exhibited a globe of the Holophane type constructed by Professor Blondel, in which the prisms were arranged in two distinct sections, one being totally reflecting and the other refracting.

DR. W. ETTLES thought that the first thing the society should do was to come to some unanimity of opinion as to the physiological principles involved before taking up the practical side of the question.

DR. SILVANUS P. THOMPSON, who was in the chair, said the council would take into serious consideration the suggestion of Dr. Stockhausen that an International Committee should be formed to gather information from all parts of the world, and also the suggestion of Dr. Ettles that an effort should be made to come to some general agreement upon the physiological principles.

Illuminating Engineering Society.—Prof. A. G. Vernon-Harcourt, Sir William Preece, K.C.B., F.R.S., and Sir Joseph Swan have been elected honorary members of the Illuminating Engineering Society.

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CORRESPONDENCE

METAL FILAMENT LAMPS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—We are greatly obliged for the notice you gave us on our metal filament lamps on page 87 of the current issue, but we wish to point out a sentence which we consider might lead your readers to think that our high-voltage lamp is not of the highest efficiency.

If you will kindly refer to our letter of the 18th ult. you will see in the latter part that we advocate the use of low-voltage lamps, in preference to high-voltage, as 25- or 50-volt lamps have a better efficiency than high-voltage lamps. This, of course you are aware, applies to lamps of all makes, and not to our lamps in particular. Foster metal filament lamps are made with the utmost care, and most severe tests are enforced before lamps are sent out from the factory. In this way, both high- and low-voltage lamps are as perfect as human ingenuity and modern appliances can make them.

We sincerely trust you will mention the above fact in your next issue, and so dissipate any erroneous impression which may exist concerning Foster metal filament lamps.

Yours faithfully,

THE FOSTER ARC LAMP AND ENGINEERING CO., LTD.

THE INSTITUTION LIBRARY.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Your correspondent "Associate Member" has voiced a subject which of late has exercised the minds of provincial members of the Institution of Electrical Engineers, and, taking into consideration the large amount of money which is being expended in the new building (a sum voted without any provincial member having the opportunity to protest), there is grave cause for complaint amongst those members who are not fortunate enough to live near London. After a struggle some years ago, local sections were granted, and these are only kept going by strenuous efforts on the part of the local officials. To show how little consideration is given to local sections, it is only necessary to turn up the balance sheet of any section. One of them shows a list of members as follows : 28 members, 85 associate members, 30 associates, and 60 students. These members' subscriptions amount to no less than £369 12s. The grant from the parent institution amounted to £54. Out of this princely sum have to be provided clerical service, printing, &c., postage, and refreshments. As the local University grant the use of the room, nothing is charged to this head.

I should like to suggest to the committee that they be a little more liberal with local sections, and that each local section centre should have a room of their own where a reference library, occasionally circulated from London, could be kept, together with useful technical journals. This should not be a difficult matter to arrange, and would be a great boon to all country members. More freedom might also be given to local sections with regard to Papers, and any Paper of peculiar local interest should be given every opportunity to be read and published.

It would be interesting to know what provincial members, as a whole, think of the question of the benefit of the Institute to themselves, for, beyond receiving the journal, a few months after all the contents have been published and commented upon, in the technical Press, and the right to use the title of the Institution, country members have little or no return for their heavy subscription.

"PROVINCIAL."

LOCAL NOTES

ACTON: *Electricity Undertaking.*—For the quarter ending December 31st there was a gross profit of £1,903, and after providing for loans and interest there was a net profit of £679. This is the first time a net profit has been made upon the undertaking.

ARGENTINA: *Electric Traction.*—Messrs. Colson, Brookhouse & Pyne have applied to the Santa Fé municipality for a concession for electric tramways. The Public Works Committee of the Uruguayan Chamber of Deputies will, says the *Review of the River Plate*, report favourably on the project for an electric railway from Colonia to Montevideo. It is anticipated that the scheme, which is promoted by Mr. W. P. Steer, will take four years to complete.

Buenos Ayres: Tax on Telephone Revenue.—The City Council have, says the *Review of the River Plate*, imposed a tax of six per cent. on the gross revenue of telephone companies working in the city.

BISHOP'S STORTFORD: *Electric Lighting.*—A ratepayers' meeting has passed a resolution urging the Council to proceed with the electric lighting order, and to carry out the work themselves.

BURY ST. EDMUNDS: *Hiring Metal Filament Lamps.*—The Council have adopted a suggestion of the Borough Electrical Engineer to hire out metal filament lamps for exterior shop lighting where these are preferred to small arc lamps. A charge of £1 per annum per 300 c.p. lamp, which will include supply, fixing, and maintenance, is to be made, in addition to the usual charge of 6d. per unit for current.

CANADA: *Toronto Electric Tramways.*—H.M. Trade Commissioner at Toronto reports that the Board of Control have submitted to the City Council a recommendation that application be made to the Legislature for power to expropriate the Toronto Street Railway Co., and also authority to construct a further system of service and underground tramways.

CARDIFF: *Electric Lighting Loan.*—The Corporation is taking up a loan of £7,900 from the Croydon Corporation for electrical extensions.

DUBLIN: *Electrical Extensions.*—With reference to the recent application of the Council for a loan of £103,000, the Local Government Board have sanctioned £75,000. In a report, the Electric Lighting Committee state that this amount will fairly cover all immediate requirements, but they disagree with the recommendation of the Local Government Board that in future the amounts which it is proposed to expend upon particular works should be specified. This, they point out, is very difficult in connection with sundry mains extensions, and they are communicating with the Local Government Board on the matter.

Hire of Motors.—Owing to the general reduction in the price of motors, the Committee have entered into negotiations with the General Electric Company with regard to the scale of prices fixed in the hire purchase contract, which still has 12 months to run. The company have agreed to a revised list of rates, which give very substantial all-round reductions in the list. It has also been arranged with the company to extend the agreement to cover the hire purchase of electric ovens, radiators, and other domestic appliances. This class of apparatus is to be loaned on one month's trial.

DUNDEE: *New Electricity Works.*—Professor J. A. Ewing, F.R.S., has consented to open the new Carolina Port generating station of the Corporation on Wednesday, February 23rd, Professor Ewing is a native of Dundee.

Electric Driving.—Two more works were changed over last week to electric driving—those of the Sycamore Saw Mills, and the Pearl Steam Laundry Co., Ltd. The latter is now completely driven and lit by electricity, the old boiler still being retained for heating purposes.

HALESOWEN: *Light Railway Order.*—An inquiry was held by the Light Railway Commissioners last week into an application by the Halesowen Light Railway Co. for various extensions of their powers in Birmingham, Smethwick, Oldbury, Rowley Regis, and Lye. The company obtained its original powers in 1901 and 1902. There was considerable opposition to the proposed extensions, and the inquiry was adjourned.

HANWELL: *Electric Supply.*—The Metropolitan Electric Supply Co. have written that the company confidently anticipates that the electric lighting arrangements will be completed by the agreed time, viz., June next.

HONDURAS: *Electric Lighting.*—A twenty-year concession has been granted to the Puerto Cortez & Baracoa Electric Company, for supplying electrical energy in these districts. The concession includes the construction of telephone and telegraph lines. A similar concession has been granted to San Pedro Sula. The company will operate under the name of "Empress De Luz Eléctrica de San Pedro-Sula."

INDIA: *Lucknow: Electric Lighting.*—The *Times* of India states that the invitation of the Council for tenders for a scheme of electric supply have failed in the absence of a thorough survey of the district. The Council have now arranged for an expert to prepare a scheme, and a poll of the residents will be taken in order to ascertain whether the Council shall undertake the management of the undertaking, or hand over the concession to a company.

ISLE OF WIGHT: *Electrification of Railways.*—The conference of local authorities regarding a scheme for converting the Isle of Wight railways to electric traction, or, alternatively, the construction of electric tramways, has now been concluded. The railway companies expressed the opinion that the advantages of electric traction have not been demonstrated sufficiently to warrant its adoption. The representatives of the local authorities are therefore unable to recommend any definite course of action.

JAPAN: *Electric Railway.*—An electric railway between Shinagawa and Akabane, a distance of 20 miles, has been completed. The line is the property of the Tokyo Electric Railway Co.

LIVERPOOL: *Cathedral Lighting.*—Liverpool Cathedral is being wired for electric lighting by Messrs. John Hunter & Co., on the British Insulated & Helsby Cables, Ltd., lead-covered system.

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LONDON: *London County Council: Tramway Conciliation Board.*—Mr. H. M. Hooke, of the Clerks' Department of the Council, and Mr. H. F. Auger, of the Tramways Department, have been appointed Council's and employees' representatives respectively upon the Tramway Conciliation Board.

Marylebone: Electric Cooking.—Several cooking equipments have been installed by consumers, and, as it was found that instruction was necessary in order that the consumers' cooks shall handle the apparatus as efficiently as possible and with the least waste of current, a lady instructress has been engaged to give instruction to the cooks or consumers at 5s. per demonstration.

Westminster: Street Lighting.—In reference to the experimental installation of improved gas lighting in Victoria Street, the Westminster Electric Supply Corporation are to be allowed to put in a competitive installation for electric light. This will consist of twelve metallic filament lamps erected at the west end of Victoria Street, and four flame arc lamps erected at the east end of the street, the whole cost being borne by the Supply Co. The St. James's & Pall Mall Electric Light Co., Ltd., are to be allowed to erect an experimental installation of flame arc lamps in Sackville Street, which is now lighted by incandescent gas lamps, subject to their bearing the whole cost of the installation.

PERTH: *Tramways Undertaking.*—Further details from Mr. Peter Fisher's report upon the local tramway system have been published. He comes to the conclusion that the tramways are being overcharged for electrical energy to the advantage of the lighting consumers. He also directs attention to the question of Sunday trams, which would, he says, modify his remarks as to the department being overstaffed. In the event of Sunday cars being run, all the present staff will be required.

TAVISTOCK: *Electric Lighting.*—A resolution that Messrs. Drake & Gorham, Ltd., should advise the Council upon a scheme of electric lighting was lost at the last meeting of the Council after some discussion.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BRIDLINGTON.—Extensions at an estimated cost of £2,699 are contemplated.

CARLISLE.—Application is to be made for a loan of £14,000 for electrical extensions.

Tenders are invited for two 500-kw. steam-driven generating sets with ejector condensers. Particulars from the City Electrical Engineer, and tenders by March 1st.

CORNWALL.—The Consolidated Mines, Ltd., St. Ives, propose to install additional generating plant.

DUNDEE.—It has been decided to apply for borrowing powers to the extent of £60,000 in connection with the electrical undertaking.

GILLINGHAM.—Tenders are invited for the supply of cables, house-service cut-outs, joint boxes, metal filament lamps, meters, &c. Particulars from the Borough Electrical Engineer, and tenders by February 28th.

NUNEATON.—Application is to be made for a loan of £2,105 for extensions to cables, &c.

WATFORD.—Tenders are invited for a year's supply of H.-T. and L.-T. paper-insulated cables. Particulars from the Borough Electrical Engineer, and tenders by March 1st.

Miscellaneous

BIRMINGHAM.—The Birmingham Tame & Rea District Drainage Board require electrical accessories for the year to March 31st, 1911. Particulars from Mr. J. D. Watson, Drainage Board Offices, Tyburn, near Birmingham, and tenders by March 8th.

BRAZIL.—The Ministry of Justice and Home Office Affairs is authorised to expend the sum of £25,000 upon electric lighting, &c., for the new police building in the Federal District.

BRISTOL.—The Electrical Committee require (*a*) yellow flame and white open type arc lamp carbons; (*b*) A.-C. house-service meters; (*c*) arc lamp globes; (*d*) joint, junction, and fuse-boxes. Particulars from Mr. H. Faraday Proctor. (See an advertisement on another page.)

DUBLIN.—The Corporation require arc lamp carbons. Particulars from the Town Clerk's Office. (Seen an advertisement on another page.)

SERVIA.—A Belgian Consular report states that there is an increasing demand in Servia for electrical apparatus.

SWINDON.—Tenders are invited for the supply of electrical and tramway stores and accessories. Particulars from the Tramways Manager, and tenders by February 26th.

TURKEY.—The Ministry of Public Works invites tenders by February 28th for the construction and working of an electric tramway in Niaousta.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

London County Council.—Tenders are invited for the wiring and fitting of the Barnsbury Park (Barnsbury), Lauriston Road (South Hackney), Manor Lane (Lee), and the Reay (Brixton) Elementary Schools. Particulars from the Chief Engineer to the Council, and tenders by February 23rd.

W.—Trade school for girls at Hammersmith School of Arts and Crafts, W. (£1,084). Builders, G. Munday & Sons, Muscovy House, Trinity Square, E.C.

E.—Coroner's Court, Poplar (£3,000). Builder, Gathercole Bros., Norbury, S.E.

S.W.—Electric Theatre, Garratt Lane, Earlsfield. Architects, Emden, Egan & Co., 2 Lancaster Place, W.C.

PROVINCES.

BOOTLE.—Tenders are invited for an electric light installation at the new girls' secondary schools. Particulars from the Borough Electrical Engineer, and tenders by March 1st.

CHATHAM.—Proposed school for girls (200 places). Architect, Education Committee, Kent County Council.

CROYDON.—Electric theatre, Portland Road. Builder, J. Watt, The Lodge, Bromley Road, S.E.

Proposed new handicraft centre (£950). J. Smyth, Sec., Croydon Education Committee.

DARTFORD.—School (£8,500). W. H. Robinson, architect to Kent Education Committee.

HULL.—Theatre. Architects, Freeman, Son & Gaskell, Hull.

LANCASTER.—Extension, County Asylum. Architect, H. Aspinall, 36 Dale Street, Liverpool.

MANCHESTER.—Tenders are invited for the wiring, &c., of the Exhibition Buildings, Old Hall Lane, Rusholme, Manchester. Particulars from Mr. W. Davenport, Ridler Place, Holland Street, Blackfriars, London, and tenders by February 28th.

NORTHAMPTON.—Church (£4,000). Trustees, Abington Avenue, Congregational Church, Northampton.

NORTHFLEET.—Additions to school (£3,699). Builders, G. Baker & Son, 133A High Street, Strood.

ST. ALBANS.—Isolation Hospital, Folly Mead (£3,320). Surveyor, St. Albans Rural District Council.

STOCKPORT.—Premises, Reddish Road. Stockport Co-operative Society.

TENDERS RECEIVED AND ACCEPTED

AUSTRALIA.—The Melbourne City Council have accepted the tender of the Sloan Electrical Co., Ltd., for the supply of 40,500 flame arc lamp carbons at £1,946.

BRIDLINGTON.—The Corporation have placed an order for a 350-kw. Willans-Impulse "disc and drum" type turbine with Messrs. Willans & Robinson, Ltd.

CLACTON.—The Council have accepted the tender of the Electrical Apparatus Co. for the supply of ordinary and prepayment meters.

EAST HAM.—The Council have accepted the tender of Messrs. Dick, Kerr & Co., for a balancing machine at £320.

INDIA.—The Calcutta Electric Supply Co., Ltd., have, on the recommendation of their consulting engineers, Messrs. Kennedy & Jenkin, placed an order for a 1,000-kw. Willans-Impulse "disc and drum" type turbine with Messrs. Willans & Robinson, Ltd.

LONDON: *London County Council.*—The tender of Messrs. Bolckow, Vaughan & Co., Ltd., has been accepted for the supply of track rails and fastenings at £21,065.

The tender of Messrs. P. & W. Maclellan, Ltd., has been accepted for the supply of slot rails and conductor tees at £12,386 5s.

An offer by Messrs. Hurst, Nelson & Co., Ltd., at £3,550 for ten double-deck car bodies has been accepted. Another offer by the same firm at £1,137 10s. for ten sets of four-wheeled swing bolster trucks has also been accepted.

An offer by the British Westinghouse Co. at £3,322 10s. for electrical equipments for ten cars, and another offer at £570 for ten sets of magnetic-brake equipment have been accepted.

An offer of Messrs. Hadfield's Steel Foundry & Co., Ltd., at £14,432 10s., for special track work has been accepted.

An existing contract with Messrs. Spagnoletti, Ltd., for low- and high-tension switchgear at the Elephant and Castle substation has been extended to include an additional switch at £120.

The following tenders have been received for the supply of test-room instruments for the second section of the Central Car

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Repair Depôt :—Messrs. Everett, Edgcumbe & Co., Ltd., £108 (accepted); India Rubber, Gutta Percha Telegraph Works Co., Ltd., £111; Messrs. Evershed & Vignoles, Ltd., £116; Messrs. Nalder Bros. & Thompson, Ltd., £119 9s.

Bermondsey.—The Council received the following tenders for feeder panels :—British Thomson-Houston Co., Ltd., £70 7s. 6d.; Crompton & Co., Ltd., £105 5s.; General Electric Co., Ltd., £68 17s. 6d.; Siemens Bros. (accepted), £91.

Hampstead.—The Council has accepted the tender of Messrs. Pryke & Palmer for the annual supply of engineer's stores for the electric lighting station.

LOWESTOFT.—The Tramways Committee have accepted the tender of the National Tramway Appliance Co. for apparatus to be fitted to tramcars for removing rail corrugations at £25 a set.

METROPOLITAN RAILWAY CO.—The tender of the General Electric Co., Ltd., has been accepted for the annual supply of Osram lamps for the current year to the Metropolitan Railway Co.

APPOINTMENTS AND PERSONAL NOTES

Mr. G. A. Sekon, the editor of the "Railway Magazine," has severed his connection with that journal.

Mr. H. Clifford Palmer has rejoined the General Electric Co., and will take over the management of the publication department.

Mr. Patrick Hendry has been appointed Assistant Lecturer and Demonstrator in the Engineering Electro-Technics Department of the Transvaal University College, Johannesburg.

Mr. C. Hobson has been appointed junior charge engineer at Woolwich at a salary of £100 a year, rising to £140.

NEW PUBLICATIONS

"Proceedings of Rugby Engineering Society : Season 1908-9." (Rugby : The Society.)

"Fortschritte der Elektrotechnik." Vol. I. 1909. (Berlin : Julius Springer.)

Spons' Architects' and Builders' Pocket Price Book, 1910. (London : E. & F. N. Spon.) 3s.

"Direct and Alternating Current Testing." By F. Bedell and C. A. Pierce. (London : Constable & Co.) 8s.

The Deinhardt-Schlomann Series of Technical Dictionaries in Six Languages. Vol. VI. : Railway Rolling Stock. Compiled by A. Boshart. (London : Constable & Co.) 10s. 6d.

Exposition Franco-Britannique de Londres, 1908. Section Française, Group IV. (Mecanique Générale). Report by M. Ch. Michel. (Paris : Comité Français des Expositions à L'Etranger.)

Wireless Telephones, by J. Erskine-Murray. (London : Crosby, Lockwood & Co.) 1s. 6d.

"Les Oscillations Electriques : Principes de la Telegraphic Sans Fil. By C. Tissot. (Paris : Doin & Fils.) 5 francs.

"Matriculation, Magnetism, and Electricity." By R. H. Jude and John Satterley. (London : University Tutorial Press.) 4s. 6d.

"Hazell's Annual" Guide to the New House of Commons. (London : Hazell, Watson & Viney.) 6d.

"The Indicator Handbook." By C. N. Pickworth. Part II. : The Indicator Diagram : its Analysis and Circulation. Fourth edition. (Manchester : Emmott & Co., Ltd.) 3s.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday :—*Member :* R. S. Kelsch. *Associate Members :* P. F. Allan, J. W. Barber, E. A. Behrens, C. W. Bentley, A. C. Borthwick, G. F. Boxall, L. H. Combe, H. Denehy, F. W. Foster, P. S. Glover, F. Hallows, A. I. Hodgson, J. F. Luscombe, W. D. McLaren, D. M. Macleod, C. G. M. New, L. W. Schuster, W. S. Sholl, J. W. Sims, A. S. M. Sörensen, P. L. Weston. *Associates :* T. T. Baker, S. Rudd, W. B. Smith. *Students :* M. F. Allsop, J. P. Annacker, G. H. D. Ascoli, W. E. Barker, L. E. Barnard, A. S. M. Best, J. M. Bloomfield, C. P. Bowmaker, E. A. Boyd, C. C. H. Brazier, C. A. Brearley, R. B. Breeze, R. H. P. Broome, C. L. Bullock, E. W. N. Burden, H. G. Byng, H. Carey-Thomas, L. W. Chambers, W. J. Chambers, T. A. Collett, R. E. Connold, L. W. Cooper, W. E. Cornille, P. R. Coursey, H. H. U. Cross, W. B. Cushion, D. B. Da Cunha, A. T. P. Davies, G. F. Davies, M. De Angelis, H. De Coundouroff, L. B. Dent, R. W. Dudley, H. M. Dunkerley, R. C. Dunn, C. T. Eaddy, H. J. Eley, J. W. Elliott, E. L. M. Emtage, A. W. Epton, R. A. Everitt, A. M. Faulkner, H. H. Foster, J. A. Garbarino, A. H. Gay, D. Gill, H. Green, H. Greenwood, G. B. Hay, P. V. Henk, J. E. Hogarth, G. Holdsworth, C. L. Huang, R. N. James, V. G. Kirloskar, F. R. L'Estrange, W. H. Lovell, R. W. Macklin, M. Marshall, J. B. Miller, T. D. Morison, D. E. Nicolle, K. Northover, E. Orloff, J. D. Peattie, N. J. Perryman, D. A. J. Petruse, F. C. L. Racker, S. M. Rawson, S. W. Redclift, A. Riddle, L. Roberts, W. E. Russell, J. A. Rutherford, P. G. Ryder, C. S. Salvesen, C. W. Saunders, G. J. Scott, V. D. G. Serodio, S. V. Setti, E. W. Sleight, B. Snowball, V. Soper, W. G. Spencer, S. E. W. Taylor, J. M. Thornton, F. Troutet, C. C. Villa, J. G. L. Welch, A. Willmore, E. H. E. Woodward, R. P. Yates.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £61 10s. to £62 5s. per ton (last week, £61 15s. to £62 5s.).

LIQUIDATIONS, BANKRUPTCIES, WINDINGS UP, &c.—Notice is given of an intended dividend in the bankruptcy of Robert Foster, and Walter Baker, trading as the Nelson Electrical Co., Stott Street, Nelson. The trustee is Mr. C. H. Plant, Official Receiver, 13 Winckley Street, Preston, and the last day for receiving proofs is February 12th.

The Mitcham Electric Fan Co., Ltd., is to be wound up voluntarily for the purpose of the transfer of the business to the Dynamic Syndicate, Ltd.

Mr. Harold Mather, Acresfield, Bolton, has been appointed trustee in the bankruptcy of Messrs. Platt & Bleasdale, electrical engineers, Victoria Square, Bolton.

Meetings of La Capital Tramways Co., Ltd.; La Capital (Extensions) Tramways Co., Ltd.; La Capital Traction & Electric Co., Buenos Ayres; and the Buenos Ayres New Tramways, Ltd., will be held at the offices of the liquidators, Messrs. Lazarus and Thursby, 62 London Wall, London, E.C., on February 22nd, at twelve noon, for the purpose of hearing the liquidators' account of the winding up.

Creditors of the Himalaya Electric Railway, Ltd., are requested to send particulars of their claims to the liquidator, W. W. Turner, 28 Chapel Street, Liverpool, by February 23rd.

A meeting of the Santoni Arc Lamps and Engineering Co., Ltd., will be held at the offices of Messrs. McIntosh, Whyte & Co., 11 Queen Victoria Street, London, E.C., for the purpose of hearing the liquidator's account of the winding up.

J. Platt and R. Bleasdale, electrical engineers, of Bolton, have been adjudicated bankrupt.

The Chipping Norton & District Light & Power Co., Ltd., is to be wound up voluntarily. Mr. C. T. Butcher, 25 Balloch Road, Catford, is liquidator. A meeting of creditors will be held at 1 West Street, Finsbury Circus, London, on February 2nd, at 12 noon.

The public examination of Peter Smith, electrical engineer, 18 Mill Street, Warrington, took place last week. His debts amount to £210, and the bankruptcy is attributed to bad trade.

In the Manchester County Court last week, on the motion of the British Westinghouse Co., a compulsory winding-up order was made against Messrs. E. Russell & Sons, Ltd., electrical engineers and contractors, Cross Street, Manchester.

A first and final dividend of 2s. 3½d. in the £1 will be paid in the bankruptcy of W. T. Harris, electrical engineer, 460 Commercial Road, Portsmouth. Payment will be made by Messrs. Whittaker & Bailey, on February 10th, at 3 Portland Street, Southampton.

A receiving order has been issued against Messrs. Felgate & Storey, electrical engineers, 10 Queen Victoria Street, Reading.

DISSOLUTION OF PARTNERSHIP.—The partnership between U. Horsfall, J. Crowther, and E. O. Coulthard, trading as Willis & Co., electrical and mechanical engineers, 2 Commercial Street, Knott Mill, Manchester, has been dissolved.

B.T.-H. METERS.—It has been brought to the attention of the British Thomson-Houston Co., Ltd., that certain statements are being made to the effect that the B.T.-H. type M.H. Mercury Meter for continuous-current circuits, and types A.C.T. and R.H. for alternating-current circuits, are manufactured abroad. They desire to state that these are manufactured at their works at Rugby, and any report to the contrary is false.

PLANT FOR SALE.—The Leeds Corporation have some modern central station or sub-station switchgear for sale. For particulars see an advertisement on another page.

CANADIAN AGENCIES WANTED.—A Cheshire firm manufacturing electric overhead travelling cranes, electric pulley blocks, electric hoists, electric transporters, and electric runways, desires to appoint Canadian agents.

A firm of architectural metal workers in the English Midlands making electric lighting fittings, &c., wishes to enter into correspondence with prospective agents or buyers in Canada.

Particulars, &c., may be obtained at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Oxford Electric Co., 9 per cent. per annum for the December half-year. Northampton Electric Light & Power Co., 6½ per cent. per annum for the December half-year. Mather & Platt, 10 per cent. per annum, with a bonus of 2 per cent. for 1909.

NATIONAL ELECTRIC CONSTRUCTION CO.—Dr. G. T. Moody has been elected a director in place of Mr. W. H. Fowler, who has resigned.

ROSARIO ELECTRIC CO.—It is announced that the Board have signed an agreement with the Société Financière de Transports et d'Entreprises Industrielles of Brussels, under which the Brussels Co. have an option up to July 1st next of acquiring the company's concession.

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COMPANIES' MEETINGS AND REPORTS

ANGLO-AMERICAN TELEGRAPH CO., LTD.—The report for the December half-year shows a net profit of £150,644, after setting aside £10,000 to the renewal fund.

At the meeting last week the report and accounts were adopted.

LANARKSHIRE TRAMWAYS CO.—The report for the half-year shows a balance of £19,426. The sum of £8,500 has been placed to reserve for depreciation, and a dividend of 5½ per cent. per annum for the half-year is recommended, carrying forward £1,328.

At the meeting on Thursday the report and accounts were adopted.

GIANT'S CAUSEWAY & PORTRUSH ELECTRIC TRAMWAYS CO.—At the annual meeting on Friday the report and accounts were adopted. The profit for 1908 amounted to £1,485, and, after meeting debenture and mortgage interest, a balance of £389 is carried forward.

CITY & SOUTH LONDON RAILWAY CO.—At the meeting last week, the report and accounts given in our issue for January 27th were adopted. Mr. C. B. Stuart Wortley, chairman of the company, who presided, said that their reduced fares had been amply justified by results, for whilst the receipts per train-mile had increased, the expenditure had decreased owing to the trains being far better filled. The number of passengers during the past half-year was the largest in the history of the company.

METROPOLITAN DISTRICT RAILWAY CO.—The report for the December half-year shows a net revenue of £25,942 after providing for interest and other charges, and setting aside £10,000 as reserve for renewals. The full dividend is recommended on the 4 per cent. guaranteed stock. The gross receipts increased by £17,737, and the working expenses decreased by £1,195. Arrears of dividend on the guaranteed stock now amounts to £246,754, and this is to be dealt with under a capitalisation scheme.

Sir George Gibb presided at the meeting on Wednesday last week, when the report and accounts were adopted. The chairman dealt at length with the scheme for capitalising the arrears of dividends on the 4 per cent. guaranteed stock, details of which were given in our columns some time ago. Dealing with the working expenses, he stated that the figures for January showed a decrease in the works costs at the Lot's Road power-house of no less than 27 per cent., and he believed that the efficiency of working there compared very favourably with any large power-house in the world. The present position was such that there was every indication of the full dividend on the 4 per cent. guaranteed stock being maintained in the future.

PROVINCIAL TRAMWAYS CO.—Extraordinary general meetings were held on Friday sanctioning the reduction of the company's capital from £400,000 to £275,440.

BRITISH ALUMINIUM CO., LTD.—The necessary meetings of the various classes of shareholders were held on Friday, when the scheme of reconstruction outlined in our last issue was agreed to.

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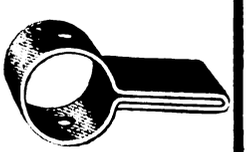
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The TUDOR ACCUMULATOR Co., Ltd.,
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CENTRAL ELECTRIC SUPPLY CO.—There is a net profit of £5,036 for the year 1909, and, after paying 5 per cent. on the ordinary shares, the sum of £36 was carried forward. The output during the year was 17,282,370 units. The extensions at Grove Road Works have now been completed, making the total capacity 12,830 kw.

REES ROTURBO MANUFACTURING CO.—The net profit for the 11 months to October 31st, 1909, was £8,111. After meeting the 5 per cent. preference dividends, £2,000 have been placed to depreciation, and £2,978 carried forward.

DUBLIN UNITED TRAMWAYS CO.—The net revenue for the December half-year amounted to £58,167. Dividends at the rate of 6 per cent. per annum on both preference and ordinary shares are recommended, and £15,000 are set aside towards renewal of permanent way. The sum of £9,267 is carried forward. At the meeting last week the report and accounts were adopted. A feature of the accounts is the sum of £8,150 repaid to the company in respect of income tax overpaid during the past six years.

THE CITY OF BUENOS AIRES TRAMWAYS CO. (1904).—The net revenue for 1909 was £69,842, and after meeting a dividend of 5s. per share on the ordinary shares, and transferring £3.700 to amortisation fund, the sum of £142 is carried forward.

BLACKPOOL & FLEETWOOD TRAMROAD CO.—The report for the December half-year shows a balance of £11,577, after meeting debenture interest. The directors recommend a dividend of 9 per cent. per annum on the ordinary shares, carrying forward £2,577.

DUBLIN & LUCAN ELECTRIC RAILWAY CO.—The report for the December half-year shows an available balance of £1,240, and after meeting the 5 per cent. preference dividends a balance of £415 is carried forward.

BRISTOL TRAMWAYS & CARRIAGE CO.—The gross revenue for 1909 was £285,564, and the working expenses £199,371. After meeting mortgage interest, preference dividends, and a 6 per cent. dividend on the ordinary shares, the balance is transferred towards reconstruction of permanent way. The number of passengers carried during the year shows a decrease of 812,651 compared with 1908.

BAKER STREET & WATERLOO RAILWAY CO.—The revenue for the December half-year amounted to £88,578, an increase of £2,222, whilst the working expenses have decreased by £2,019. After providing for interest, rents, and preference dividends, a dividend of 3 per cent. per annum is recommended on the ordinary shares, except those held by the Underground Electric Railways Co. of London, upon which the dividend is 1½ per cent.

GREAT NORTHERN, PICCADILLY & BROMPTON RAILWAY CO.—The receipts during the December half-year were £152,341, an increase of £9,106, whilst the working expenses decreased by £2,326. After meeting preference dividend and setting aside £3,000 for contingencies, a dividend of 1¼ per cent. per annum is recommended on the ordinary shares, carrying forward £6,024.

CHARING CROSS, EUSTON & HAMPSTEAD RAILWAY CO.—The receipts for the December half-year were £105,138, an increase of £11,072, whilst the working expenses increased by £1,046. A dividend of ¾ per cent. per annum is recommended on the ordinary shares.

NEW COMPANIES

G. H. SCHOLES & CO., 27 Blantyre Street, Chester Road, Manchester. Capital, £8,000 in £1 shares (5,000 preference shares). To acquire the business of electrical and mechanical engineers carried on by G. H. Scholes.

G. PEARSON & SONS, 154 Abbot Road, Poplar, London, N. Capital, £2,000. Makers of electrical accumulators, &c.

REID BROS., ENGINEERS, 12 Wharf Road, City Road, London, N. Capital, £30,000. To acquire the business of electrical, telegraph, and telephone engineers now carried on by J. Reid & E. J. Reid.

BRADFORD ELECTRICAL CO., 56 Manningham Lane, Bradford. Capital, £1,000. Electrical engineers, &c.

EBRO LIGHT & POWER CONSTRUCTION CO.—Registered by Messrs. Slaughter & May, 18 Austin Friars, London, E.C. Capital, £100,000. To carry on the business of electrical engineers, promoters of and workers of tramways, railways, electric, hydraulic, and other works, &c., and to adopt an agreement with A. Parrish.

STAR ELECTRIC LIGHT CO.—6 St. Swithin's Lane, London, E.C. Capital, £1,000. To acquire business of electrical enginers and contractors, carried on by Star Electric Light Co.

TRACKLESS TROLLEY.—15-16 Cockspur Street, London. Capital £100. To acquire inventions relating to trackless trolley systems, whether Stoll's System or otherwise, and to equip trackless trolleys, tramways, light railways, omnibuses, and other vehicles. The subscribers are G. F. Underwood and C. P. Wenzel, of 14 and 15 Cockspur Street, London.

VERA CRUZ TELEPHONE CONSTRUCTION SYNDICATE.—Registered by Linklater & Co., 2 Bond Court, London, E.C. Capital, £10,000. Telephone, telegraph, and electrical engineers, and to adopt agreements with Messrs. W. T. Henley's Telegraph Works, Co., Ltd., J. Sitzenstatter and R. B. Bumeller.

ELECTRIC TIMEKEEPERS.—Registered by Messrs. Christopher & Son, 5 Argyle Street Place, London. Capital £1,000 (£300 twenty per cent. cumulative preference shares). To take over certain inventions relating to electric clocks, &c., and to adopt an agreement with C. Haunz.

"FLOAT" ELECTRIC CO.—Registered by Mayo, Elder & Co., 10 Drapers Gardens, London, E.C. Capital £10,000. Electrical engineers and manufacturers.

UNDERHILL & RITCHIE, 79 Bath Street, Glasgow. Capital £5,000. To acquire business of electrical and general engineers, now carried on.

RURAL ELECTRICITY SUPPLY CO., 11 Victoria Street, London. Capital £10,000 (10,000 deferred shares 1s. each). Electrical engineers, suppliers of electricity, &c. Subscribers:—B. P. Gibbons, Dingley, Tilehurst, Berks, company director; G. B. Crockatt, The Knoll, Kidmore Road, Caversham, electrical engineer; H. T. Harrison, 11 Victoria Street, S.W., engineer; S. I. Pettit, Hurley, West Tarring, Sussex, engineer; J. D. Dymond, 16 Davies Street, W., engineer; E. S. New, 11 Victoria Street, S.W., engineer; H. Dixon, 11 Victoria Street, S.W., secretary.

TRAFFIC INDICATORS, 385 City Road, London. Capital £5,000. Electrical engineers, manufacturers of indicating instruments.

ELLIS & WARD, Edmund Street, Birmingham. Capital £10,000. Electrical engineers and contractors.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[*Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."*]

ROENTGEN RAY APPARATUS.—A very complete new catalogue of Roentgen-ray electro-therapic apparatus has just been issued by Messrs. W. Watson & Sons, Ltd. (313 High Holborn), together with a booklet entitled "Hints on the Use of X-ray Apparatus." A full description of Messrs. Watson's special design of intensified induction coil is included, together with various forms of their "moto-magnetic" mercury jet and other interruptors. Complete outfits are listed of high-frequency, as well as Roentgen-ray apparatus, together with many useful accessories and electro-medical apparatus generally.

ELECTRICALLY-DRIVEN PRINTING MACHINERY.—A well-illustrated handbook, entitled "Electric Control of Printing Machinery," has just been published at the price of one shilling by the Adams Manufacturing Co., Ltd. (106 New Bond Street, London, W.). This is of the nature of a technical treatise on the subject, with special reference to the "Igranic" switchgear manufactured by this firm. Photographs of a large number of important installations and of the automatic and other switchgear employed are included in the handbook. A push-button system for the control of large rotary presses is also described and illustrated.

ROLLER BEARINGS.—The Empire Roller-Bearings Co., Ltd. (15 Victoria Street, Westminster, S.W.) have issued a new leaflet giving particulars and prices of two standard patterns of roller bearings for trucks and wagons. One pattern is suitable for works trucks, mine tubs, and wagons for heavy duty. The other is adapted to railway trollies and inspection cars or trucks which have to be dismounted quickly from their axles; in this pattern the cages and rollers are made self-contained for convenience in dismounting.

SMALL MOTORS.—Two new leaflets from the Edison & Swan United Electric Light Co. deal with electric motors. In one of these small motors from 1/50 to 1/7 h.p. for both continuous and alternating current are described, the latter including both single-phase commutator type and single- and three-phase induction motors. The other leaflet deals with continuous-current motors from ½ to 20 h.p., made under the Zone patents, with specially arranged field distribution giving exceptionally good commutation. These are listed in the open protected, enclosed ventilated, and totally enclosed patterns.

MOTORS, SWITCHGEAR, AND ACCESSORIES.—A new abridged price list of installation materials for electric light and power has been issued by the A.E.G. Electric Co., Ltd. (121 Charing Cross Road, London, W.C.). This is a book of about 150 pages, giving a *résumé* of all this company's electrical apparatus and fittings, with lists of sizes and prices. The first 30 pages are devoted to photographs of electrical installations put down by the company, turbo-generators, large machines, transformers, and special applications of electric power. This is followed by abridged lists of all the company's specialities, including motors of all types, fans, wiring fittings, switchgear, instruments and meters, arc lamps, metal filament lamps, special carbon filament lamps, &c. An index is provided.

ELECTRIC TYRE PUMP.—We have received a leaflet from Messrs. E. E. Coy (77 St. John's Road, Bootle) describing a self-contained set consisting of a small motor driving an air-pump through gearing for use in garages for inflating motor-car tyres.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Feb. 10th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

15,605/09. **Enclosed Flame Arc Lamp.** SIEMENS-SCHUCKERTWERKE-GES. A metallic receptacle comprising an inner cylinder and an outer annular chamber communicating with the cylinder at top and bottom is placed above the lamp globe, and a transparent cylinder enclosing the arc projects up into the inner cylinder. The fumes from the arc are sucked up into the latter, and a circulation is kept up in the receptacle so that the particles of chemical material are deposited on the cool inner surface of the annular chamber. Five claims, one figure.

19,393/09. **Radial Commutators.** F. W. LE TALL (*Westinghouse Electric & Manufacturing Co., U.S.A.*). To prevent overheating at the working surfaces of radial commutators, sets of bars are assembled radially round a ribbed sleeve on the shaft so that passages are left between the several sets and the shaft. The like bars of the several sets are connected by thin lugs so as to leave spaces for the air to pass up radially from the shaft along the working faces. A forced circulation is obtained due to the centrifugal effect. One claim, four figures.

19,466/09. **Arc Furnace for Treating Gases.** SALPETERSÄURE INDUSTRIE-GES. Between the main electrodes are two auxiliary electrodes, connected by a resistance. Each of the auxiliary electrodes forms with its adjacent main electrode an arc expanding device of the horn pattern. Should the main arc be blown out, two arcs are formed at the two horn devices, and expand out until they meet and thus restrike, the main arc. One claim, two figures.

20,246/09. **Motor Control.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) In order to reverse two or four motors of a traction equipment when they are working in parallel for the purpose of exerting a braking effect, the fields of the motors are short-circuited, and the connections between each field and its armature are reversed. Four claims, two figures.

Opposition to Grant of Patents

17,349/08. **Wireless Telegraphy.** E. VON LEPEL. Opposition has been entered to the grant of this patent. The specification, abstracted in ELECTRICAL ENGINEERING, December 23rd, page 1086, describes the discharger used in the Lepel system of wireless telegraphy, in which the metal discs are separated by a thin piece of paper.

6,424/09. **Wireless Telegraphy.** W. P. THOMPSON (*Ges. für Drahtlose Telegraphie*). Opposition has been entered to the grant of this patent, which covers apparatus for producing slightly damped oscillations by the Wien "shock excitation" method. The spark-gap comprises two parallel metal plates with a ring of insulating material between them to enclose the sparking area.

8,146/09. **Metal Filaments.** R. HOPFELT. The grant of this patent is opposed. It covers a process for removing hydrocarbons by sintering the filaments in an atmosphere of a halogen compound such as phosphorus tri-chloride.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Manufacture of electrodes] 2,027/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: TANNER and CLAREMONT [Cables and distribution system] 27,859/08; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Insulating material] 2,127/09; BURTON [Insulators] 25,259/09.

Dynamos, Motors, and Transformers: ALLGEMEINE ELEKTRICITÄTS-GES. [A.-C. commutator machines] 1,705/09; MAVOR and MAVOR & COULSON, LTD. [Control of speed of A.-C. motors] 12,917/09.

Electric Ignition: HOPPS [Engine ignition] 5,210/09; ISAACSON [Magneto apparatus] 23,177/09; R. BOSCH [Brush-holders for distributors] 27,103/09.

Electrometallurgy and Electrochemistry: SOC. FRANÇAISE ELECTROLYTIQUE [Extraction of copper from ores and alloys] 4,574/09; FULLER [Dry batteries] 17,824/09.

Heating and Cooking: BERRY [Heating apparatus] 4,672/09.

Storage Batteries: TATE [Bifunctional plates] 7,097/09.

Switchgear, Fuses, and Fittings: READ [Motor Starters] 2,383/09; JOHNSTONE [Plug fuses and fuse-boxes] 2,779/09; BRITISH THOMSON-HOUSTON CO. and WEDMORE [Protective devices for H.T. systems] 3,192/09; JOEL [Portable lamps] 9,693/09; SIEMENS BROS. & CO. and FERREIRA [Mercury switch for railway signalling] 15,854/09; HOWE and TAYLOR [Switches] 22,385/09.

Telephony and Telegraphy: SIMPSON [Wireless telegraphy] 27,746/08; MONASCH [Production of phase-displaced oscillations] 9,427/09; PICKFORD [Telephone transmitters] 14,209/09; FOSS [Sound intensifier for telephones] 17,137/09; KINGSBURY (*Western Electric Co., U.S.A.*) [Telephone selector switch] 20,841/09; MOLONEY and ROSS [Telephone transmitters] 25,028/09.

Traction: FRASER, and TUDOR ACCUMULATOR CO. [Train-lighting system] 1,820/09; MARDON and HUDSON [Signalling] 2,382/09; BROCK [Rail joint] 9,996/09.

Miscellaneous: ELECTROMOTORS, LTD., and HAMILTON [Machine tools] 1,575/09; TRENTMANN [Electrically lighted life-buoys] 19,424/09; ALLGEMEINE ELEKTRICITÄTS GES. [Centrifugal pumps] 21,763/09; SIEMENS & HALSKE AKT.-GES. [Fire alarm systems] 24,185/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: JACKSON and SCHEIBE [Control of mercury vapour rectifiers] 1,482/10; SCHEIBE [Control of mercury vapour rectifiers] 1,483/10.

Distributing Systems, &c.: SATTLER [Cable-making machinery] 1,290/10.

Dynamos, &c.: AKT.-GES. BROWN BOVERI ET CIE [Machines for starting purposes] 20,827/09.

Electric Ignition: ELEKTRISKA AKTIEBOLAGET A.E.G. [Control system for submarine mines] 1,206/10.

Telephony, &c.: STEINACKER and PLISINER [Heavy current microphone] 13,922/09; FESSENDEN [Wireless telegraphy] 187/10.

Miscellaneous: FELTEN & GUILLEAUME LAHMEYERWERKE AKT.-GES. [Transporting mechanism] 25,590/09; DELON [Apparatus for generating direct current at high pressure] 847/10.

Application for Restoration of Lapsed Patent

17,879/04. **Terminals.** J. SCHADE. The Fahnestock Electric Co. have applied for the restoration of this patent, which expired in 1907, owing to non-payment of renewal fees. It covers a spring-clip terminal, comprising a slotted strip of metal folded over so that the wire is gripped between the upper end and a hooked projection from the lower end.

Amendment Allowed.

12,739/02. **Lamp Cap.** A. SWAN (General Electric Co., U.S.A.) Leave has been granted to amend further this specification, which describes a lamp cap with a glass button uniting the contacts and interlocked with the shell. See ELECTRICAL ENGINEERING, December 30th, 1909, Vol. V., p. 1,104.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Lamp with electrodes of magnesia and magnetite] 21,931/05.

Distribution Systems, &c.: T. L. BOYDEN [Pressure regulation] 23,110/03; W. M. MORDEY and G. C. FRICKER [House service box] 21,850/05.

Dynamos, &c.: F. J. and R. CHAPLIN [Wire brushes] 22,966/04; E. BOLTON [A.C. motor with automatic rotor resistance control] 21,583/05; H. H. LAKE (*International Holding Co., U.S.A.*) [Electro-magnetic drive] 21,652/05; A. VEDRINE and R. DE QUELEN [Field system] 21,658/05; S. VON AMMON [Homo-polar machines] 21,947-7A/05.

Electric Ignition: J. S. FOLEY [Sparking-plug] 23,323/02; H. C. HOLDEN [Commutator] 21,480/05; S. J. WILLIAMS [Interrupter] 21,521/05.

Electrometallurgy, &c.: P. GARUTI and R. POMPILI [Electrolytic production of oxygen and hydrogen] 23,663/96; H. KOLLER and P. ASKENASY [Electrolytic apparatus] 23,151/03.

Incandescent Lamps: C. L. MENGES [Filaments of non-conducting oxides and carbon or refractory metals] 10,815/99.

Instruments, &c.: J. ROUTIN and C. E. L. BROWN [Meter] 24,833/97; F. H. MERRITT [Repayment meter] 21,683/05; V. ARCIONI [Meter] 21,855/05.

Storage Batteries: J. BIJUR [Planté plates] 23,120/03; O. IMRAY (*C. Potter, U.S.A.*) [Casting plates] 23,490/03.

Switchgear, &c.: C. H. OFFORD [Time-switches] 21,253/01; ELECTRIC & ORDNANCE ACCESSORIES CO. and R. F. HALL [Switch contacts] 21,485/05; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Silicon resistances] 21,753/05; A. A. LINES [Terminal] 21,870/05.

Telephony, &c.: C. M. JACOBS and A. H. NICHOLSON [Relays for selective signalling] 23,255/02; J. D. ANDREWS [Selective signalling] 21,565/05.

Traction: L. T. ALLEN and R. E. SHARPLES [Trolley wire hanger] 23,032/04; A. E. HACKING and J. PYCROFT [Operating points and switches] 23,135/04; A. VEDRINE and R. DE QUELEN [Control of electric vehicles] 21,659/05; E. A. HEATH [Side-conduit points and switches] 21,821/05; E. TYER [Signalling] 21,927/05.

Miscellaneous: A. PRODAM and A. KERETZ [Discharging torpedoes] 21,558/05; F. KUHN [Alarm clock] 21,752/05; J. C. BOWIE and J. H. PHELPS [X-ray tube] 21,804/05.

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ELECTRICAL ENGINEERING

No. 165 [Vol. VI., No. 8] THURSDAY, FEBRUARY 24, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

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United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

An interesting example of the difficulties that can be successfully overcome when applying electric drive to a textile mill designed originally for belt drive is afforded by the installation at the Broughton Flax Mills, Manchester. The spinning frames are driven in groups of from fifteen to twenty by 60 h.p. direct-current motors suspended from the ceiling and driving through chain-gear. The latter was adopted after an unsuccessful trial with spur-gearing, there being no space for a rope or belt drive. The motors are of a special construction, which permits of easy erection even under the unfavourable conditions of the case in question. (Page 131.)

A letter has been addressed by Mr. W. M. Mordey, as Chairman of the Electrical Engineering Committee of the Japan-British Exhibition, to the electrical manufacturers of the United Kingdom, drawing their attention to the advisability of a thoroughly representative exhibit of the products of the industry. (Page 132.)

A most complete water-cooling plant has just been erected for the Salford Electricity Works at a total cost of over £12,000. The hot water from the condensers is pumped out of the hot well by four turbine pumps driven by 60 h.p. direct-current motors into a common pressure main, from which it is distributed to four cooling towers of the natural draught chimney pattern. In these towers the water is reduced some 35° Fahr. in temperature, and flows from the tanks below into a common suction tank. The plant has been designed to deal with 750,000 gallons of water per hour, and has several interesting features. (Page 133.)

In a Paper read before the Institution of Electrical Engineers, Mr. F. Hope-Jones described the working of several different systems of electric time services with dials electrically operated by current impulses sent out at intervals from a master clock. He also showed a number of oscillograms demonstrating the smooth current-wave obtained with his own, the Synchronome system, and pointed out how the self-induction of the circuit was beneficial in enabling the necessary current to operate the dials to be obtained, with a longer duration of contact, even if the cell-voltage falls off considerably. Among the points brought up in the discussion were the avoidance of sparking at the contacts, current consumption, and the synchronising of master clocks. (Page 135.)

The action by the "Z" Electric Lamp Manufacturing Co., Ltd., against Messrs. Marples, Leach & Co., Ltd. (now Adnil Electric Co., Ltd.), for infringement of their patent No. 21,654 of 1906, was concluded before Mr. Justice Parker on Thursday, judgment being reserved. In his speech for the defendants Mr. Terrell, K.C., argued that phospham was used by the Bergmann Co. for a totally different purpose than by the plaintiffs, and that therefore there was no infringement. Mr. Walter, K.C., for the plaintiffs, said the patent was for improvements in electric lamps, and therefore the defendants did infringe. (Page 136.)

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MR. A. ANGOLD read a Paper before the Association of Engineers-in-Charge recently, in which he described some of the phenomena of the electric arc and the development of the arc lamp. Thin carbons were essential for steady burning, and to get long burning hours without long and expensive coppered carbons the magazine type had been evolved. High candle-power metal filament lamps were compared unfavourably with small enclosed arc lamps. (Page 137.)

MR. H. E. YERBURY'S Paper on equitable charges for tramway supply has been further discussed by the Birmingham Section of the Institution of Electrical Engineers, and some interesting figures of costs and load factors were given. (Page 138.)

AN illustration is given of some tantalum lamps which survived the effects of an explosion. (Page 138.)

TESTS have been carried out with the Edison storage battery in America on a small-sized tramcar. We give some particulars of latest forms of the cell. (Page 139.)

MR. A. P. TROTTER writes on the recent discussion on glare before the Institution of Illuminating Engineers. The correspondence is also continued on the library of the Institution of Electrical Engineers. (Page 139.)

A NEW process has been introduced for the plumbing of lead-covered cables and other lead joints. A low-temperature weld of the two surfaces to be jointed is produced by inserting a piece of prepared tin-foil between them and heating with a blow-lamp. (Page 140.)

THE Publicity Committee appointed by the London Electric Supply Companies and Local Authorities owning electricity works has commenced its publications, and is inviting the co-operation of provincial authorities. (Page 140.)

THE Joint Committee of London Electric Supply Companies and Local Authorities owning electricity works has appointed two engineers on either side to report on the question of linking up the London undertakings. (Page 140.)

THE twentieth annual dinner of the General Electric Co., Ltd., took place on Saturday, and in the course of a speech, Mr. Hugo Hirst, the Managing Director, complained of the indifference of the Government to the manufacturing industries of this country. (Page 141.)

AMONG the specifications published by the Patent Office on Thursday last was one by A. E. Tanner and E. A. Claremont for a method of equalising the dielectric stress in H.-T. cables by inserting at intervals metal wrappings connected to resistances or choking coils, so as to make equal the total conductance of successive layers.—A patent by P. L. Fraser and the Tudor Accumulator Co. relates to the T.A.C. train-lighting system.—E. B. Wedmore covers a protective device for cable systems, in which the switch trip-coil is operated from a potential transformer in the case of small faults, and by a current transformer in cases where the potential is reduced as the result of a heavy fault.—A hot-plate for A.-C. systems, containing both a resistance heating spiral in close contact with the plate, and a disc for eddy-current heating, is protected by A. F. Berry.—H. A. Mavor describes a three-phase induction motor with several windings, which are supplied at different periodicities in several combinations to obtain variable speed.—A patent for a special shape of former-wound armature coil, affording a neat arrangement at the ends of the armature, expires tomorrow after a life of fourteen years, and on Thursday next a patent expires covering a magnetic separator for minerals of slight magnetic susceptibility. (Page 142.)

THERE was a net profit of £1,040 upon the Hull municipal telephone system for 1909.—Further experiments are to be carried out in the City of London with electricity for street lighting.—A 2,000-h.p. Curtis turbine has been installed in the power-house of the Fife Electric Power Co.—A scheme of public electric lighting has been prepared at Harrogate.—The Islington Electricity Committee recommend current being supplied for power purposes to a large consumer at 0·9d. per unit.—An agreement will probably be entered into by the Woolwich Council for the West Ham Corporation to supply electricity in North Woolwich. (Page 143.)

LOCAL GOVERNMENT BOARD inquiries have been held as follows:—Bolton, £4,608; Shrewsbury, £6,328; Worcester, £656. A loan of £5,180 is proposed at Rugby, and new generating plant at an estimated cost of £31,000 is proposed at Newport (Mon.). Loans have been sanctioned as follows in London:—Poplar, £20,900; Southwark, £3,330; Woolwich, £3,600. Telephone instruments are required at Hull, and electric cranes by the Secretary of State for India and the Buenos Aires municipality. A large number of municipalities require electrical stores. (Page 146.)

A DIVIDEND of 10 per cent., in addition to a bonus of 2 per cent., is recommended on the ordinary shares of Messrs. Mather & Platt for 1909. The report for 1909 of the London Electric Supply Corporation states that a new contract for further power supply is being negotiated with the L.B. & S.C. Rly. Co. Dividends are recommended by a large number of the London Electric Supply Companies. (Page 146.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, FEBRUARY 24TH.

Royal Institution.

3 p.m. Afternoon Lecture II., "Illumination: Natural and Artificial," by Prof. S. P. Thompson, F.R.S.

Institution of Mining Electrical Engineers: London Branch.

8 p.m. At the Institution of Junior Engineers, 39 Victoria Street, London, S.W.

FRIDAY, FEBRUARY 25TH.

Institution of Electrical Engineers: Manchester Section.

6.45 for 7.15 p.m. Annual Dinner at the Midland Hotel.

SATURDAY, FEBRUARY 26TH.

Royal Institution.

3 p.m. Afternoon Lecture III., "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson, F.R.S.

Institution of Mining Electrical Engineers: Midland Branch.

3.30 p.m. At University College, Nottingham. "Electric Shocks," by W. Maurice.

Institution of Mining Electrical Engineers: Cumberland Branch.

4 p.m. At Grand Hotel, Whitehaven.

Institution of Mining Electrical Engineers: Yorkshire Branch.

6 p.m. At Royal Victoria Hotel, Sheffield, "Electric Shocks," by W. Maurice.

TUESDAY, MARCH 1ST.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology, "The Commercial Side of the Electrical Industry," by J. I. Law Brooks.

WEDNESDAY, MARCH 2ND.

Dynamicables.

7.30 p.m. Dinner at the Trocadero.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At 92 Victoria Street, London. "Insulating Materials," by T. J. Sack.

THURSDAY, MARCH 3RD.

Royal Institution.

3 p.m. Afternoon Lecture III., "Illumination: Natural and Artificial," by Prof. S. P. Thompson, F.R.S.

Rontgen Society.

8.15 p.m. At 20 Hanover Square, London. (1) "Dental X-ray Technique," by C. A. Clark; (2) "Radium Collector for Atmospheric Electricity," by F. H. Glew.

SATURDAY, MARCH 5TH.

Royal Institution.

3 p.m. Afternoon Lecture IV., "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson, F.R.S.

The Duties of the Institution of Electrical Engineers to the Electrical Industry.—In reply to Mr. E. Garcke's suggestion (see ELECTRICAL ENGINEERING, February 10th, page 97), that the Council of the Institution of Electrical Engineers should provide an organisation to enable steps to be taken with a view to improving the general industrial conditions under which electrical undertakers, manufacturers, and contractors are working, the Secretary has stated that the Council are of opinion that this is not within the proper scope of the Institution.

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ELECTRIC DRIVING OF A LARGE FLAX SPINNING MILL

ONE of the most important of the many textile mills in the Manchester district which have been or are being converted to electric drive is the Broughton Flax Mills, Broughton, owned by Messrs. Wm. Renshaw and Co., Ltd. These mills are the oldest established in England, if not in the United Kingdom, and employ from 900 to 1,000 hands. Apart from the various auxiliary machines, the mills contain 30,000 spinning spindles, and it must be remembered that for a flax-spinning mill the machinery is much heavier and more costly than for a cotton-spinning mill, the cost working out at about £5 per spindle in the former, as against £1 per spindle in the latter case.

The raw flax used in this mill comes principally from Belgium, and is collected from the farmers in the flax-growing districts in the neighbourhood of Courtrai, where the finest and best qualities are procured by steeping in the River Lys. At the mills it first goes through the process of hackling by being passed through very long machines of the most modern description. The tow made in this process is carded before going through the preparing process. The dressed flax, however, is not carded, but goes through a similar process of preparation as the carded tow, and for these processes there is an enormous number of machines, which turn the flax out in the form of rovings. These rovings are then taken to the spinning rooms, of which there are several, and there the rove is spun into yarn through hot water. The yarn is then passed on to the reeling rooms, and is wound into hanks or on to rolls and pirns, ready for weaving, and is shipped abroad to all parts of the world.

The main building is five stories high, and is divided into two parts. On the ground floor are two large steam engines, driving respectively two vertical shafts, one in each half of the building. These shafts are coupled through bevel gearing to the horizontal shafting on each floor. A year or so ago, however, it was decided to convert the whole to electric driving if a suitable and commercially practicable method could be devised, and the shafting of two floors has already been disconnected from the vertical driving shafts and

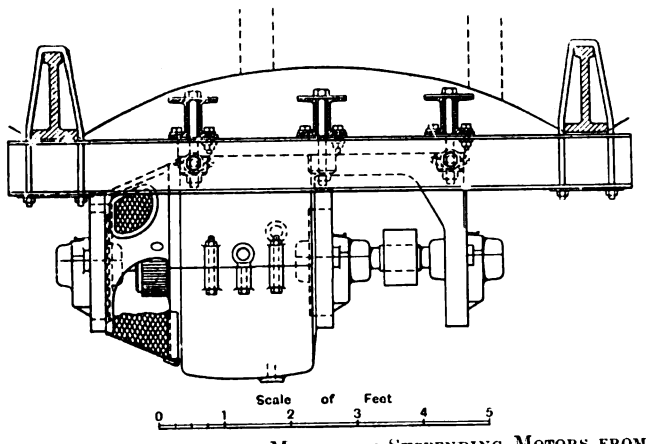


Fig. 1.—Sketch showing Method of Suspending Motors from Cast-iron Joists.

coupled to motors. It is not easy to appreciate the difficulties which have been encountered without visiting the building itself. From considerations of space it was not practicable to place the motors on the floor, and so it was necessary to suspend them from the ceiling. The latter, however, consists of a series of brick arches supported on cast-iron joists, and consequently the distribution of the weight of the motors and the avoidance of vibration were most important factors for consideration. As an initial trial, the shafting driving two large groups of machines was disconnected from the main system, and each group was driven by a separate motor coupled to the shafting through spur gear with raw-hide pinions. The adoption of spur gearing was rendered necessary in view of the fact that there was not space for a belt or rope drive. It must be remembered that it is necessary in flax spinning to have a steady drive just as in cotton spinning, as the steadier the drive the better the work. As there was much vibration with this arrangement, however, another system had to be tried.

The problem appears to have been solved with com-

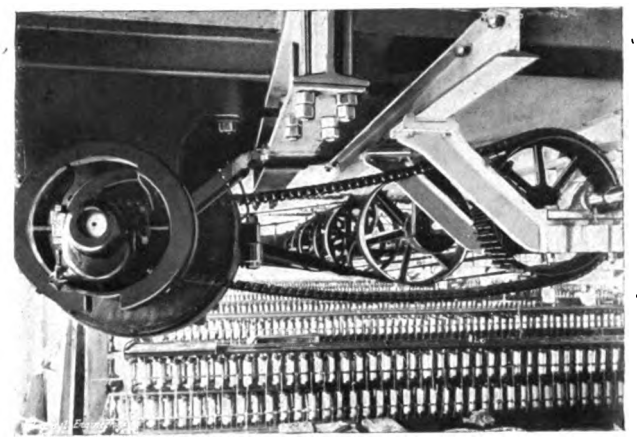


Fig. 2.—Chain-drive with Gear-case removed.

plete success by the application of chain drive, which gives the necessary flexibility without requiring a great length between the centres of the pulleys as in a belt or rope drive. Already four drives have been installed on this plan by Messrs. Hans Renold, Ltd., of Manchester, and run entirely without vibration. In two of the large spinning rooms the shafting has been disconnected from the vertical driving shaft, and has been divided in the centre of the room, so that each half of the room, comprising from fifteen to twenty spinning frames, is driven by a separate motor. Fig. 1 shows the method of suspending the motors from the cast-iron joists, and Fig. 2 is a photograph showing one of the chains with the case removed.

It will be noticed that two 10 in. by 8 in. wrought-iron girders were suspended from the cast-iron joists by means of iron straps, and the motor suspended from three channel girders laid across and bolted to the suspended girders. Layers of felt were interposed between the joists and the main girders, and between the latter and the cross girders to prevent the transfer of vibration to the cast-iron joists. For taking up any wear in the chain, a small movement of the motor is allowed for by means of slides and forcing screws.

The drives have ratios varying between 2·3 to 1 and 3·9 to 1. The chains run at a speed of 1,245 ft. per min., are enclosed in sheet-metal gear cases, and run practically silently. The two chain wheels are approximately 9 in. and 28 in. in diameter. Three drives have a centre distance of 6 ft. 6 in., and the fourth is 7 ft. 3 in. Three out of the four drives have chains 8 in. wide and 1·5 in. pitch, with a breaking load of 62,800 lbs., while the fourth is only 6 in. wide, and has a breaking load of 47,090 lbs. In the former cases the load is estimated to reach over 70 h.p., but in the latter case the maximum load is estimated never to exceed 60 h.p.

The motors were supplied by the Rees Roturbo Manufacturing Co., Ltd. (Wolverhampton), and are each rated at 60 h.p., 440 volts, 525 r.p.m. They are interpole compound-wound motors capable of a 25 per cent. overload for ten hours, or 75 per cent. overload for half an hour, and run sparklessly at all loads with fixed brush position. The guaranteed maximum temperature rise is 70° Fahr. on normal load, and 80° Fahr.

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on the 25 per cent. overload. As shown in Fig. 1, the motors are provided with the Rees-Parker patent gapped frame. This construction, which among other advantages permits of easy removal of the armature, is illustrated in Fig. 3.

The field-magnet yoke is cut across the horizontal diameter just above the interpoles, and the bearings are mounted in circular seatings in an extension at each end of the frame, bored out with the magnet-poles, thus ensuring perfect alignment and allowing the bearings to be rotated so that the motors may be adapted for belting to a wall or in an inverted position to a ceiling, as in the present case. To ensure a rigid construction, each motor is arranged with three bearings, each automatically lubricated by means of two oil rings. The gapped frame permits of the armatures being lowered vertically for inspection or removal; this is a great advantage with the motor suspended from the ceiling in a cramped position, when there is always considerable difficulty in erection or removal if the armature has to be threaded in endways. In the present case, suitable holes were made in the ceiling, and to erect the motors slings were threaded from the story above for lifting the various parts into position. The motors are arranged for a variation in speed by shunt resistance in order to increase the speed of the line shafting by 25 per cent. if necessary. Suitable starting panels are provided with enclosed type switchgear, consisting of an Adams starter with shunt rheostat, a Berry-Skinner double-pole switch-fuse, and an ammeter.

Current is supplied at 440 volts from the Salford Corporation mains, the service cables being brought into a special switch-

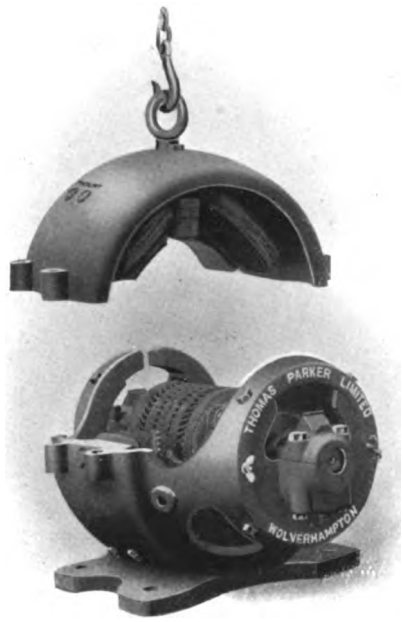


FIG. 3.—REES-PARKER GAPPED FRAME MOTOR.

house built on to the main building. The switchgear comprises two main circuit breakers by Eckstein, Heap & Co., and a large board. The latter is already fitted up for the whole installation, namely, four motors for each of the five floors, there being six 500 amp. circuits in all, including that for the mechanics' shop. Each circuit is controlled by a Bertram-Thomas circuit breaker with a switch in one pole, and a Bertram-Thomas ventilated multiple-wire fuse in the other. There is an Aron meter and a recording ammeter registering the total supply, and a separate ammeter in each circuit. Braided, rubber-covered 0·5 sq. in. cables are strung on insulators outside the building up to a four-way fuse-board on each floor. The fuse carriers are of slate with porcelain handles, and were supplied by Messrs. Bertram-Thomas.

Much credit is due to Mr. V. A. H. M'Cowen, Borough Electrical Engineer of Salford, for the successful application of electric drive under such difficult conditions, and we should like to express our thanks to him, to Mr. H. M. Girdwood, Managing Director of the mills, and to the firms above mentioned for assistance in preparing this article. Mr. Girdwood was kind enough personally to conduct our representative over the mills and to explain the nature of the work.

THE JAPAN-BRITISH EXHIBITION

THE Electrical Engineering Committee of this Exhibition consists of the following members:—

W. M. Mordey (*Chairman*), Dr. Gisbert Kapp (*Vice-Chairman*), S. W. Baynes, G. H. Bowden, C. S. Colton, S. Cowper-Coles, Col. R. E. Crompton, E. Garcke, T E. Gatehouse, Albert Gay, Robert Hammond, K. Hedges, Dr. Edward Hopkinson, W. L. Madgen, W. C. Mountain, Sir W. H. Preece, W. R. Rawlings, C. P. Sparks, A A. Campbell Swinton, and C. S. Thomson.

Mr. Mordey has addressed the following letter to the electrical manufacturers of the United Kingdom:—

DEAR SIR,

On behalf of the Electrical Engineering Committee for the forthcoming Japan-British Exhibition at the White City - the names of which are given above—I shall be glad if you will allow me to call the special attention of electrical engineers to the advisability of making a thoroughly representative exhibit of the products of our industry. The Exhibition—which will be open during the whole of the summer—will, no doubt, be visited by a large number of influential people from Japan, and will attract the attention of the very numerous tourists from all parts of the world who visit London during the summer. Our enterprising ally, Japan, is very much alive to the advantages to be derived from the use of electrical engineering appliances of all sorts, and presents a large and growing field for such work. It is very important that our visitors should realise that this country occupies a leading position in all matters connected with electrical engineering, and there can be no better way of bringing this result about than by a good representative exhibit in all important sections of electrical engineering, particularly those dealing with power and lighting.

Yours faithfully,

W. M. MORDEY,

Chairman of the Electrical Engineering Committee.

Electric Traction in Switzerland.—The Swiss State Railway authorities are engaged in securing water power all over the country for the purpose of electric power supply for the railways. The power secured in Canton Tessin now amounts to 30,000 h.p., and in Canton Uri to 17,000 h.p. The total amount already secured is about 70,000 h.p.

Theory of the Single-phase Induction Motor.—A Paper by Mr. C. F. Smith, joint author with Mr. W. Cramp, of the recently published work, "Vectors and Vector Diagrams," has been accepted for publication as an original communication in the *Journal* of the Institution of Electrical Engineers. The Paper is entitled "The Relation between the Stator and Rotor Circuits of the Single-phase Induction Motor." A number of formulæ expressing the connection between the current and voltage in the stator, and in the rotor of a single-phase induction motor are deduced from theoretical considerations, and the relations obtained are illustrated in the form of curves obtained experimentally on a standard three-phase 5-h.p., 220-volt, 50-cycle, 4-pole, A.E.-G. motor. Experiments were made with two of the three-phase stator windings in series, and also with only one phase supplied. The conclusion is arrived at that the ratios of voltage and current transformation in a single-phase motor must be considered to have each two definite values—one value with the rotor stationary and in the position for maximum mutual induction, and one value when the rotor is in rotation. There is no gradual change from one ratio to the other. The Paper concludes with a table giving the voltage, current, and impedance ratios for the two cases of a stator winding, embracing two-thirds of the stator circumference, and for a winding of half this width.

The Preparation of Papers to be Read before Societies.—Speaking at the annual dinner of the Physical Society recently, Dr. C. Chree, F.R.S., who was in the chair, said that the number of Papers read before the Society had become much larger of recent years, but he thought there might be some improvement in the presentation of such Papers. Generally speaking, there were three ways in which an author might be congratulated:—Firstly, on producing valuable results: secondly, on the form in which he had put them; and, thirdly, both author and audience might be congratulated that the reading had been accomplished. Of these three the second was the most rare. Papers usually consisted of 25 per cent. due to the author, and 75 per cent. of material that preceded the Paper. Authors were apt to neglect the 75 per cent., and to assume that the audience knew all about it. Also, if any mathematics appeared in a Paper, the author generally proceeded to put it upon the blackboard. This was not desirable, because a physicist's knowledge of mathematics was usually not good, and mathematical results were frequently not of great value. In some ways it might be better for authors to read each other's Papers instead of their own. He also thought it would be of great advantage occasionally if the Society could have a general discussion of a subject by a physicist well acquainted with that special branch of knowledge.

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WATER-COOLING PLANT AT THE SALFORD ELECTRICITY WORKS

WHEN there is no river or other natural source of supply of water for condensing purposes, the means for cooling the condensing water is an extremely important part of a central station system. We have recently had an opportunity of inspecting the plant put down at the Salford Electricity Works for this purpose (at a cost of some £12,000), which is undoubtedly one of the largest of its kind in this country, and possesses several new features of interest. The pumps for raising the hot water to the top of the cooling towers are installed in a separate building adjacent to the towers themselves, and the whole plant shows evidence of most careful design and forethought for all possible emergencies. The works is situated at Pendleton, Salford, between two locks about a couple of miles apart on the Manchester, Bolton & Bury Canal, and for some years has been using the canal water for both condensing purposes and for the feed water. There are other smaller works using the water along the same reach, and a year or so ago it was discovered that the water was being taken in at a temperature of over 80° Fahr., which sometimes reached even 100° Fahr., and discharged at 140° Fahr., whereas the figure for the discharge temperature according to the agreement with the Lancashire & Yorkshire Railway Co., the owners of the canal, was 90° Fahr. Further, the railway company and the large owners began to complain, as in certain weathers the steam on the surface of the water extended for about a mile along the canal, and the water was so hot that it brought out the pitch from the seams of the barges. The canal water is also dirty.

It was therefore decided to drop the contract with the canal company and to erect a cooling-tower plant to deal with the condensing water, and as 750,000 gallons of water has to be circulated per hour at full load, it will be seen that the pumping plant, as well as the cooling towers themselves, is of considerable magnitude.

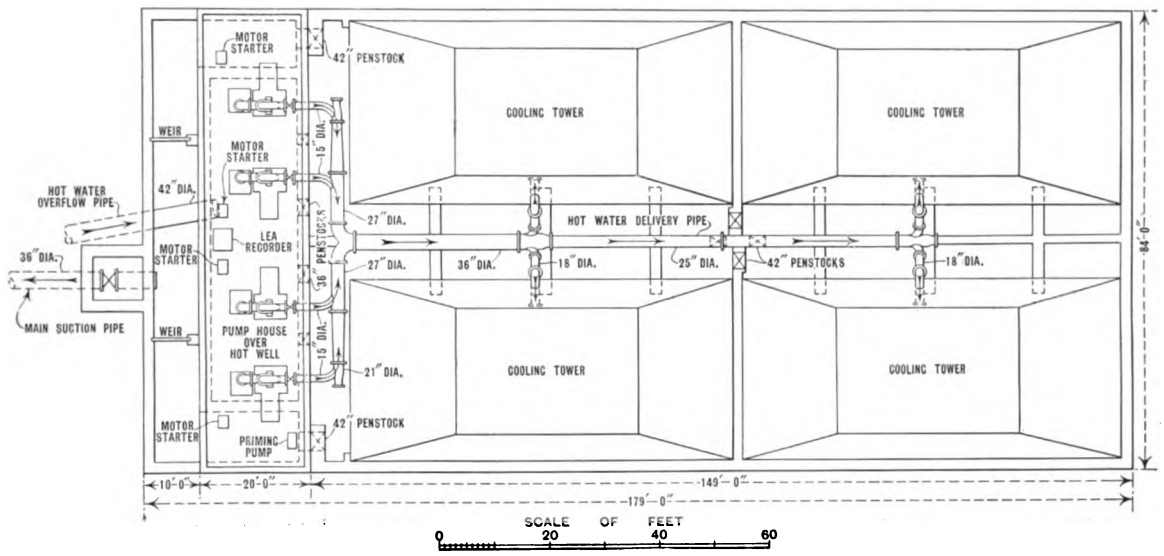


FIG. 1.—BLOCK PLAN SHOWING GENERAL ARRANGEMENT OF SALFORD WATER-COOLING PLANT.

The general arrangement of the new cooling plant, the main contractors for which were Messrs. Balcke & Co., Ltd. (27 Clements Lane, London, E.C.), is shown in Fig. 1. A 40-inch diam. discharge pipe from the nine condensers (eight of which are jet, and one surface) is led into a hot-well tank under the pump-house by the towers, and the water is pumped from there by four motor-driven centrifugal pumps up to the distributing troughs in the four cooling towers. The towers themselves are illustrated in Fig. 2, and are of Messrs. Balcke & Co.'s natural draft chimney type, each tower being capable of dealing with 187,500 gallons of water per hour. They are constructed entirely of wood, and consist of tapering rectangular towers built on concrete foundations with tanks below for receiving the cooled water.

The cooling apparatus proper is built into the lower part of the tower, and consists of wooden distribution troughs, splash plates and cooling hurdles, by which the incoming warm water is divided up into minute drops and brought into the closest possible contact with the air entering from below. The cooling effect is obtained partly by evaporation and partly by conduction of heat to the air. Each tower is 75 feet in height, and the water is delivered into the tower at a point some 22 feet above the top of the tank, the remaining 53 feet of chimney providing the necessary draught.

Under the present conditions, the water enters at a temperature from 90° to 100° Fahr., and is cooled by its passage through the tower to 65° Fahr. The result of these better water temperature conditions is an appreciable rise in vacuum which naturally results in economy in fuel. The towers are unusually wide, about 33 feet at the bottom, and, to ensure that the incoming cold air reaches the water in the centre, the lower part of the tower is divided into four, instead of two, vertical sections, and a supply of cold air into the inner sections is effected by means of spec... diverting plates in the air duct below. The outer structure is of pitch pine encased with red deal boards, both creosoted under pressure, but the distributing troughs and cooling baths are of red deal uncreosoted. All steel and iron parts, such as the splash plates, washers, bolts, and nails are galvanised. The four towers are guaranteed to be able to cool 750,000 gallons per hour continuously from 115°

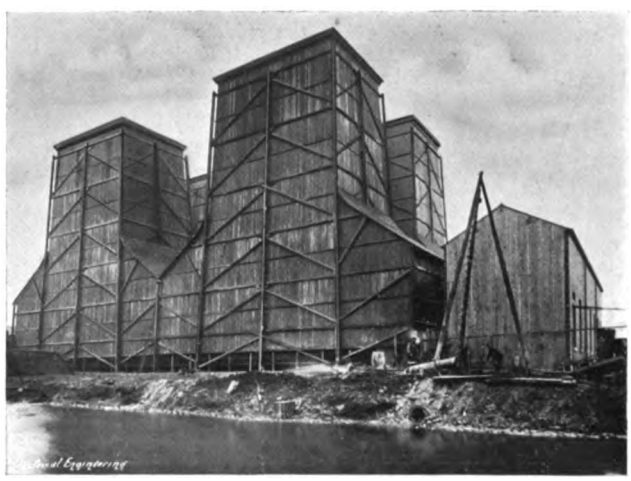


FIG. 2.—GENERAL VIEW OF COOLING TOWERS AND PUMP-HOUSE.

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Fahr. to 80° Fahr., with an air temperature of 55° Fahr., and a humidity of 75 per cent.

Between each two of the four concrete tanks below the towers is a hand-operated 36-inch penstock, so that any one tank can be isolated for cleaning. The water runs away through two 42-inch penstocks into the suction tanks, and from these over two weirs into the 36-inch cast-iron pipe to the condensers. The main valve in this pipe is situated in a concrete pocket at the suction tank end, and is operated by worm gearing. There are two pipes with 42-inch penstocks between the hot-well and the cold water tanks for "short circuiting" the pumps and towers should that be necessary. The weirs in the suction tanks are also provided with bye-passes controlled by 24-inch penstocks.

The four pumps are of Messrs. Mather & Platt's patent high lift turbine pattern, with specially designed guides on the cast-iron body, allowing the water to leave the impellor and to enter the whirlpool without shock. The impellor is of the double suction type keyed to a manganese bronze spindle. Each pump is designed to deliver 250,000 gallons per hour, against a total head (including the 10 feet suction and the calculated friction in piping) of 30 feet, when running at a speed of from 450 to 500 r.p.m. The bearings are exceptionally long. Water-sealed glands are fitted where the spindle passes through the pump covers to prevent air leakage. Each pump is driven through a leather flexible coupling by a Mather & Platt 60 h.p. 460-volt D.C. 4-pole shunt motor. The couplings prevent any strain on the shafts should they come slightly out of alignment. The general arrangement of the pumps and pipework is illustrated by Fig. 3, which is a section and a portion of an elevation through the pump house. A general view of the pumps is given in Fig. 4.

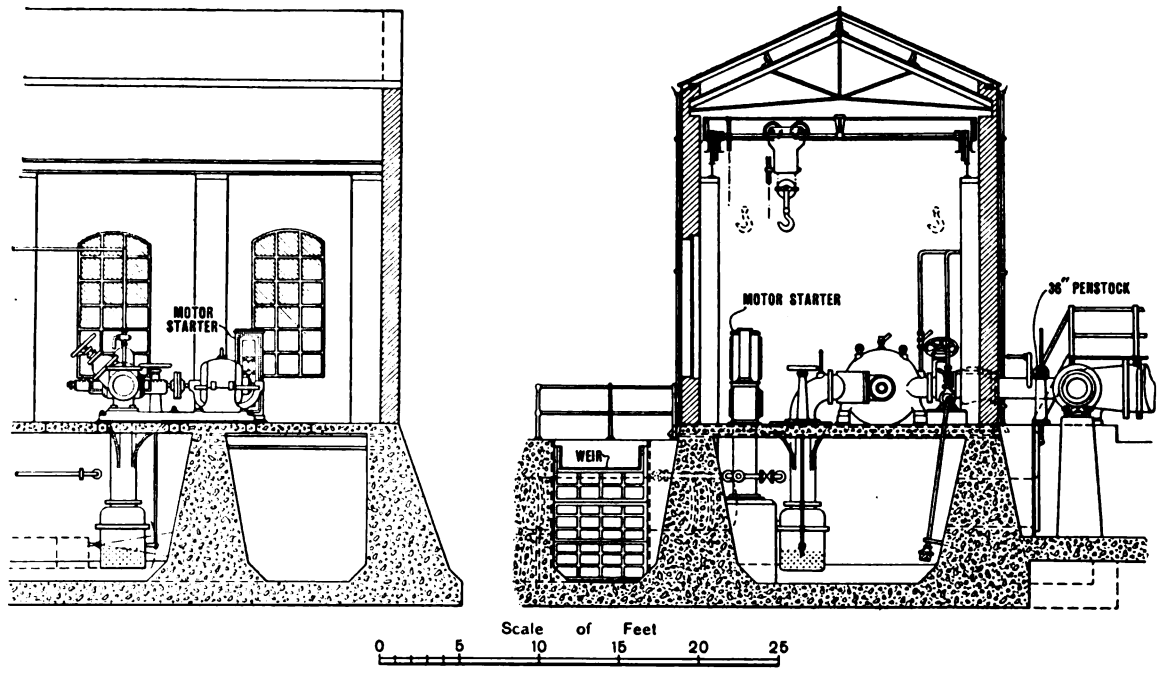


FIG. 3.—PARTIAL ELEVATION AND SECTION OF PUMP-HOUSE.

The motors are supplied through one of two independent circuits from the main switchboard which lead to a link change-over board in the pump-house. From this board the leads are taken in steel conduit under the concrete floor to the motors and starting pillars. Each of the latter comprise a starter with an interlocked shunt field rheostat, a double pole switch with overload release, and an ammeter, all enclosed in a glass-fronted cast-iron pillar. These and also the motor frames are earthed to the conduit. The meters for registering the consumption of the pumping plant are on the main works power board. The surface wiring is carried out in steel conduit, and a wall plug with a length of protected cable and a hand lamp is provided for each set. An 8-ton manually-operated overhead crane travels the whole length of the house, and is employed for lifting the bend, foot-valve, and rose on the suction side for cleaning. The height of the crane is such that the rose can be raised 10 inches above the floor of the pump house. These parts are not fixed to the floor in any way, but are bolted only to the pump case. The 18-inch foot valve is closed when priming the pumps previous to starting up. For priming, a small Mather & Platt low lift turbine pump, coupled to a ½ h.p. Matthews & Yates motor, is provided. This runs at 1,400 r.p.m., and can deliver 33 gallons per minute against a head of 16 feet. It is connected to the main pumps as shown in Fig. 2 by a 2-inch pipe.

The two weirs shown in Fig. 1 are in parallel, and either can be connected by means of 3-inch valves with the float chamber of a Lea (rectangular notch) Recorder which is situated in the pump house, and measures and records the rate of flow over either or both. The pumps deliver into a common riveted mild-steel pressure main with bends and tees of cast iron. Between each pump and the mains are a double flange 15-inch sluice valve and an automatic back pressure valve for preventing the water returning to the hot-well and running the pump as a turbine should the motor fail. The back pressure valves also have hand-wheels for manual operation. Between each tower and the delivery main is a cast-iron pipe with two 18-inch sluice-valves. The total amount of make-up water required is about 80,000 gallons per day. At present this is taken from the canal, and is treated with soda-ash and lime in a softening tank which also acts as a settling tank for the mud, &c. As has already been mentioned, however, the canal water is very dirty, and an artesian well is therefore being sunk to supply the make-up water instead. The boring arrangements can be seen in Fig. 2. The pump for the make-up water will be electrically driven. It will be placed at the end of the pump house, the temporary end of which will be removed and the house extended. The lifting capacity of the pump will be 15,000 gallons per hour from a depth of 500 feet.

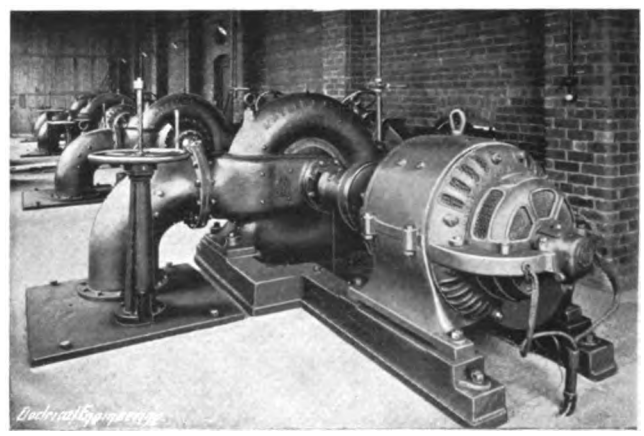


FIG. 4.—60-H.P. PUMPING SETS.

The generating plant of the station consists of eight Browett, Lindley compound tandem vertical engines, driving Mather & Platt 750 kw. continuous-current generators and one Brown-

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Boveri—Willans-Parsons 1,000 kw. D.C. turbo-generator running at 1,250 r.p.m. The traction load is dealt with by some of the slow-speed vertical sets, while the lighting and power load is taken by the remaining slow-speed sets and the turbo-generator. The total capacity of the station, excluding some small motor-driven alternators for a separate supply, is 7,000 kw. There is a small battery and balancer for equalising the three-wire distribution systems, and a larger battery to assist with both lighting and traction loads with a capacity of 3,200 amp. on a one-hour rating is now being installed.

The whole of the work was entrusted to Messrs. Balcke & Co., Ltd., and was carried out to the plans of Mr. V. A. H. M'Cowen, Borough Electrical Engineer, Salford. In conclusion, we should like to express our thanks to Mr. H. J. Hawkins, Deputy Borough Electrical Engineer at Salford, for assistance in preparing this article, and to Mr. W. Maudsley, Clerk of Works for the above new works, who kindly showed our representative over the plant.

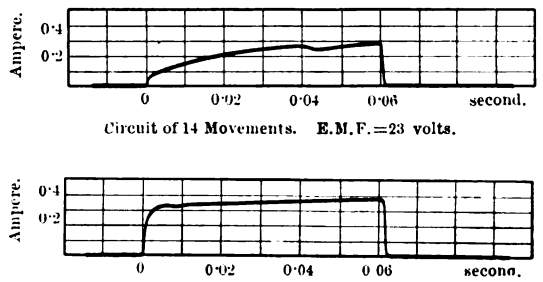
MODERN ELECTRIC TIME SERVICE

A PAPER with the above title was read on Thursday last before the Institution of Electrical Engineers in London by Mr. F. Hope-Jones, of the Synchronome Co. The subject could, said the author, be divided into three sections :—(1) Independent self-wound clocks driven by electricity, (2) synchronising systems in which a standard clock sends out electrical impulses to correct independently driven clocks, and (3) circuits of dials actually driven by electrical impulses sent out at short intervals by a master clock. Included in the first division are the Hipp, Scott, Aron, Synchronome, Eureka, Fery, and the Brooklyn Self-winding Clock Co.'s clocks. The latest, the Eureka clock, was fully described in ELECTRICAL ENGINEERING, June 17th, 1909, Vol. V., p. 563. The Brooklyn clocks are fitted with a synchronising device, and represent class two; these clocks are in use in the London underground railway stations.

The author then described the mechanism of several systems of electrical impulse dials introduced in the year 1905, after the Synchronome system had held the field alone for five years. In the LOWNE master clock, a magnet is energised every fifteenth swing of the seconds pendulum, and is caused to put in tension a spring which is released, and its energy imparted to the pendulum in the course of the next swing. The secondary dials are of the simple step-by-step type with series magnets operating the pawls, and a low-resistance coil is shunted across each main coil directly it has operated its pawl, thus leaving a greater E.M.F. across the magnets which have not yet worked. The pendulum is never free; it does work at the end of its swing, and all the energy for contact making is derived from it, but fine design and workmanship have resulted in excellent time-keeping performances. The ARON system is based upon the self-winding action of the well-known meters of that name, and is typical of Continental practice. The movement is used to wind what may be described as an ordinary striking clock, in which the striking part turns a commutator every minute, sending an impulse to the dials and reversing the polarity of the battery every time. With the polarised dial movements used in this and other German systems, every impulse may be a group of splashes instead of a smooth-topped wave without a single dial getting out of step. In the PERRET system, the energy for contact is derived from the hour-hand wheel, and, as only a weak contact is obtained, this is limited to small currents and low voltage. Relays are used for circuits of dials, and the system needs more than usual expert handling.

In the SYNCHRONOME system, the power required to work the contacts is not taken from the pendulum nor from the escapement which drives it. Contact is made every half-second by a lever detached from the pendulum. This lever is lifted again above a catch and the circuit broken by an electromagnet in series with the dial magnets. A roller on the lever falls on a curved pallet on the pendulum when the lever is released, and runs down it, giving an impulse to the pendulum at the moment when it passes through its zero position. Thus the pendulum is free at all times except in the middle of its swing. Should the battery current fall below a certain value, the pendulum assists the magnet to lift the lever. The dial movements are of the simple reciprocating armature type. The GENT time transmitter is very similar, in that a roller on a weighted lever descends on to an impulse surface on the pendulum, giving it an impulse in the centre of its swing.

A number of oscillograph records of the impulses sent out from a master clock of the Synchronome type were then shown by the author. Two of these are illustrated in the accompanying figure. The first represents that sent out into a circuit comprising twelve small movements and two large ones, having a total resistance of 61·8 ohms. The E.M.F. was 23 volts and the maximum current 0·37 amperes. The area of the curve is 0·012 coulomb = 3·5 ampere-hours per annum. The dials operate at 0·25 ampere in 0·045 second, and the switch breaks at 0·27 ampere in 0·06 second. The voltage might drop 30 per cent. or the resistance increase 42 per cent. before the magnet would refuse to reset the gravity arm, but the duration of the impulse would be two or three times as long. The precision of the make is worthy of notice. This is due to the switch arm "sailing" into contact at the speed of the moving pendulum. The slight depression in the current curve when the dials operate is due to the back E.M.F. generated when the armatures fly up to the magnets. A leather buffer is provided to receive the switch arm when it makes contact. If this is taken away the curve has a slight jump at the beginning, as the switch arm rebounds off the contact. The break is practically instantaneous. On account of the self-induction in the circuit, the dials are operated and the circuit is broken before the current has time to rise to its full value. By varying the self-induction in the circuit and the tension of the dial springs, the duration of contact necessary for



Circuit of 14 Movements. E.M.F.=23 volts.

Circuit of 12 Movements and Carbon Filament Lamp. E.M.F.=204 volts.

IMPULSE WAVE-FORMS OF SYNCHRONOME CLOCK CIRCUITS.

the current to rise to a sufficient value to operate the dials can be varied at will, and this reserve of current ensures that the system will operate with heavy drop of voltage or rise of cell resistance. That the inertia of the dial armatures cannot be ignored is demonstrated in the second oscillogram, for which the circuit comprised the switch and twelve small dials, the current being taken from the lighting mains at 204 volts with a 32-c.p. 200-volt carbon filament lamp in series. The beginning of the curve is steep owing to the voltage being high and the self-induction trivial compared with the resistance. Though the dials will work on 0·25 ampere if they have 0·02 of a second to do it in, the current has to rise to above 0·3 to accomplish the work in half the time, and any attempt to work them more quickly would involve a much higher voltage, and it would be undesirable on account of the noisy action of the dials that it would cause.

The author then described briefly the two systems which have appeared since 1905, viz., BOWELL'S and MURDAY'S. The vibrations of the pendulums of the master clocks in each of these systems are maintained by the Foucault-Hipp electric "Butterfly" escapement. In Bowell's system (made by the Silent Electric Clock Co.) the pendulum charges into contact springs at the end of its swing, making a comparatively long contact to operate dial movements with rotary armatures in a permanent magnetic field. In Murday's system (made by the Reason Manufacturing Co., Ltd.), the contact is a passing one made at zero, and the dial movements have reciprocating armatures pivoted between the poles. Finally the author gave a few notes on heavy motor-operated turret clocks.

DISCUSSION.

Mr. H. R. KEMPE (General Post Office) referred to the system at the General Post Office, where electrical synchronising was adopted. There were a large number of independent hand-wound clocks in various offices, and it would hardly be economical to scrap them in order to put in electrically driven clocks. Synchronisation was very simple, and cost very little. With electrically-driven clocks the impulse was once every minute or half-minute, and it was impossible to tell exactly to

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a few seconds what the actual time was. He regarded the use of non-inductive shunts as the salvation of electrical time service, as they completely prevented sparking, and ensured clean contacts. A good deal too much might be made of the cost of current. The total current cost for an installation of 100 clocks hardly exceeded 2s. 6d. per annum; it was quite possible that the interest on the increase in cost of apparatus with reduced current consumption, would exceed the cost of the current saved.

Mr. A. C. BROWN urged electric clock makers to dispense with the three-degree pendulum. Clocks kept better time when the arc of oscillation was very much more. Generally, a great deal too much power was put into pendulums, and had to be taken out again, and they very often neglected to take precautions to get rid of this surplus. Pendulums could be separated from the clocks, but they were greatly influenced by the surrounding local gravitational influences, and should be placed in the basement, as near the earth as possible.

Mr. E. T. COOK (East London Technical College), said a number of his students had worked out a pendulum of the Murday type, in conjunction with a Hipp trip switch, and in spite of Mr. Hope-Jones' condemnation of this form of switch, it had worked for four years without any stoppage. With regard to the kick at making contact, this, he believed, was due to the pad (which took up the normal vibration due to the switch arm falling downwards) becoming hard. In the course of time it seemed that the kick would become very much greater, and he had known kicks of this kind to operate one of the dials and set it in advance of the others.

Mr. J. N. ALTY, referring to the oscillogram, which showed a very sudden rise of current on 200-volt mains with a 32 c.p. lamp in series, asked if this could not be avoided by using an inductive resistance instead of a lamp to increase the time constant. It would be interesting to have diagrams of dials connected in parallel. He knew this would mean doubling the wiring, but one dial failing would not then affect all the others. It might also be more economical for the batteries.

Mr. W. DUDDELL said the question of trouble with batteries largely depended on how many there were in series. With a large number working a large number of dials, the leakage current would be very much greater than the ampere hours per annum required to work the dials. He suggested that if Mr. Kempe capitalised the cost of winding the Post Office clocks, it would not seem so uneconomical to substitute electrically-driven clocks.

Mr. A. E. MCCLOSKEY suggested the desirability of synchronising all master clocks from Greenwich, or some other observatory, as from Mr. Brown's remarks it seemed that the master clock was very easily upset, and with it all the others in the circuit.

Mr. HOPE-JONES, in reply to the discussion, entirely agreed with the use of non-inductive shunts; they were an additional safeguard against breakdown, as they afforded alternative paths to the coils. There were very good reasons why the three-degree pendulum should not be abandoned, but he would reply to this point in writing. There were also reasons against putting the dials in parallel. The suggestion of putting in inductive resistance in 200-volt circuits, instead of lamps, was a very good one, and might be applied.

Birmingham and District Electric Club.—This club held its first annual dinner last Saturday at the Colonnade Hotel, New Street, Birmingham, Mr. G. O. Donovan (president) in the chair. An excellent musical programme was provided, interspersed between the speeches.

Obituary.—We regret to announce the death, on the 6th inst., at the age of 72, of Mr. W. R. Green, who has been associated with the firm of R. Waygood & Co., Ltd., lift and crane manufacturers (Falmouth Road, London, S.E.), for over fifty years, some time as director, and latterly as consulting engineer. Mr. Green was a nephew of the late Richard Waygood, and prior to the commencement of his connection with the firm founded by his uncle, he served four years as engineer in the Royal Navy, after an apprenticeship with Messrs. Gourlay Brothers, marine engineers, of Dundee.

On Saturday night Mr. Ernest White, managing director of the New Brotherton Tube & Conduit Co., Ltd., shot himself in his room at the company's offices at Wolverhampton.

Thury A.-C. Clock System.—A system of electric time service, a development of the Wheatstone A.-C. system, is described in the *Elektrotechnischer Anzeiger*. The new system has been designed by Mons. R. Thury, and consists of a master clock operated from a direct-current source, and generating three-phase alternating current of a perfectly steady frequency, which is supplied to synchronous motors on the secondary dials. The three-phase current is generated in a horizontal stationary armature, within which oscillates an inductor about a vertical axis. Fixed to the inductor spindle is a pendulum of the conical type with crossed arms. Current is supplied to the main winding on the inductor by slip-rings, and a second winding under the control of the pendulum is provided to regulate the speed of oscillation. The secondary dial movement consists of a permanent magnet which rotates synchronously in a field produced by means of two coils supplied with the three-phase currents.

THE "Z" METAL FILAMENT LAMP PATENT

Action for Infringement

THE action of the "Z" Electric Lamp Manufacturing Co., Ltd., against Messrs. Marples, Leach & Co. (now Adnil Electric Co., Ltd.), for infringement of their patent No. 21,654 of 1906, was concluded before Mr. Justice Parker on Thursday, judgment being reserved. It will be remembered that the patent claims, by the use of phospham or other compound, to remove the last traces of carbon in tungsten filaments, either by painting phospham on the stems of the lamps or by embodying it in the tungsten paste before squirting. The main defence to the action is that phospham is used in the Bergmann lamps (which are those alleged to be infringements) as an inert vehicle for carrying red phosphorus, the gases given off from which improve the vacuum of the lamps and so prevents blackening. Our report last week dealt with the case up to Tuesday, Feb 15th, upon which day the case for the defendants was opened.

On Wednesday, Feb. 16th, further evidence was called on behalf of Messrs. Marples, Leach & Co.

Mr. E. BEVAN confirmed the evidence of Mr. Hehner on the previous day that phospham did not remove carbon in filaments, inasmuch as it did not give off ammonia at the temperatures inside incandescent lamps.

Dr. HARRY BRESLER, chemist at the Bergmann works in Berlin, spoke of experiments which he had made, in which lamps blackened when treated with phospham alone, but did not blacken when red phosphorous was added. Dr. Felix Paul Manfroni, works manager at Messrs. Bergmann's lamps works, gave similar evidence.

Speeches were delivered on Thursday. Mr. Terrell, K.C., for the defendants, submitted that it was impossible to construe the patent into one for the prevention of blackening metal filament lamps, as was suggested. If this were the intention, then the patentee had concealed his intention very cleverly, and the patent was not a good one, for it was the duty of a patentee to be quite frank to the public. His contention was that the patent merely intended to produce a stronger filament by preventing the tungsten being attacked by the carbon. Messrs. Bergmann claimed that their object in using phospham was not to remove carbon, and before the plaintiffs could succeed on the question of infringement they must prove the defendants had actually removed carbon. His own evidence was that phospham hopelessly failed to bring about such a result. His interpretation of the law of the subject was this: if he had used phospham with the intention of removing carbon and had not succeeded in doing so, then he had not infringed. If, on the other hand, he had used phospham with no intention of removing carbon, and it did in fact remove carbon, then he had infringed.

Mr. JUSTICE PARKER said that presumably the alleged infringing lamps were the same as those in respect of which Messrs. Bergmann had paid royalties to the German "Z" Co.

Mr. TERRELL replied that this was the prejudice with which he had to contend. He had been prevented by Mr. Walter from showing what the German patent contained; as a matter of fact there were totally different claims in the German patent. Continuing, Mr. Terrell said the patent claimed to remove carbon by means of ammonia in the lamp. The Bergmann Co. treated their filaments in an ammonia atmosphere before they were put into globes, and removed the carbon in that way. Therefore, how could it be said that they removed carbon by means of phospham in the globes? Further, he claimed that the amount of carbon remaining in the Bergmann filaments after sintering was so infinitesimal that phospham would have no effect upon it. What was alleged was a theoretical infringement, but there must be an actual infringement before the case against him could succeed. The mere use of phospham must not be taken as evidence of infringement.

During some discussion, Mr. Justice Parker agreed that it was a proper conclusion to be drawn from the evidence for the defendants that phosphorous vapour in the lamps prevented decomposition of the filaments. The point was whether it was necessary to use phospham for this purpose. If the defendants had not removed carbon, then they had not infringed.

Mr. TERRELL said that, following out the specification literally, they had found it impossible to make a filament a quarter of an inch long. There was no indication of the proportion of phospham to be used, and they had taken it as the same percentage as the amount of carbon in the filament. In other words, they had had to experiment, and if this had to be done with any specification then the patent was bad.

Mr. WALTER, K.C., for the plaintiffs, claimed that his evidence proved conclusively that phospham did remove carbon, and that the defendants had used it for this purpose. He admitted that the evidence of the experts on either side was in direct conflict, and the court would have to decide between the two. The specification was one for effecting improvements in metal filament lamps by the use of phospham, and it was clear, on this reading of it, that the defendants had infringed.

As mentioned above, judgment was reserved.

London Electrical Engineers (Territorial Force). The following are to be lieutenants:- Second Lieutenants William E. Hammerton, Frederick H. Masters, Thomas H. Vitty, Frederick C. Clarke.

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MODERN ARC LAMPS

In a Paper read before the Association of Engineers-in-Charge on Wednesday, February 9th, Mr. A. Angold, of the General Electric Co., described the development of the modern arc lamp and its application. When an arc is struck between two electrodes, commenced the author, the conductor in the gap is made up of the material of the positive electrode in a gaseous or a finely divided state, though it is asserted that if the positive electrode is kept cool enough, the material in the gap will be supplied by the negative electrode as in the case of magnetite arcs. The resistance of an arc of definite length diminishes as the current increases, and so, to obtain a steady arc, an external resistance or choking coil is connected in series. Long series of arcs will work with less resistance, as fluctuations in the separate arcs tend to balance one another. The composition of the electrodes has a marked effect on the steadiness of the arc, as, if the material has a large increase of resistance as it cools down, the arc is difficult to maintain, especially with alternating current. An enclosed arc lamp with two solid carbons, and running off a 40-cycle A.C. circuit, will have an apparent power-factor of 0·7, not because the current lags, but because the arc is not restruck at each half cycle until the voltage has risen to a considerable amount. For this reason, carbons for A.C. lamps are cored with a material with the smallest negative temperature coefficient possible, and by this means the apparent power factor is brought up to 0·9 or nearly unity. With cored carbons, whether the cores are for steadying the arc or increasing the light, as in flame arc lamps, it is most important that the arc should be kept to the core, and thus be fed constantly with the chemicals of the core, and for this reason it has become usual to employ small diameter carbons. Other methods, such as multi-core carbons and carbons with very large cores, are employed, but do not appear to meet with great success, due to variations of temperature as the arc travels over the large carbon surface.

For flame lamps, continued the author, the materials used in the carbon cores are generally compounds of calcium and titanium, the former for a golden, and the latter for a white light. The slags which are produced by the combustion of these materials at the carbon ends cause the supply of material to the arc to vary considerably, and for this reason the flame arc will probably never be quite as steady as the old open-type arc. The enclosed flame arc is at a greater disadvantage than the open flame arc in this respect, as there is less air to carry the disturbing material away from the arc. Besides the above compounds, substances are added to secure steady running. The method most largely adopted to ensure steadiness of burning is to employ small diameter carbons, but this necessitates a great length to obtain a reasonable life, and the carbons must be coppered or provided with additional cores of metal, or contact must be made near the burning end, owing to their high resistance. Enclosing the arc has the same bad effects as increasing the diameter of the carbon, and so the long thin carbon lamp has been most favoured, in spite of its disadvantages. The author next described the Angold magazine lamp in which a number of comparatively short thin carbons are automatically brought into action successively. This lamp was described and illustrated in Electrical Engineering, February 4th, 1909, Vol. V., p. 109.

Mr. Angold then passed on to consider automatic cut-outs. The true differential cut-out has great advantages over the plain series or shunt cut-outs, as there is always a closed circuit at the instant of switching on, which prevents excess voltage across the lamp and cut-out terminals; further, there is less chance of the equivalent resistance remaining in parallel with the arc. Mr. Angold then described the twin-arc enclosed lamp, pointing out, however, that it was better to run two 6-amp. single-arc lamps in series on 200 volts than two 3-amp. double arcs in parallel, so far as light is concerned, though the convenience of separate units in the latter case sometimes outweighs the lower efficiency. Auto-transformers, distributing coils, and compensating coils for A.C. lamps were then briefly described and their advantages compared.

Turning again to the flame arc lamp, the author described the various methods of supporting and feeding the carbons, including those in which one carbon is supported on a refractory abutment. The author considers that in the latter types there is bound to be some interference with the regular burning of the carbon, and that the ideal arrangement is one in which the carbons have no obstruction near their burning ends. The following specific consumptions per hemispherical British candle-power are given in the Paper as typical, including a 20 per cent. resistance loss. (1) Single-enclosure with opaline globe 0·91 watt; (2) open-type with opaline globe 0·77 watt; (3) vertical carbon *flame using* heavily mineralised carbon and opaline globe 0·3 watt; (4) inclined-carbon flame with opaline globe 0·3 watt. The angles of maximum candle-power below the horizontal are given as 30°, 42°, 38°, and 70° respectively.

Finally, the author makes some comparisons between high candle-power metal filament lamps and small arc lamps. Taking the consumption of the former as 1·25 watts per horizontal Hefner candle-power, the consumption per mean hemispherical British candle-power works out at 1·7 watts, *i.e.*, considerably above that of the single-enclosure arc lamp. As to comparitive costs, taking a 600 hemispherical c.p. metal filament lamp at 16s. 6d., and allowing a life of 1,500 hours, lamp renewals cost 1s. 1d. per 100 hours, as against 1d. per 100 hours for carbons for an enclosed lamp.

Discussion.

Mr. H. W. Handcock, who was in the chair, drew attention to the urgent necessity for uniformity in candle-power ratings. At present arc lamps were rated in hemispherical c.p., but incandescent lamps were rated in horizontal c.p., in some cases in British c.p., and in other cases Hefner c.p. There was great room for improvement in the basis of rating arc lamps. It would be interesting to have the results of experience as to the relative penetrative power of the light from various kinds of arcs and metal filament lamps. The present year was really the centenary of the electric arc, as it was in 1810 that Humphry Davy first exhibited the arc at the Royal Institution. The author had not referred to the manufacture of arc lamp carbons; there was only one works in this country for this purpose, and it was satisfactory to know that the British Admiralty were supporting these works.

Mr. L. Gaster spoke upon the necessity for providing plenty of light in workshops and factories, and referred to a report of the Fidelity & Casualty Co. of New York, dealing with the prevention of industrial accidents. This found that bad illumination was responsible for the largest number of accidents in workshops and factories. He would like to see a legal limit fixed for the amount of illumination per worker, as had been done in Holland, and urged manufacturers to give attention to this matter in the interests of the output from the works. He did not think the author's comparison with metal filament lamps should be taken too seriously, as arc lamps could never be made in sufficiently small sizes for ordinary illuminating purposes. The question of marking and standardising metal filament lamps was now engaging the attention of the Engineering Standards Committee.

Mr. F. Broadbent referred to the prevention of shunt coils from burning out by means of a cut-out. Nothing was said, however, about preventing the coil of the cut-out from burning out. When the Middlesbrough Docks were lighted many years ago, an automatic switch was devised, which cut in a resistance when the voltage of the lamp, viz., 60, was exceeded. He also suggested the use of inverted flame arc lamps.

Mr. Angold, in reply, agreed that the rating of arc lamps was at present very much too high. Personally, he never specified c.p. if he could avoid it, but the buyers were to blame in this matter. If there were not a demand for high figures, arc lamp makers would not give them of their own accord. He had got over the difficulty of shunt coils of cut-outs burning out by the use of a differential cut-out. In this he switched on to the equivalent resistance in the first place, and if everything was in order the cut-out opened, but if something was wrong, then it remained in. He had experimented with inverted flame arc lamps with three carbons, having their points uppermost. The arc in this case was lifted by the draught, and very good results had been obtained.

Universal Electrical Directory, 1910.—The 1910 Universal Electrical Directory, published by our contemporary, *The Electrical Review*, has now been issued. As usual, it bears evidence of careful elimination of unimportant entries. The arrangement has not been altered from that of last year, there being British, Colonial and general, Continental, and United States sections, each subdivided into an alphabetical and a geographical section.

Electrical Exhibition.—An International Electrical Exhibition is to be held at Dordrecht from April 30th to May 16th next. All articles intended for the exhibition will be allowed to enter duty free, provided they are not eventually sold in the country. Electrical energy will also be supplied to exhibitors free of charge. Inquiries concerning this exhibition should be sent to the Secretaris der Technische sub-Commissie der Tentoonstelling van Electriciteit, Steegoversloot 37, Dordrecht.

The Kearney High-Speed Railway.—It is stated that a proposal to deposit a Bill for the construction of an electric railway on the Kearney high-speed system, between Norfolk Street, Strand, and the Crystal Palace, is under consideration by the Kearney High-Speed Railway Co. By this system it is claimed that a speed of 90 miles per hour can be obtained on the surface and 50 miles per hour in the tunnel. The cars run upon one rail, but an overhead guard rail is employed. The cost of construction is said to be only £250,000 per mile.

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EQUITABLE CHARGES FOR TRAMWAY SUPPLY

THE Paper on this subject, by H. E. Yerbury (Chief Electrical Engineer, Sheffield Corporation Tramways), on which we have already reported discussions by the Institution of Electrical Engineers in Manchester, Sheffield, London, and Glasgow (see ELECTRICAL ENGINEERING, Jan. 27th, page 64, Feb. 3rd, page 73, and Feb. 17th, page 118), was further discussed at Birmingham on Wednesday, Feb. 16th.

In the Paper, Mr. Yerbury had criticised the usual methods of allocating the relative proportions of generating costs in combined lighting, power, and tramway stations when determining the charge to be made for energy supplied to tramways. He contrasted the figures of 0·865d. charged at Manchester, with the 0·371d. obtained at the Sheffield independent station, and denied that the difference was justified by the expense of extra plant for the peak and conversion. He would base the charge on capital and running costs for the tramway plant only with a profit of from 3 to 5 per cent.

Mr. R. A. CHATTOCK (City Electrical Engineer, Birmingham) opened the discussion, and remarked that it was evident that the Paper was written by a tramway manager, not by a supply engineer. According to Mr. Yerbury, the engineers of combined stations charged exorbitantly for supply to tramways, and sold millions of units elsewhere much below cost price. Committees, as a rule, were composed of hard-headed business men, who would be extremely unlikely to sell below cost price, and the fact that the price charged to the Tramway Committee was thoroughly criticised by that committee was a sufficient justification of that price. Mr. Yerbury admitted that the load factor largely affected the cost per unit, and assumed that in the case of tramways, it was better than in the case of power. In Birmingham the load factors were as follows :— Lighting, 10·75 per cent.; power, 34·0 per cent., and traction, 27·5 per cent. The costs of distribution were very different in the case of power and traction. These two considerations, the lower load factor and the greater cost of the distribution system in the case of tramway supply, justified, in his opinion, charging a higher price for traction than for power. With regard to the figures under "fixed charges," viz., interest at 3·13 per cent., and sinking fund at 2·05 per cent., he considered these very low, and thought something must have been omitted. Possibly the cost of the distribution system had not been taken into account. This figure per unit generated was given as 0·241d., whereas in Manchester it was 0·441d., and in Birmingham 0·378d. It should be borne in mind that tramways loans had a longer life than those for light and power supply. The figures given in the tables at the end of the Paper, included in the case of the combined stations, every charge, and, in addition 5 per cent. profit on the total cost, whereas the figures for separate tramway stations did not include depreciation or any profit.

Mr. A. M. TAYLOR (Birmingham Corporation) commented on the questions of works costs, and maintained that these should be divided into running costs and stand-by charges. He showed a series of curves compiled from the records of the Manchester station, which gave the coal, oil, wages, repair, and management, as compared with the kw. output of the station, and pointed out that several of these items, such as oil, repairs, &c., were a fixed quantity, and did not increase in proportion to the kw. He also gave a table of the fixed charges at Manchester, which was as follows :—

	Power.	Traction.
Standby Coal	0·74	0·47
Oil	0·18	0·04
Wages	1·11	0·75
Repairs	1·20	0·70
Rates	1·02	0·95
Management	0·46	0·39
Interest and S.F.	5·12	4·82
Reserve and Depreciation	2·09	1·32
	£11·92	£9·44 per k.w. per annum.

MR. JACKSON commented on the fact that the law of supply and demand appeared to be thrown over by Mr. Yerbury. A company would have to earn 5 per cent. on its total capital cost instead of 5 per cent. on the running costs. No account of the risk was taken in the running costs.

MR. YERBURY, in reply, said that Mr. Chattock appeared to shelter himself behind his committee. His loans were originally for 30 years, but had latterly been reduced to 25. In Manchester the large sinking fund determined the high price to the tramway department. As regards profit, interest and sinking fund set aside would be declared by a company as dividend. At Bradford and Manchester, 3 per cent. on the works cost was considered an equitable profit. With regard to Mr. Taylor's suggestion to separate out the fixed charges in the works cost, he thought it would be very difficult to determine the amount of coal used to compensate for radiation losses. He adopted the standard tramway form of account, in which coal, oil, waste, and water were classed as running charges. With reference to Mr. Jackson's remarks, he pointed out that the acquisition of a traction load at once brought down the works cost of a combined station, and as regards risk from accidents, this was covered by the ordinary insurance policy.

"TANTALUM" LAMPS IN AN EXPLOSION

THE accompanying illustration shows a two-light fitting with "tantalum" lamps, which were found amongst the debris after a serious explosion at Salford of a large still containing carbolic acid. The fitting, which was on the outside brickwork of the still, was connected to overhead wires on insulators, the whole of the front of which was blown out. Some of the brickwork was hurled a distance of 20 or 30 yards, and, being soaked in the liquid, at the same time caught fire. The wires connecting the fitting, however, did not break, and pulled the



TANTALUM LAMPS FOUND IN DEBRIS OF EXPLOSION.

insulators, fittings, &c., back into the debris, where it was found after the fire. Though the fitting was badly damaged and had been under water for two hours, with the thick outer globe broken, both of the "tantalum" lamps were found to be intact, although after the still front blew out they must have fallen approximately 15 ft. They had been in use since June, 1909, and the occurrence is an excellent illustration of the extraordinary strength of the tantalum filament.

Illumination.—On Thursday last, at the Royal Institution, Prof. S. P. Thompson delivered the first of three afternoon lectures on "Illumination, Natural and Artificial." After pointing out the necessity for a unit of light, the lecturer described the various standards and the attempts to arrive at uniformity. The present international candle was not really a physical unit, but was a physiological unit, as it could not be expressed in terms of any physical units. The eye could only estimate equality, and was incapable of making quantitative comparisons. The lecturer then described several forms of photometer, including the Trotter grating, in which a white screen illuminated at an angle by one source is viewed through another screen with a series of vertical slots illuminated at an angle from the other source. When the illumination of the portion of card round a slot was equal to that of the portion of the other card seen through the slot, the slot disappeared. Another simple and useful photometer screen consisted of two thin slabs of translucent wax stuck face to face with a piece of tin-foil between. The two slabs were illuminated respectively by the two sources to be compared, which were shifted until the slabs were equally bright when viewed on edge. The Lummer-Brodhun photometer was really a development of the Bunsen grease-spot photometer, as, by means of a system of prisms, the two sides of a white screen illuminated respectively by the two sources were viewed simultaneously, and the distances altered until the illumination was equal. Finally, the lecturer described the Trotter Universal photometer for measuring illumination (see ELECTRICAL ENGINEERING, Vol. I., page 849). Turning to the influence of colour, Prof. Thompson referred to the division of any given light into percentage proportions of the three so-called primary colours. Thus, according to Abney, sunlight contained 19 per cent. red, 37 per cent. green, and 44 per cent. blue-violet; and light from an ordinary open arc lamp contained nearly the same proportions, viz., 22 per cent. red, 36 per cent. green, and 42 per cent. blue-violet. The eye was most sensitive to green light, and in a feeble light the sensitiveness increased for blue-green rays. The lecture this afternoon will be devoted to sources of light, black-body radiation, modern illuminators, and luminous efficiency

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THE EDISON BATTERY FOR TRAMWAY TRACTION

SOME particulars are given in the *Electrical World* (New York) of the tests which, as we have already announced, have been made in America with a tramcar propelled by the Edison alkaline secondary battery. The tests in question were made at West Orange, New Jersey, with a special car seating only 26 passengers, and driven through silent chains of two 110-volt motors rated at 5 h.p. each. The whole car is stated to weigh under 5 tons, so that it is obvious that nothing like full-sized tramway conditions were attempted.

The battery equipment of the car consists of 200 cells of Edison A4 type for driving, and 10 similar cells for lighting. All the cells are placed under the seats.

During the trials it was found that the motors gave the car a maximum speed of 15 miles per hour, and with 14 stops per mile enabled a schedule of eight miles per hour to be maintained. The power consumption in accelerating is said to be about 3½ kw., and in running about 1½ kw. The consumption is, of course, variable, and depends very much upon road conditions. The controllers are arranged to give the following three combinations: First step, batteries in parallel at 50 volts, and motors in series; second step, batteries in parallel at 100 volts, and motors in series; third step, batteries at 100 volts, and motors in multiple. The body of the car weighs 3,500 lb., the truck and electric equipment 3,500 lb., and the battery 3,000 lb., giving a complete car of 10,000 lb. The battery equipment is said to be capable of supplying energy for 150 miles on a single charger.

The construction of what is stated to be the latest form of the Edison battery differs somewhat from that of the original cell. The iron element has an excess capacity over the nickel element, and does not differ much from the iron electrode formerly used. Much time has been spent in perfecting the nickel element. The former positive plate was made up of flat rectangular pockets containing nickel oxide and graphite. It was found that the graphite oxidised, and that mechanically the structure could not resist the swelling action of the nickel oxide. In the new plate round tubes 4 in. long and about the diameter of an ordinary pencil are used to retain the nickel oxide. The tube is made of thin perforated steel, which, when filled with the active material and properly bound by eight steel rings, makes expansion of the active material impossible, and insures perfect internal contact. Instead of the graphite formerly employed, electrochemically prepared flakes of pure nickel are interspersed in the oxide to increase the conductivity of the active mass, because nickel oxide of itself is a poor conductor. Each positive plate consists of a grid of nickel-plated steel holding 30 of these tubes. The negative plate comprises 24 flat rectangular pockets supported in three horizontal rows in a nickel-plated grid. The pockets are made of thin nickel-plated steel perforated with fine holes, each pocket being filled with an oxide of iron, and afterward subjected to very heavy pressure.

The plates of each group are hung on a connecting rod perpendicular to, but integral, with the pole. They are held apart by nickel-plated steel washers, and held firmly in contact by nuts screwed on both ends. The two outside plates are negative, and are insulated from the retaining can by sheets of hard rubber. Hard rubber pieces are also fixed between the steel-containing vessel and the side and bottom edges of the plates. The electrolyte consists of potassium hydrate (21 per cent. solution), to which has been added a small amount of lithium hydrate. The function of the lithium hydrate is not clearly defined. The normal specific gravity of the solution is 1·210, which does not change during charge or discharge. The efficiency and capacity of the cell, however, are not affected to any extent if the specific gravity of the solution is as low as 1·160. Below this a temporary effect is noticeable in the output of the cell. The following are details of two standard types of cell:—

	Type A-4.	Type A-6.
Rated ampere-hour output	150	225
Average discharge voltage per cell	1·2	1·2
Normal rates of charge and discharge in amperes	30	45
Weights (in pounds) of cell complete	13·5	19·2
Width of can (inches)	2 9/16	3¾
Breadth of can	5	5
Height of can	13⅜	12⅜
Height of cell to top of pole (not assembled)	15⅜	13⅜
Required height of battery compartment	15	15

It is stated that charging may be done at double the above rates for one hour if the temperature is kept from rising much above 100° F. It is also permissible, though not recommended, to discharge a battery continuously at rates up to 25 per cent. above normal, and for occasional short intervals of time as in hill climbing or starting on heavy roads, no harm is said to result if the rate be increased to three or four times normal. The capacity of the battery increases after it has been placed in service. It also possesses considerable reserve capacity. The highest practical limit of output is reached when a battery is charged 10 hours at the normal rate, and its value will be, for a fully formed battery, perhaps 30 per cent. more than the rated output. Efficiency is sacrificed somewhat, of course, when the highest available capacity of the battery is utilised. A seven-hour charge at normal rate is considered a normal charge.

It has been found in testing the battery under severe conditions that with a rated discharge three times normal the voltage drops 0·03 volt for every 10 amp. increase. On returning to normal discharge, the voltage comes up to a value a trifle higher than normal, owing to the heat generated at the heavy discharge rate. Heat on discharge increases the output, while heat on charge diminishes it; but excessive heating at all times impairs the life of the battery, and should be avoided. The watt-hour efficiency of the cell is given as from 60 per cent. to 65 per cent. The smaller battery gives about 14 watt-hours per pound of cell, and the larger cell 16 watt-hours.

CORRESPONDENCE

GLARE.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—May I correct one or two mistakes in the report of my remarks at the recent meeting of the Illuminating Engineering Society? Concealed lighting, where the lamps are hidden by a cornice, is generally an expensive mode of lighting. A shaded lamp within range of vision is a different matter. The intrinsic brilliance of the shade should not, I think, exceed one or two candle-power per square inch. I showed a specimen of a clear glass shade designed by me thirty years ago, not on the Holophane principle, but on the principle on which the Holophane system was based some twelve years later. With a 16 c.p. lamp in such a shade the brilliance is spread over about 7½ square inches, and is therefore (allowing for loss) about 4 c.p. per square inch. This is unpleasant at close quarters. The Holophane globes are better in this respect. I said that it is a mistake to use the actual measured diameter of a filament in estimating the intrinsic brilliance. The apparent diameter which is increased some ten times by irradiation should be used.

Feb. 18th, 1910. Yours faithfully,
A. P. TROTTER.

THE INSTITUTION LIBRARY.

To the Editor of "ELECTRICAL ENGINEERING."

SIR,—In answer to "Provincial" and "Associate Member," it would, perhaps, surprise them to know how few London members of the I.E.E. really avail themselves of the opportunity of consulting the most complete library of electrical science in England. I happened, whilst visiting the Institution Library, to read the letters of "Provincial" and "Associate Member," so out of curiosity I looked at the visitors' book to see how many members used the Library. I was astonished to find that for the present month the average number of readers was only 1·5 per day. The total number for January was 44, or an average of 1·7 per day! From July to December of last year there was an average of 1·6 per day. I have not included Sundays or holidays in the averages.

There is still another figure to be taken into account, and that is the number of members residing within the postal district of London; I think there are nearly 2,000, of whom an average of only 1·6 per day use the Library. How does this figure compare with the 200 members of the Local Section mentioned by "Provincial"? Would a reference library be worth maintaining for the benefit of one member per week, calculating the figure on the basis of the London returns?

I find in the last annual report of the I.E.E. that 862 members of all classes had visited the Library during the 12 months ending May 20th, 1909. This is an average of 18 per week, or three per day. That year appears to be a record, but this year the number has gone down nearly 50 per cent., for what reason I know not.

I believe I am right in saying that most provincial public libraries receive the more important technical papers, and not a few of them have a small collection of standard engineering works; if not, it is open for the public to suggest such standard technical books as they consider ought to be in a public library. Even if the Library Committee did not agree to the suggestion, the request might be carried a little further in the form of a petition to the Library Committee with a list of, say, a dozen or so local supporters, which would probably have the desired effect.

I might mention that the figures can easily be checked.

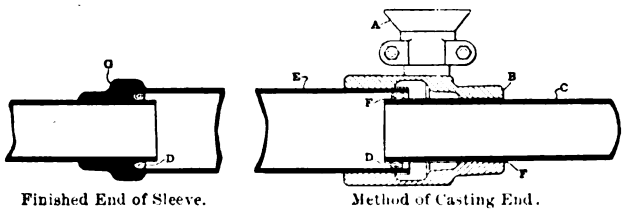
Yours faithfully,
Feb. 21st, 1910. LONDONER.

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CABLE JOINTS AND BOXES

New System of Lead Jointing

A NEW process for the jointing of lead in pipe or other form, the invention of Mr. T. Harden, late of the British Insulated & Helsby Cables, Ltd., is being introduced by the Metal Jointing Co., Ltd. (Adelphi House, 71 Strand, London, W.C.). The lead surfaces to be joined are cleaned in the usual way, and a thin sheet of specially prepared tin is inserted between them. The joint is then heated with a blow-lamp, and the melting of the tin causes the lead surfaces on either side of it to melt at a lower temperature than the normal melting point of lead. An actual weld is thus formed between the two surfaces to be joined. The tin strip for this purpose is supplied by the company under the name of "Amalgaline," and consists of a ribbon of pure tin 0·05 mm. in thickness, treated with a patent composition to prevent the formation of oxides during heating In the case of a joint in an ordinary lead-covered cable, after the conductors have been jointed and insulated, the lead sleeve is drawn over the joint, a strip of "Amalgaline" is wrapped round the lead covering of the cable at each end, and the sleeve is dressed down to this. Sufficient heat is then applied to the outside of the sleeve over the "Amalgaline," and the joint is complete. In telephone, telegraph, and other large dry-core cables, it is not always desirable to dress down the heavy lead used for sleeves, and so for such work a mould is used as illustrated in the accompanying figure. The sleeve is passed along the cable in the



SKETCH ILLUSTRATING METHOD OF JOINTING LARGE LEAD-COVERED CABLES WITH AMALGALINE.

usual way before the conductors are jointed and the jointing is proceeded with; when completed, the sleeve is scraped clean inside for a short distance, the outer surface of the lead of the cable being similarly treated. A piece of "Amalgaline" is placed on the cleaned part in the interior of the sleeve, and another piece, *F*, is wrapped round the lead sheathing of the cable. The sleeve *E* is then drawn into position, and a piece of ordinary engine packing, *D*, is driven between the cable and the sleeve. The mould *B* is then placed in position and molten lead poured in. An important feature is that the mould is so constructed that the hot metal runs direct from the pouring gate to the space beneath the cable, and then wells up round the cable, so that there is no risk of the lead being burned through by the metal being poured direct on to it. The time for plumbing a large telephone cable is said to be reduced by about 30 min.

The system is also advocated for making tee joints in lead-covered cables, and the company has already supplied a number of small house-service boxes made entirely of lead. These are divided in the usual way, but require no packing. When the joint is complete, "Amalgaline" is placed between the flanges and round the cables where they enter the box, and the whole heated up and welded water-tight. Of course, no supplementary bonding is required.

We understand that a large number of sleeve joints have been made by this process by the Fulham Electricity Department, and that during a period of over two years they have in no single instance needed the slightest attention.

Electric Power at the G.W.R. Works.—In our article describing the electrical equipment of the G.W.R. carriage and wagon works, Swindon, brief reference was made to the older power station at the locomotive works, which is quite separate from the carriage and wagon works. It may interest our readers to know that in this station, which has been running some three or four years, there are three generators of the Phœnix Dynamo Manufacturing Co.'s make, each having an output of 165 kw. at 200 r.p.m., and coupled to Westinghouse gas engines. The company supplied a number of the motors in use at the locomotive works, and in addition recently supplied the G.W.R. with a 75-kw. generator coupled to a high-speed engine, which is working at the Didcot Provender Store. They have also lately delivered a 75-kw. generator, which is coupled to a Fielding & Platt gas engine at the G.W.R. Tyseley generating station.

ADVERTISING ELECTRICITY IN LONDON AND THE PROVINCES

THE Electric Supply Publicity Committee of London and District, which has been formed by the local authorities in London and Greater London owning electricity works, in conjunction with the electric supply companies, has now got seriously to work. This scheme, unlike the linking-up scheme referred to in an article below, includes all the London companies. The scheme of co-operative publicity originated with the publication of the quarterly *Electrical Bulletin* by the West End London companies, which was started some years ago, but this, we are informed, has now ceased to exist, and the idea is now being carried out on a much larger scale by the Joint Committee. In order to extend the scope of the committee, provincial electricity committees and companies are being asked to co-operate in the purchase of literature in order to enable this to be published on broad lines and printed in large quantities, thus reducing the cost to the individual undertakings. The first production consists of a poster 40 in. by 25 in., depicting a bird's-eye view of a portion of London illuminated by a metal filament lamp, which will be printed in five colours, and has a space at the foot for the full name and address of the individual undertakings to be inserted. The Joint Committee have also prepared a "spring-cleaning" circular, which is especially suitable for this season of the year.

LINKING UP LONDON ELECTRICITY WORKS

IN our issue for May 20th, 1909 (ELECTRICAL ENGINEERING, Vol. V., Page 467), we published an article describing the efforts which were then being made by the London electricity supply companies and local authorities owning electricity works to take advantage of the "linking up" provisions of the London Electric Supply Act, 1908. This Act, for the first time in the history of the electrical industry, legalised "association" between various electric supply authorities. A Committee was formed consisting of six representatives of the companies, and six representatives of local authorities, to consider a scheme for linking up the various undertakings in London and Greater London. The basis of the scheme was the laying of a ring main, and the use of a pressure of 10,000 volts three-phase and 50 periods with an agreed unit of converting plant throughout, namely, 500 kw., which could be used singly, or two or more in parallel, as circumstances might demand.

The Joint Committee have appointed engineers on either side as follows: Mr. C. P. Sparks (County of London Electric Supply Co.), Mr. Frank Bailey (City of London Electric Lighting Co.), Mr. W. C. P. Tapper (Stepney), and Mr. C. Newton Russell (Shoreditch). The scheme for linking up only includes those companies scheduled in the London Electric Supply Act, 1908, viz., all the London companies with the exception of the St. James & Pall Mall; Westminster; Kensington & Knightsbridge, Notting Hill & Central Electric Supply Companies; and the London municipal electric undertakings (with a few exceptions, such as the Hackney Borough Council) are also taking part in it. The sub-committee of electrical engineers is preparing a report giving more definite recommendations, in addition to the technical points which we have mentioned as already having been agreed upon, but it is improbable that this report will be ready for publication until late in April.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—*Associate Members:* A. S. Angwin, J. E. Barnes, E. Barrs, H. G. Brown, J. Brown, C. Crompton, R. Cunningham, P. T. Davies, R. N. Duncan, F. A. Gaby, W. L. Gundry, E. Harlow, F. W. H. Hayes, F. S. G. Hinings, A. Imbery, W. Ireland, E. J. Ivison, G. C. Jefferyes, F. H. MacHugh, T. H. Matthewman, A. J. Murray, J. H. Murray, F. F. O'Hagan, J. Patrick, F. C. Poulton, T. E. Scharffetter, E. Slader, W. A. Talbot, C. E. Tattersall, J. Waddell, R. Wheeler. *Associate:* L. H. Sharp. *Students:* F. W. Adcock, J. Allan, F. G. Allen, A. C. Bowman, H. Clark, R. H. Dryden, H. C. Hannam-Clark, C. H. Hill, K. G. Maxwell, R. F. Niven, T. R. Parry, T. D. Todd.

Telegraph Traffic and Movements of Cable Ships.—The c.s. *Pouyer Quertier* repaired the cable between Paramaribo and Cayenne on the 15th inst.—The recent storms are responsible for a lot of damage to land wires all over the British Isles.—The Saigan-Bangkok line ceased working on the 19th inst., but was restored on the 20th. The line between Bagdad and Bassorah became interrupted on the latter date.—The *Minia* was engaged off Newfoundland during the early part of the month, and the c.s. *Amiral Caubet* spent some considerable period on the Cape Cod-St. Pierre section, which was in need of attention. During these operations the weather was stormy, and the vessel was damaged and gear was lost. The c.s. *Mackay-Bennett*, of the Commercial Cable Co., which has had during recent times so much to do with the diversion of that company's cables to Newfoundland, was recently instructed by wireless telegraphy to proceed to the States, where the section between Rockfort and Cauco was in need of attention.

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THE GENERAL ELECTRIC CO.'S DINNER

THE twentieth annual dinner of the General Electric Co., Ltd., was held on Saturday at the Trocadero Restaurant, and was, as usual, a great success. Numbers of the staff were present from the provinces, as well as London, and there were many distinguished guests.

The toast of "British Industry" was proposed by Mr. Hugo Hirst, managing director of the company, who occupied the chair in the absence through ill-health of Mr. Gustav Byng, the chairman of the company. Mr. Hirst ventilated some of the grievances of the manufacturer against those in authority. In a "confession of faith," he said, by the Institution of Electrical Engineers, which had recently been published, they said that the Institution existed principally for promoting science and applied science, but it was not yet quite clear whether the manufacturer came within the definition. For politicians, he continued, the manufacturer only exists as a subject for taxation. When we beat Napoleon about 100 years ago, and sent him to St. Helena, he called us a nation of shopkeepers, and since then we had been doing our best to show that he was wrong. It was extraordinary how the Board of Trade ignored manufacturers. For instance, neither he himself nor any of his managers, nor a manufacturers' association to which he belonged, had received any notification of the Government's intention to start the Labour Exchanges, although the General Electric Co. employs over 6,000 men, and the members of the manufacturers' association together employ hundreds of thousands. "In this country," Mr. Hirst continued, "disorganised capital flows into industry, capital from pockets not interested in the industry except as speculative dividend makers, not necessarily into the industry which wants it, but into the industry which is fashionable at the moment. The result has been that money has flowed too readily into the hands of the manufacturer, who, not being used to handle large sums of money, was, unconsciously in most cases, led into trouble and misfortune, and it also easily led to over-production. In Germany money, though coming from small investors, flows through the channels which are generally known as industrial banks, or through some financier who brings his brain, knowledge, and vast experience in matters of finance to the assistance of the undertaking, and is thus not an embarrassment, but a tower of strength to the industry. They use their money wisely. By some means they get rid of the incapable elements in each industry, and bring the capable to the front. Through the assistance of the Government, which secures them the home market, they can gauge and regulate the supply according to the demand. By such scientific control and direction of capital they have raised their industries to a state of efficiency which is the envy and admiration of all countries." America, France, and Germany gave manufacturers their proper positions. When America and Germany made up their minds to challenge us industrially, they had taken up matters where we left off, while we had remained stationary. In these countries the manufacturers had the assistance of their Governments; in Great Britain it was not so. Here we were each strong individually, and could handle an oar or paddle a canoe with the best, but on such small craft it was not possible to fight against the Dreadnoughts which the organisation of other countries represented.

The toast was responded to by the Hon. Sir John Taverner (Agent-General for Victoria), and Mr. Faithfull Begg. Other speakers were Mr. Max Railing, Mr. W. Duddell, F.R.S., Mr. R. K. Morcom, Mr. Ernest G. Byng, who proposed the "Engineering Press" in an excellent maiden speech, and Mr. Arthur Colefax, M.P.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

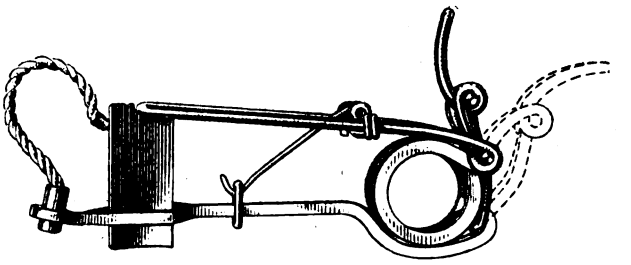
[Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."]

THE "O.S." WIRING SYSTEM.—A pamphlet from Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster), contains a reprint of an article on the lighting installation of Rossall School, which has been wired throughout on the "O.S." system with Stannos wires and fittings.

CABLES.—A new catalogue of underground cables is being issued by Messrs. Aubert, Grenier & Co. (68A Lincoln's Inn Fields, W.C.). Full particulars are given of each class of cable dealt with, among which are the following:—Paper-insulated, lead-covered, aluminium single cables, copper concentric, triple concentric, twin three-core paper-insulated cables up to 660 volts, and various patterns of high-tension cables for pressures up to 11,000 volts. Vulcanised bitumen cables are also included, up to 660 volts.

ELECTRIC POWER IN LAND RECLAMATION.—A leaflet has been published by the Allgemeine Elektricitäts-Ges., of Berlin, whose agents in this country are the A.E.G. Electrical Co. (121 Charing Cross Road, London, W.C.), describing the application of automatic electric pumping in connection with the reclaiming by the Dutch Government of large tracts of land at the estuary of the river Maas. Twenty-two pumping stations containing three-phase motors with automatic motor-driven starters were employed. The motor switchgear was controlled automatically by floats. Current was supplied at 3,000 volts from a special central station.

MOTORS AND DYNAMOS.—We have received a list of standard continuous-current dynamos and motors up to about 70 h.p., of the protected, enclosed, ventilated, and enclosed patterns, from Messrs. H. T. Boothroyd, Ltd. (Bootle, Liverpool). Particular attention may be drawn to the brush-holder used (Wooliscrofts Patent), which is shown in the accompanying illustration. This can be immediately fixed without tools, and



THE "AGILE" BRUSH-HOLDER.

is extremely light and flexible. A powerful toggle clip secures the holder to the rocker spindle, and a long carbon feed, with adjustable range of pressure, and a hold off position are provided. This holder is aptly named "The Agile."

ALTERNATING-CURRENT POWER MEASUREMENTS.—Messrs. Everett, Edgcumbe & Co. Ltd. (117 Victoria Street, Westminster), have issued an interesting pamphlet on technical considerations in connection with alternating-current power measurements, treating the whole matter from the ordinary engineer's standpoint. The conditions which are met with in practice, involving the use of wattmeters, power factor indicators, and idle-current indicators, are dealt with fully, and a particularly clear explanation is given of the reason why, in the two wattmeter method of power measurement on a three-phase circuit, one instrument reverses its reading if the power factor be below 0·5. A useful curve is also given from which the power factor can be determined from the two readings.

The Metal Filament Lamp Trade in Germany.—In a note in our last issue we mentioned that in consequence of the inconvenience caused to lamp dealers in Germany by the sudden reduction in prices by the Allgemeine Elektricitäts Gesellschaft, a temporary agreement had been come to among other manufacturers not to reduce prices without previous arrangements with the dealers and other parties concerned. A meeting was held last week, and was attended by all the German manufacturers of metal filament lamps (with the exception of the A.E.G.), the larger Austrian and Dutch manufacturers, the Westinghouse Co.'s representatives, and representatives of the German contracting firms and dealers. After discussion, it was decided that no manufacturing firm should reduce their prices before March 10th next, but that after that date the individual manufacturers should be free to alter their list prices when and how they thought fit. It is thought in Berlin that on this date all manufacturers will reduce their list prices to the level of those of the A.E.G. An agreement has also been come to between the Siemens and Halske A.G. (who, it is said, are about to manufacture tungsten lamps) and the other parties, whereby the former will further reduce the price of tantalum lamps only in proportion to the reduction made on tungsten lamps.

Electric Supply for Madras Tramways.—An action is pending between the Madras Electric Tramways Co. and the Madras Electric Supply Corporation for breach of contract to supply electrical energy. An agreement was entered into between the parties whereby the Supply Corporation were to supply electrical energy to the Tramways Company from January 1st, 1909, at one penny per unit. For various reasons the supply was not given until a later date, and the Tramways Company were compelled to continue generating at their own power station, where the works costs are said to be 1·65d. per unit. The action is to recover the sum of £3,546 18s. 2d., which is the difference in cost between the price which the Tramways Company would have paid the Supply Corporation and the extra cost of generation at the tramway station during the period from January 1st, 1909, to the date when the new supply was actually given. Before Mr. Justice Hamilton on Monday an application was made by the Tramway Company for the action to be transferred to the list of commercial cases, but the Supply Corporation opposed on the ground that evidence of a very technical nature would have to be given, thus rendering the case quite unsuitable for the commercial court. Mr. Justice Hamilton refused to transfer the action. Mr. C. C. Hutchinson, who appeared for the Supply Corporation, mentioned incidentally that in their opinion the case should be dealt with under the arbitration clause of the agreement to supply.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Feb. 17th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

27,859/08. **Equalising the Stress in H.-T. Cables.** A. E. TANNER and E. A. CLAREMONT. It is known that if the conductance of each successive layer of equal thickness of insulation of cable is equal, the potential gradient will be a straight line and the dielectric stress equal all through. To produce this condition in H.-T. direct-current cables, a number of concentric metal wrappings are embedded at equal distances in the insulation and are connected to each other and to the core by resistances such that the total resistance between core and first wrapping and between any two adjacent wrappings is equal. For A.-C. working, the successive wrappings and the core are connected to choking coils or to separate points on a compensating coil. Three claims, two figures.

1,820/09. **Train-Lighting System.** P. L. R. FRASER and TUDOR ACCUMULATOR CO., LTD. This is one of the patents covering the T.A.C. train-lighting system described in ELECTRICAL ENGINEERING, Dec. 9th, 1909, p. 1034. The dynamo is connected in parallel with accumulators through an automatic switch. The dynamo field circuit contains iron-wire resistances which give constant current within considerable limits of voltage. The field is reduced by the automatic switch when the battery is charged. Two claims, one figure.

3,192/09. **Protection of Cable Systems.** BRITISH THOMSON-HOUSTON CO. and E. B. WEDMORE. This patent covers a combination of current and potential transformers, and a closed circuit relay controlling the switch tripping contacts. So long as the fault is small and the voltage normal, the trip coil is operated by the potential transformer when the relay works, but should a heavy fault bring the voltage down, the necessary energy to operate the trip is supplied by the current transformer. The relay is caused to throw the current transformer into parallel with the potential transformer in the latter case. With this system it is said to be possible to set reverse-current relays for feeder protection to operate at much less than one-tenth load. Three claims, one figure.

4,574/09. **Electrolytic Extraction of Copper.** SOCIÉTÉ FRANÇAISE ELECTROLYTIQUE. The alloy or ore from which the copper is to be extracted forms the anode, and is placed in a basket suspended in an aqueous ($\frac{1}{10}$) solution of per-sulphuric acid saturated with pure sulphate of copper. The ore need not be subjected to any preliminary treatment. The copper in the ore dissolves in the form of sulphate without liberating hydrogen, and the electrolysis of the cupriferous solution imparts a deposit of pure copper to the cathode. Any other metals present in the anode do not dissolve, but are precipitated in the form of per-oxides. One claim.

4,672/09. **A.-C. Hot-plate.** A. F. BERRY. The heating winding consists of a nickel strip, a thin oxide film on which forms a good heat conducting insulation for low pressures. The strip is wound flat in a spiral on the under surface of the hot-plate, and the convolutions are unequally spaced by insulating distance pieces to compensate for heat-disturbing factors and to produce a uniform temperature over the plate. A disc of brass or other good conductor may be placed over the spiral, the eddy-currents induced in it assisting to heat the plate. A bottom plate is placed over the whole. Thin mica is interposed between the nickel strip and the top plate. Five claims, two figures.

12,917/09. **Variable Speed A.-C. Motors.** H. A. MAVOR and MAVOR & COULSON, LTD. In a previous patent, a system was described in which a number of motors, each possessing a different number of poles and mounted on one shaft, were supplied with currents of various frequencies from a number of independent generators, the machines being connected in several different combinations to obtain different speeds of the shaft. According to this invention, the motors are combined in one machine, the stator of which has several independent windings producing different number of poles. Three claims, three figures.

25,028/09. **Telephone Transmitter.** M. MOLONEY and J. ROSS. This is a microphone transmitter for long-distance work. The casing contains a carbon cup, with a number of radially arranged carbon pencils with pointed ends fitting into a groove in a carbon centre stud. The latter has a point which passes through the centre of two carbon washers, between which is small shot. The metal diaphragm just clears the centre stud and is pressed against the carbon washers. Seven claims, six figures.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

4,238 of Feb. 25th, 1896. **Armature Winding.** J. DEVONSHIRE (*W. H. Knight, General Electric Co., U.S.A.*). This patent covers former wound coils in which the two sides of the coil are joined at each end by two straight portions with a double twist at the angle, so that the two halves of the coil are in different but parallel planes.

4,805 of March 3rd, 1896. **Magnetic Separators.** J. P. WETHERILL. A separator for minerals of low magnetic susceptibility, such as limonite, siderite, and rutile, is described. The finely powdered ore is fed on to travelling bands, which pass over the tapering poles of two adjacent electromagnets. The gangue falls off immediately the bands pass over the pole ends, but the mineral is carried a little farther to the other sides of dividing screens under each pole.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: BRITISH THOMSON-HOUSTON CO. (*A. B. Everest, U.S.A.*) [Constant-current transformer with floating coils] 21,670/99; BRITISH THOMSON-HOUSTON CO. (*J. A. Essberger, Berlin*) [Motor control by pressure variation] 22,031/01; H. WRIGHT [Train-lighting system] 22,334/05.

Electric Ignition: F. REICHENBACH [Driving magnetos] 22,113/05; C. A. DAY (*Fabrik Elektrischer Zunder Ges.*) [Commutator] 22,198/05; ELECTRIC IGNITION CO. and F. H. HALL [Switch] 22,585/05.

Electrometallurgy, &c.: P. M. JUSTICE (*C. Davis, U.S.A.*) [Hardening surfaces of plates, &c.] 22,233/01; F. H. LORING [Arc furnace for treating air] 22,101/05.

Instruments and Meters: E. DUBOIS and REASON MANUFACTURING CO. [Electrolytic meter] 23,853/03; SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Indicating instrument] 23,972/04.

Switchgear, &c.: C. H. OFFORD and S. JEVONS [Time switches] 19,386/00; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Connections of mercury-vapour rectifiers] 22,261/05; H. PIERSON [Trip-gear for switches] 22,419/05.

Telephony, &c.: H. OPPENHEIMER (*A.-G. Mix. & Genest*) [Portable loud-speaking telephone] 22,061/05.

Traction: A. GARDINER [Automatic signalling] 22,357/05; M. P. McLAREN [Trolley-head with grinding arms] 22,578/05.

Miscellaneous: J. Y. JOHNSON (*A. Wolf & Co., Frankfurt*) [Thermo-electric cell] 23,858/02; L. B. MILLER [Interrupter] 22,317/05.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: WEINERT [Carbons] 20,832/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: HEYLAND [Regulation of A.-C. systems] 2,520/09.

Dynamos, Motors, and Transformers: MOSER [Synchronous A.-C. generator with automatic pressure regulation] 7,106/09; DE DAILLENS and JORIS [Portable drilling machines] 7,410/09; BRITISH THOMSON-HOUSTON CO. and DAWSON [Current collectors for machines] 15,421/09; HUNT and SANDYCROFT FOUNDRY CO. [A.-C. machines] 16,170/09.

Electric Ignition: GRIFFIN, 2,411/09; HINDLEY and STANFORD, 15,389/09.

Electrometallurgy and Electrochemistry: COWPER-COLES [Manufacture of reflectors] 2,396/09; NEWLANDS and PARKINSON [Electrolyte for primary cells] 11,926/09; BUNET and BADIN [Electrical manufacture of oxides of nitrogen] 16,224/09.

Incandescent Lamps: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Manufacture of metal filaments] 4,164/09.

Storage Batteries: SCHMELTZ [Method of charging] 23,863/09.

Switchgear, Fuses, and Fittings: BRÜLL [Resistances] 1,998/09; TERREY, PEATEY, and HUNT [Automatic transformer switch] 2,144/09; WEEKES [Switch-fuse] 2,287/09; SPAGNOLETTI [Small circuit-breakers] 2,733/09; CURTIS and ADAMS MANUFACTURING CO. [Resistances] 3,191/09; MUIR and CHAMEN [Electric lanterns] 9,760/09; A.-G. BROWN, BOVERI ET CIE. [Control of lighting installations with accumulators] 16,631/09; WALL [Signal lamp] 16,878/09; EDWARDS (*German*) [Fuses] 19,263/09.

Telephony and Telegraphy: PICKERING [Antiseptic devices for telephones] 14,012/09.

Traction: MASCORD, LANGE, and CHITTY [Motors and transmission gear for petrol-electric vehicles] 2,285/09; DAWBARN [Trolley-wire collector] 2,311/09; SHAW [Signalling] 11,968/09; DE SAINTE-CLAIRE [Clutches for electric vehicles] 13,234/09; KOZESNIK [Third-rail system] 15,032/09.

Miscellaneous: HOVLAND [Signalling] 2,272/09; HURRY [Combined bell-push and fire-alarm] 5,337/09; KELVIN & JAMES WHITE, LTD., CHETWYND and CLARK [Compass] 19,057/09, and 29,719/09; HARRISON (*Baker*) [Influence machine] 25,106/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Traction: ANGUS [Preventing collisions] 756/10.

Miscellaneous: SIEMENS & HALSKE AKT.-GES. [Signalling] 23,029/09; EMERY [Signalling] 1,536/10; SIEVERT [Electromagnetic carriers for glass bodies] 1,710/10; LUTH and ROSENS ELEKTRISKA AKTIEBOLAG [Clocks] 1,793/10.

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LOCAL NOTES

BUSHEY (Herts): *Electric Supply.*—Mr. J. F. C. Snell has been retained by the Council in connection with negotiations with the Watford District Council for a supply of electricity in bulk.

CLITHEROE: *Electric Lighting.*—The Council have asked the Board of Trade for an extension of time in which to carry out the terms of their Electric Lighting Order.

COOMBE: *Electric Supply.*—The Kingston Corporation have suggested supplying in Coombe when asked to do so by residents there under the powers of the Electric Lighting Act, 1909, relating to supply to premises in contiguous areas. The Council appear to regard this proposal as dealing with the question in a piecemeal manner, and that the supply would never be under the control of the Council.

DUBLIN: *Trolley Rope Accident.*—Damages to the extent of £30 were awarded against the Dublin United Tramways Co. last week in respect of a passenger who was injured through a loose trolley rope striking him and injuring the muscles of his neck. It was stated that the trolley rope caught the passenger round the neck and lifted him off his feet.

FIFE: *New Tramway Plant.*—A 2,000-h.p. B.T.H. Curtis turbine has been installed in the power-house of the Fife Electric Power Co., at Townhill, Dunfermline, for the purpose of supply to the West Fife tramways.

HARROGATE: *Street Lighting.*—Mr. G. Wilkinson, the Borough Electrical Engineer, has prepared a scheme of public electric lighting.

HULL: *Municipal Telephone Undertaking.*—The net profit on the municipal telephone undertaking for 1909 was £1,040, which brings the reserve fund up to £3,000, independently of the repayment of loans.

LIMERICK: *Stealing Electricity.*—A curious condition of affairs was revealed at the Limerick City Petty Sessions last week, when a local wiring contractor was charged with connecting up certain lamps at the Catholic Literary Institute in such a manner that the energy was not registered by the meter. The magistrates came to the conclusion that notice of connecting the additional lamps was given to the Corporation supply department, and called attention to certain evidence that it was more or less the custom to allow additional temporary lamps to be connected on the supply side of the meter. If this were so, then neglect was going on in some department, and should be inquired into.

CITY OF LONDON: *Street Lighting Experiments.*—At the last meeting of the Corporation an offer was received from the City of London Electric Lighting Co. to make further experiments in street lighting at an approximate cost of £525 per annum, and this was agreed to. The Gas, Light & Coke Co. are also to make similar experiments.

LONDON: *Islington: Power Charges.*—The Electricity Committee have been in negotiation with a firm who are at present large consumers of electricity, and who propose to abandon their steam plant, and to instal electric motors (which will increase their consumption of electricity for power to over 200,000 units per annum), provided the Council make a reduction in the price. At present the rate is 1d. per unit up to 50,000 units per quarter, and 0·8d. per unit for all consumption over 50,000 units. In future the rate of 1d. per unit is to be charged, less 10 per cent. when the consumption amounts to 200,000 units or more per annum, provided a three years' agreement is entered into. This will bring the charge to 0·9d. per unit.

Poplar: Street Lighting.—The charge for public lighting from April 1st is to be £13 per kw. per annum, *plus* ½d. per unit, which, upon the present consumption, is approximately equal to 1½d. per unit. The present charge is 1½d. per unit.

LOWESTOFT: *Supply Outside Borough.*—The Council is considering the question of extending the electric supply mains into Pakefield and Kessingland.

NEWPORT (Mon.): *Electricity Charges.*—Acting on the recommendation contained in the recent report upon the electricity undertaking by Mr. C. P. Sparks, the Electricity Committee recommend an increase in the charges for electricity for all purposes of ½d. per unit, with a 5 per cent. discount instead of 2½ per cent. for prompt payment. New plant is to be installed. (See "Tenders Invited" columns.)

PERTH: *Sunday Trams.*—The Corporation have, apparently as a consequence of the recent report of Mr. Peter Fisher, tramway manager at Dundee, decided to run the tramcars on Sundays.

PINNER: *Electric Lighting.*—The Pinner, Stanmore, Harrow Weald, and Edgware Electric Lighting Order granted to the Northwood Electric Light & Power Co. in 1906 has been revoked by the Board of Trade.

PWLLHELI: *Electric Lighting.*—The Council have agreed to transfer their Electric Lighting Order to a private company, one of the conditions being a maximum price of 6d. per unit for lighting and 3d. per unit for power. The promoters are to refund to the Council the costs of obtaining the Order.

WALSALL: *Electricity Accounts.*—The accounts of the electricity department for the year to December 31st, 1909, show a gross profit of £6,784, and after meeting capital charges, a balance of £653 is carried forward. The number of units sold was 1,690,753, and the maximum demand was 1,026 kw.

WEST HAM: *Supply in North Woolwich.*—With reference to the supply of current to the Port of London Authority for use in a portion of the Royal Albert Docks, outside the borough, a deputation waited upon Woolwich Borough Council this month. The following proposals were considered at subsequent interviews:—(1) The Council to supply current for the whole of the requirements within the dock area under control of the Port of London Authority. (2) The Council to supply current in bulk to the Woolwich Council for distribution by them in their North Woolwich district. (3) The Council to supply and distribute current in the North Woolwich district. The Electricity Committee of West Ham, having considered the opinions of their Electrical Engineer upon these proposals, have agreed to supply current in bulk to the Woolwich Council for distribution by them in their North Woolwich area on certain terms, on condition that Woolwich consent to West Ham supplying current for the requirements within the Dock area under the control of the Port of London Authority, subject to an agreement being executed by the two authorities to contain, among other things, the following stipulations asked for by Woolwich:—(*a*) A supply from duplicate mains. (*b*) The price quoted to be revised should the West Ham Corporation supply any other consumer under similar circumstances at a lower price.

WILLESDEN: *Bulk Supply.*—The agreement with the North Metropolitan Electric Power Supply Co., embodying the new terms upon which electricity in bulk is to be supplied, is to commence from March 31st, 1911, instead of February 8th, but the revised rates for bulk supply are to date back from December 31st, 1910.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BOLTON.—A Local Government Board inquiry was held last week, concerning a loan of £4,608 for the purchase of land, &c., in connection with the electricity undertaking.

BRUMBY AND FRODINGHAM.—A scheme of public lighting, at an estimated cost of £2,500, is under consideration.

CANADA.—A Canadian correspondent of the High Commissioner for Canada, 17 Victoria Street, London, asks to be placed in touch with a United Kingdom financial house open to interest itself in an electric railway in the Niagara Peninsula.

DUBLIN.—Tenders are invited for extra high-pressure and low-pressure cables, delivered at the Fleet Street stores, or laid complete. Particulars from the City Electrical Engineer, and tenders to the Chairman of the Lighting Committee by March 2nd.

LONDON: *Hammersmith.*—Tenders are to be invited for the supply of 8 transformers for delivery in April. One is to be 250 kw., one is to be 200 kw., and six are to be 100 kw.

Marylebone.—The Finance Committee of the L.C.C. sanctioned a loan of £20,900 for street electric lighting. The Committee, however, accede to the application with great reluctance, as in their opinion the streets proposed to be dealt with appear to be sufficiently lighted by gas at present. It does not seem, they state, that apart from street lighting, any appreciable revenue will be forthcoming from the mains to be laid, but on the other hand they are unable to say that the scheme will involve any charge on the rates.

Poplar.—The Finance Committee of the L.C.C. have sanctioned a loan of £3,516 for electric lighting.

Southwark.—The Finance Committee of the L.C.C. have sanctioned a loan of £3,330 for electric lighting.

Woolwich.—The Finance Committee of the L.C.C. have sanctioned a loan of £3,600 for electric lighting.

MANSFIELD.—The Electricity Committee have in view further extensions of the electrical plant. No estimates have yet been prepared, however.

MORECAMBE.—The recommendations of the consulting engineers to rearrange the superheaters and water-softening plant, and bring the batteries up to their fuel capacity, in addition to extending the cables, have been adopted by the Council. A further recommendation is the improvement of the incandescent electric street lighting.

NEWPORT (Mon.).—New generating plant is to be installed at an estimated cost of £31,000.

RUGBY.—A loan of £5,180 for new generating plant is proposed.

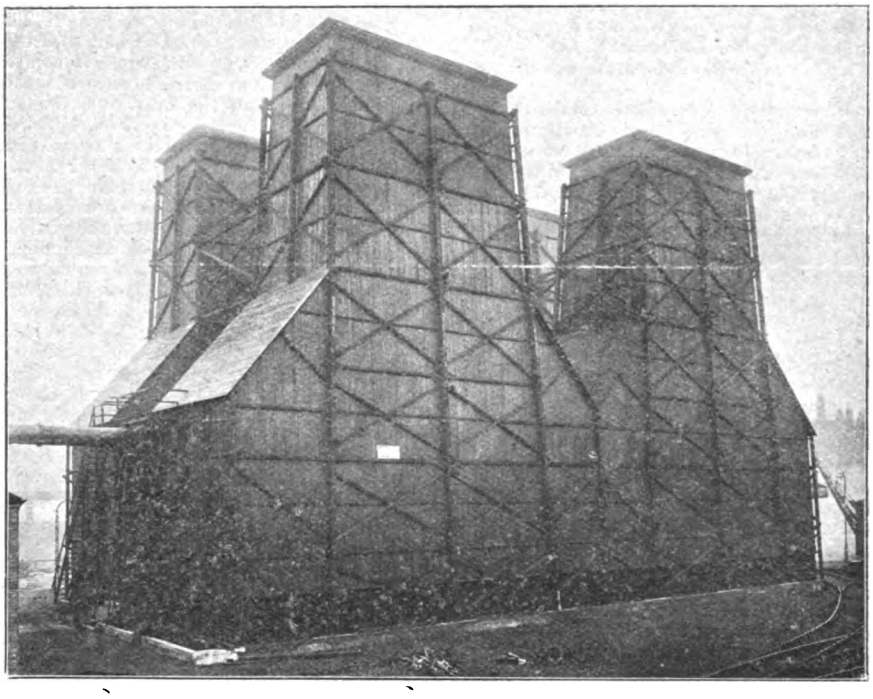
SHREWSBURY.—A Local Government Board inquiry was held last week concerning a loan of £6,328 for electric lighting.

WOLVERHAMPTON.—A local paper states that large extensions are contemplated at the Commercial Road Electricity Works. The recent fire in the power-house of Messrs. Bayliss,

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Jones & Bayliss's works has brought the matter to a head more rapidly than would have otherwise been the case.

WORCESTER.—A loan of £656 for electricity purposes was the subject of a Local Government Board inquiry last week.

Miscellaneous

BOLTON.—The Tramways Committee require general stores, including lighting materials, trolley-poles sundries, and overhead materials. Particulars from the General Manager, and tenders by March 5th.

BUENOS AYRES.—The Government will shortly call for tenders for the supply of twenty one-ton electric cranes for the Port of Buenos Ayres.

CAPE COLONY.—Tenders are invited by March 15th by the Chairman of the Tender Board, Control and Audit Office, Parliament Street, Cape Town, for the supply of electric motors. Forms of tender may be seen at 73 Basinghall Street, London, E.C.

CARDIFF.—A report by the Borough Surveyor, recommending an expenditure of £8,000 in repairing the tramway track, has been adopted by the Lighting and Tramways Committee.

EDINBURGH.—The Council have agreed to the construction of an electric tramway to the new markets at Gorgie.

HESTON AND ISLEWORTH.—The Electricity Committee require electrical stores. Tenders to the Clerk by March 1st.

HULL.—Tenders are invited by March 10th for the supply of telephone instruments. Particulars from the Clerk.

INDIA.—The Secretary of State for India invites tenders by March 8th for overhead electric travelling cranes. Particulars from the Director General of Stores, India Office, Whitehall, S.W.

LONDON: *London County Council.*—The reconstruction of the horse tramways from Tooley Street to Deptford and the construction of tramways from Evelyn Street, Greenwich, at an estimated cost of £110,000, is recommended.

Battersea.—The Electricity Committee require electrical stores, including arc lamp carbons, meters, Nernst lamps, incandescent lamps, &c. Tenders to the Clerk by February 28th.

Fulham.—Tenders are invited for electrical stores. Particulars from the Clerk, and tenders by March 2nd.

PONTYPRIDD.—Tenders are invited by March 7th for electric lamps and stores and paper- and rubber-insulated wires and cables. Particulars from the Borough Electrical Engineer.

SALFORD.—Tenders are invited for miscellaneous electrical stores, including cable, ammeters, circuit-breakers, carbon filament lamps, &c. Particulars from the Borough Electrical Engineer, and tenders by February 28th.

TASMANIA.—Tenders are invited by March 28th, by the Deputy Postmaster-General, at Hobart, for the supply of 17 cordless switchboards. Copies of the specifications may be seen at the Board of Trade Branch, 73 Basinghall Street, London, E.C.

WREXHAM.—Tenders are invited for electrical stores, including cables, meters, cut-outs, incandescent lamps, arc lamp carbons, &c. Particulars from the Borough Electrical Engineer, and tenders by March 15th.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

N.W.—Structural improvements at Great College Street School, St. Pancras (£4,541). Builders, C. F. Kearley, Great Marlborough Street.

Secondary school for 450 girls, Highgate Road, St. Pancras, N.W. Architect, L.C.C. Education Committee, Victoria Embankment.

E.—Factory, Fairfield Road, Poplar, E., for Bryant & May. Architects, Holman & Goodrham, 6 King's Bench Walk, Temple, E.C.

S.W.—Theatre, Mitcham Road, Tooting, S.W., for Picture Palaces, Ltd.

PROVINCES.

AYR.—Additions, tanning works, Mill Street (£1,000). Architect, A. Stevenson, Cathcart Street, Ayr.

Church Hall, St. Leonards (£3,000). Architect, P. McGregor Chalmers, 95 Bath Street, Glasgow.

BELFAST.—Warehouse and shops, York Street (£8,000). Architect, A. Stevenson, 83 Royal Avenue, Belfast.

BOOTLE.—Schools. Architects, Medcalfe & Medcalfe, Moorfields, Liverpool.

DARWEN.—School, Ross Street (£6,700). Architect, H. Littler, Ribblesdale Place, Preston.

DUMFRIES.—Scottish Borderers' Drill Hall (£1,550). Architect, W. F. Crombie, Union Chambers, Dumfries.

ILFORD.—Hospital (£6,920). Builder, H. J. Carter, Grays.

KEIGHLEY.—School (£5,000). Architect, A. P. Harrison, 136 Highfield Lane, Keighley.

LAINDON.—School (£1,700). Architect, C. M. Shiner, 10 John Street, Adelphi, W.C. Builder, G. Brown, Grays.

LARNE.—Carnegie Library (£4,000). Architect, W. P. Clarke, Castle Street, Liverpool.

LEEK.—Territorial buildings (£2,890). Architect, G. C. Cowlishaw, Hanley. Builder, T. Godwin, Hanley.

LEVENSHULME.—Primitive Methodist Church (£1,200). P. M. Trustees, Levenshulme.

LUDLOW.—School (£2,130). Builder, T. Vaughan, Hereford.

Fire Station. Surveyor to Town Council.

NUNEATON.—Library. Borough Surveyor.

PENGE.—Extensions to Council Offices (£3,500). Surveyor, U.D.C.

SUNDERLAND.—Boys' Industrial School (£2,000). Architect, G. W. Bain, John Street, Sunderland.

SWANSEA.—Girls' Intermediate School. A. W. Halden, Secretary, Swansea Education Committee.

WEST HAM.—The Clarkson Street school is to be fitted for electric lighting at an estimated cost of £300.

TENDERS RECEIVED AND ACCEPTED

AUSTRALIA.—The New South Wales Government Railways, Sydney, have provisionally accepted a tender for a 6,000-kw. turbo-alternator and condensing plant from Messrs. Willans & Robinson, Ltd., Rugby.

BELFAST.—The tender of Messrs. Babcock, Wilcox & Co. has been accepted for two water-tube boilers, economisers, and stokers.

DEVONPORT DOCKYARD.—The Admiralty have accepted a tender for two 1,200-kw. direct-current turbo-dynamos and condensing plant from Messrs. Willans & Robinson, Ltd., Rugby.

LONDON: *London County Council.*—The tender of Messrs. Johnson & Phillips, Ltd., has been accepted for the electric lighting at the Cow Lane School, Rotherhithe.

The tender of Messrs. P. & W. Maclellan at £12,386 for the supply of slot rails and conductor tees having been withdrawn, the tender of the Frodingham Iron & Steel Co., Ltd., at £12,798 17s., is now recommended for acceptance by the Highways Committee.

The tender of the British Electric Transformer Co., Ltd., has been accepted for the supply of two static transformers for tramway sub-stations at £429 10s.

Shoreditch.—The Guardians have accepted the tender of the James Keith & Blackman Co., Ltd., at £55, for an electric fan with hoods in the laundry.

GOVERNMENT CONTRACTS.—The following tenders have been accepted by the Government departments named:—War Office: Incandescent electric lamps, British Tungsten Lamp Co., Ltd., Cryselco, Ltd., General Electric Co., Ltd.; installation of electric light at Stanhope and Marlborough lines, Aldershot, J. B. Saunders & Co. General Post Office: Paper-core cable, Callender's Cable & Construction Co., Ltd., Henley's Telegraph Works Co., Ltd., Johnson & Phillips, Ltd., Western Electric Co.; glow lamps, Edison & Swan, United Electric Light Co., Ltd.; twelve electric lifts at new G.P.O., King Edward Street, E.C., and five electric lifts at head P.O., Bristol, R. Waygood & Co., Ltd.; electric lighting of Sheffield new head P.O., W. S. Vaughton; electric lighting of block B of Postal Telegraph Stores Depôt, Cherrywood Road, Bordesley Green, Birmingham, Beaven & Sons, Ltd.; electric storage battery at G.P.O. (West), E.C., the Electrical Power Storage Co., Ltd.; electrical Switchgear at King Edward Building, G.P.O. (West), and G.P.O. (South), E.C., British Thomson-Houston Co., Ltd.; motor converters, &c., at G.P.O. (West), E.C., Bruce Peebles & Co., Ltd.; steam exhaust, feed, &c., pipework at P.O. Central Power Station, Upper Ground Street, S.E., Aiton & Co.

Glasgow Telephone System.—An arrangement has been arrived at between the Post Office and the National Telephone Co., as a result of which there will be no active competition between these concerns in Glasgow so far as canvassing for new subscribers is concerned. A number of the Post Office canvassers have been transferred to the company, who will do all the canvassing that may be required up till the end of 1911, when the Post Office will take over the system.

Interruption to Supply at Bristol.—Through the breakdown of a selector switch on a switchboard in the Avonbank station of the Bristol Corporation Electricity Department, a large section of the single-phase lighting supply in the City and Clifton districts was interrupted on Friday evening last for nearly an hour. The offical report issued by Mr. H. Faraday Proctor (City Electrical Engineer) states that this particular board is divided into two sections, and that selector switches are provided so that any machine can be connected to either section. One of these switches broke down and put the bus-bars to earth, and it was not until this was localised and the switch was isolated that the whole supply could be restored. No damage was done apart from that to this switch, and the whole of the trouble consisted in the inconvenience and annoyance caused to the consumers. The street-lighting, which is fed from another section of the plant, was unaffected, but several business premises, hotels, and theatres suffered considerable inconvenience.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £61 15s. to £62 5s. per ton (last week, £61 10s. to £62 5s.).

B.T.-H. CARDIFF BRANCH.—The British Thomson-Houston Co., Ltd., Rugby, have opened a branch office at Royal Chambers, Cardiff, to care for their business interests in the South Wales district.

LONDON OFFICE.—Messrs. Nortons (Tividale), Ltd., colliery equipment specialists, have opened a London office at 145 Cannon Street, E.C., which will be in charge of Mr. C. J. Seaman, who recently resigned the position of general manager and managing director of Messrs. Heenan & Froude.

CANADIAN AGENCIES WANTED.—A London firm manufacturing electrical frequency indicators and vibration tachometers wish to open up Canadian business.

A London firm of engineers manufacturing a trolley standard earthing device, two-blade rail cleaners, tangential suspension gear for overhead lines, suspension gear for E.H.T. transmission lines, block signalling apparatus, switchgear, &c., for street railways, &c., desire to appoint Canadian representatives.

Inquiry is made by a firm at Manchester manufacturing electric light and power machinery and accessories, main switches and switchboards, &c., for the names of Canadian firms open to take up their agency.

A London engineer with Colonial experience asks to be placed in touch with United Kingdom manufacturers of machinery, cranes, electrical goods, &c., requiring a representative at Toronto, to which city he is shortly proceeding.

Full particulars of these inquiries may be obtained from the offices of the High Commissioner for Canada, 17 Victoria Street, London, S.W.

A London company manufacturing electric twinkling signs wishes to be placed in communication with Canadian importers.

A firm covering British Columbia and Western Canada seek the sole agency of United Kingdom manufacturers of electric light fittings, lamps, &c.

Full particulars from Board of Trade, City Trade Branch, 73 Basinghall Street, London, E.C.

PLANT FOR SALE.—Brighton Corporation have a quantity of second-hand electrical plant for sale. (See an advertisement on another page.)

AGENCY.—Messrs. Nalder Bros. & Thompson, Ltd., have appointed Mr. Arthur P. Haslam, of Suffolk House, Laurence Pountney Hill, London, their representative for the sale of limiters, telethermometers, etc., in the London district.

COMPANIES' MEETINGS AND REPORTS

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS CO.—The accounts for last year show a profit of £40,470. After meeting debenture interest, sundry reserves, and reserve against Lofthouse Park, Ltd., a balance of £9,654 is carried forward.

At the meeting last week, Mr. H. S. Leon said the directors were considering the adoption of trolley omnibuses, but as the Sheffield Corporation had applied for Parliamentary powers to do this, they thought it best to wait and judge by Sheffield's experience in the matter.

ST. JAMES & PALL MALL ELECTRIC LIGHT CO.—The net profit for 1909 was £29,025, and after meeting the 7 per cent preference dividends and 10 per cent. on the ordinary shares, there is a balance of £2,025 to be carried forward. The company generated 5,587,351 units, and purchased 5,764,690 units from the Central Electric Supply Co.

At the meeting last week, Mr. Walter Leaf said it was estimated by their officials that about half their consumers had changed over to metal filament lamps, and that it would take two years for the process of changing over to be completed.

BRUCE PEEBLES & CO.—There is a loss of £5,683 for the period from December 5th, 1908, to December 31st, 1909, to which has to be added the interest on first and second debentures, making a debit balance of £12,981. The directors are of the opinion that great progress has been made in obtaining licences and developing new manufactures, and certain arrangements have been completed which it is anticipated will materialise in the near future.

Mr. F. E. Andrews, who presided at the meeting last week, said the cash position of the company was strong. They had pushed their foreign trade on the spot, which the directors thought was better than sitting at home and grumbling and waiting for legislative reforms which, although doubtless would help the electrical industry, would probably, after all, not prove a panacea for all the evils of cut-throat competition, insensate jealousy, and excess of productive capacity, from which electrical engineering works were at present suffering.

YORKSHIRE ELECTRIC POWER CO.—The report and accounts given in our issue for February 3rd were adopted at the meeting last week. Mr. A. G. Lupton, who presided, said that the most satisfactory feature of the year was the increase of the motors connected by firms already on the mains, quite apart from new consumers. He was pleased to say that the promoters of a number of Bills which affected the company's interests had agreed to modifications which would render it unnecessary to oppose any of them.

BRISTOL TRAMWAYS & CARRIAGE CO.—At the meeting last week, Sir George White said the absolute lack of expansion of the company's traffic indicated that they were practically at the limit of tramway riding in Bristol. He then mentioned that himself and his brother intended to develop aviation in Bristol, and had already ordered several aeroplanes. It was their hope to establish the manufacture of these machines in Bristol, but in the first place it was proposed to hold demonstrations which would undoubtedly attract people from all parts and add to the tramway traffic.

LONDON UNDERGROUND ELECTRIC RAILWAYS.—The half-yearly meetings of the Baker Street & Waterloo, Great Northern, Piccadilly & Brompton, and Charing Cross, Euston & Hampstead Railways were held on Thursday, when the reports and accounts given in our last issue were adopted. The scheme for amalgamating the three companies was approved.

NATIONAL TELEPHONE CO.—The gross profit for the December half-year, after deducting Post Office royalties amounting to £153,857, was £523,440, an increase of £27,802 compared with the corresponding period of 1908. The following dividends are recommended:—First and second preference shares, 6 per cent. per annum; third preference shares, 5 per cent. per annum; preferred stock and deferred stock, 6 per cent. per annum, less tax in all cases.

SOUTH METROPOLITAN ELECTRIC LIGHT & POWER CO.—The sum of £1,106 is carried forward from 1909 after meeting debenture interest, full dividends on the 7 per cent. and 6 per cent. preference shares, adding £6,500 to depreciation and writing £1,500 off preliminary expenses. In spite of an increase in the number of consumers, the revenue of the year was less owing to the use of metal filament lamps. In order to meet the requirements for supply in an adjoining district the West Kent Electric Co., Ltd., was registered, and has taken over certain of the powers of the Kent Electric Power Co., Ltd., for an area between Northfleet, Sevenoaks, and London. An agreement has been entered into to give a bulk supply, and arrangements have been made for the Company to work the undertaking and to subscribe £10,000 share capital of the West Kent Electric Co., Ltd., one half of which will be for laying mains for the supply of electricity in the Bromley Rural district, where a number of orders have already been obtained.

REES ROTURBO MANUFACTURING CO.—At the meeting last week, when the report and accounts given in our last issue were adopted, the chairman stated that there was no intention—as had been suggested—of the company abandoning the electrical portion of their business.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—W. T. Henley's Telegraph Works Co., 15 per cent. for 1909. Charing Cross, West End & City Electricity Supply Co., 5 per cent. for 1909.

London Electric Wire Co. and Smiths; 10 per cent. for 1909. Newcastle & District Electric Lighting Co., 3 per cent. for 1909, carrying forward £2,938. W. T. Glover & Co., 5 per cent. on the ordinary shares for 1909. Adelaide Electric Supply Co., 6 per cent. on the preference shares for half-year to Feb. 28th.

Bournemouth & Poole Electricity Supply Co., 5½ per cent. for 1909.

BRITISH COLUMBIA ELECTRIC RAILWAY CO.—Subscriptions are invited for £530,000 4¼ per cent. perpetuated consolidated debenture stock.

EVERSHED & VIGNOLES.—Mr. A. Schneider, M.A., who has been associated with the management of this company since its commencement, has been appointed a managing director.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. R. Chapman, chief electrical engineer to the Underground Electric Railways Co., of London, Ltd., has resigned, and intends to return to America.

The salary of Mr. W. E. Ireland, rolling stock superintendent to the L.C.C. tramways, is recommended to be increased from £450 to £500 per annum.

Mr. E. W. Dickinson, superintendent of the L.C.C. generating station at Greenwich, is recommended for an increase in salary from £400 to £450 per annum.

Mr. T. L. Horn, resident electrical superintendent for the northern section of the L.C.C. tramways, is recommended for an increase in his maximum salary from £350 to £375 per annum.

Mr. J. R. Walker, charge engineer at the L.C.C. Greenwich power house, is recommended for promotion as senior charge engineer with a salary of £280 per annum, rising to £300 in April, 1911. Mr. Walker's present salary is £250 per annum.

It is recommended that the salaries of Messrs. J. P. Dudin, O. A. Pilcher, and E. W. L. Nichol, charge engineers at the L.C.C. Greenwich power house, shall be increased from £250 to £270 per annum

Mr. A. A. Voysey, the electrical engineer and inspector of the City of London Corporation, is seriously ill and has been granted twelve months leave of absence. If at the end of that period he is unable to resume his duties he is to be granted a retiring allowance of £100 per annum during the pleasure of the Corporation.

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ELECTRICAL ENGINEERING

No. 166 [Vol. VI., No. 9] THURSDAY, MARCH 3, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.

Canada. 8s. 8d. per Annum.

Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

Our monthly supplement on "Electrical Engineering in Mines" is included in this issue. After some correspondence relating to the novelty of a recently described leakage device and on the fixing of shaft cables, an account is given of a series of experiments on electricity and coal dust explosions. The formation of a Cumberland branch of the Institution of Mining Electrical Engineers is recorded, and a new design of enclosed air-cooled mining motor is described and illustrated. Other novelties, of which particulars are given, include a new shot-firing generator, and a watertight magneto mining telephone. Discussions on electric shocks at six of the branches of the Institution of Mining Electrical Engineers are reported, and a summary is given of electrical mining patents which have been published during February.

A new set of regulations has been issued by the Home Office under the Cinematograph Act, which remove the cause for misunderstanding of the clause as to the maximum voltage inside the enclosure. The 110-volt limit is only to hold when the lamp is at work, and does not apply to open circuit voltage. (Page 149.)

A useful handbook to the Home Office Regulations regarding the generation and use of electricity in premises coming under the Factory Acts, has been issued, in which explanatory notes and recommendations as to how the requirements may be met are given, together with valuable advice as to the avoidance of danger, founded on the experience of H.M. Electrical Inspector of Factories. (Page 149.)

A fire on Tuesday night damaged a portion of Messrs. Johnson & Phillips works at Charlton. (Page 150.)

We publish two letters from correspondents regarding the usefulness of the library of the Institution of Electrical Engineers. (Page 150.)

Accounts are given of inquiries into several accidents in mines attributed to electrical causes. (Page 151.)

The annual dinner of the Manchester Local Section of the Institution of Electrical Engineers was held on Friday last. Dr. Kapp emphasised the importance of the Council refraining from interfering unduly in business or political matters. The Chairman, Mr. S. J. Watson, suggested that each Local Section should have four, instead of only one, representative on the Council, and announced that the Manchester Section was considering the holding of a conversazione in that town. (Page 152.)

The second festival dinner in connection with the Electrical Trades' Benevolent Institution was held on Wednesday of last week. The funds now amount to £2,089 invested and over £300 in cash. A sum of £63, or somewhat less than the interest on the funds, was spent during the year in relieving five necessitous cases. The general opinion of those who spoke was that it would not be desirable to amalgamate this In-

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stitution with the Benevolent Fund of the Institution of Electrical Engineers. (Page 152.)

ON Monday last Mr. Justice Parker delivered judgment in the action brought by the Donnersmarckhütte against the Electric Construction Co., Ltd., for alleged infringement of the Ilgner Patent of 1902, for the electrical driving of reversing rolling mills. His Lordship considered that the defendants had applied the idea expressed in the Ilgner specification, but held that the patent was invalid. He considered the combination of a flywheel with the motor-generator of the Ward-Leonard system fairly obvious, and conversely suggested that Ferranti would have naturally applied the Ward-Leonard system of control in conjunction with his flywheel motor-generator, patented in 1895, had be desired to apply it to the driving of reversing rolling mills. He therefore concluded that the patent was invalid for want of subject matter, and the action for infringement failed. (Page 153.)

THE appeal of "Dr." Walford Bodie against the judgment of Mr. Justice Darling, ordering him to repay the sum of £1,000 which he received from a pupil, was dismissed on Thursday, after some strong remarks by the Master of the Rolls and Lords Justices Fletcher Moulton, and Buckley. (Page 153.)

AMONG the specifications published by the Patent Office on Thursday last was one by A. H. Curtis and the Adams Manufacturing Co. for a resistance unit in which the zig-zag metal strip is under tension.—The British Thomson-Houston Co. describe a process of producing a tungsten powder mixture for manufacturing filaments. No baking treatment is required, as the squirted threads are conductive.—The same firm has a specification for a method of constructing commutators for high-speed machines. The air is expelled radially between the segments.—L. J. Hunt and the Sandycroft Foundry Co. describe a form of cascade induction motor in which two economical speeds are obtained by employing slip-rings on the rotor which are short-circuited for the high speed.—A patent for a load-equaliser, comprising a flywheel coupled to an induction motor automatically controlled by a commutator motor, has been granted to the A. G. Brown, Boveri & Cie., in spite of opposition. The grant of a patent to C. H. Weber for a process for treating tungsten powder with pyridine before squirting into filaments, is opposed. A patent by A. Smith and T. Deakin for an electroplating apparatus for obtaining a bright deposit in one operation expires on Wednesday next after the full life of fourteen years. (Page 154.)

IT is stated that a saving of £2 16s. per lamp per annum has been arrived at by replacing the arc lamps in the Grove, Hammersmith, with 400 c.p. Osram lamps fitted in the same lanterns. (Page 155.)

UNDER Electrometallurgy and Electrochemistry are some notes from a Paper by A. Grönwall, dealing with the occasional non-homogeneity of electric steel. This is attributed to unequal heating, and the relative possibility of this effect in the different types of furnace are discussed. A new two-phase furnace, for which a good circulation and homogeneous mixing are claimed, is also described. (Page 155.)

THE Guernsey State Telephone accounts show a net profit of £436 for last year.—The Halifax Corporation will shortly have placed before it important recommendations relating to the management of the tramways and electricity undertakings.—Mr. A. H. Dykes, late chairman of the Beckenham Electricity Committee, refers to the large loss which is being made on the "free" wiring scheme of the Council.—A trolley omnibus company has made a proposal to instal electricity works and to run cars at Macclesfield.—Leicester tramway accounts show a net profit of £10,699 for last year.—The Hampstead Borough Council contemplate converting all their street gas lamps to metal filament lamps. (Page 156.)

EXTENSIONS are contemplated as follows:—Falkirk, £12,000; Londonderry, £9,000; Fulham, £6,880; Rhyl, £4,000; Stepney, £16,300; Shoreditch, £2,234; Islington, £4,778; Hackney, £7,137; Walthamstow, £1,210. New generating plant is to be installed at Heston and Isleworth, and Warrington. The Belfast Harbour Commissioners require 22 arc lamps. (Page 156.)

AT the meeting of the British Electric Transformer Co. last week a scheme of co-operation between transformer makers was referred to.—The Rosario Electric Company's shareholders have sanctioned a scheme for purchasing the undertaking at a large premium.—Negotiations for purchasing the National Telephone Company's undertaking before 1911 have fallen through.—A dividend at the rate of 15 per cent. is recommended on the ordinary shares of W. T. Henley's Telegraph Works Co. (Page 157.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MARCH 3RD.

Royal Institution

3 p.m. Afternoon Lecture III., "Illumination: Natural and Artificial," by Prof. S. P. Thompson, F.R.S.

Rontgen Society.

8.15 p.m. At 20 Hanover Square, London. (1) "Dental X-ray Technique," by C. A. Clark; (2) "Radium Collector for Atmospheric Electricity," by F. H. Glew.

FRIDAY, MARCH 4TH.

Northampton Institute Engineering Society.

5.45 p.m. At the Institute. "D.-C. Liquid Starters," by J. K. Hwoo.

Electro-Harmonic Society.

8 p.m. Last Smoking Concert of the season at Holborn Restaurant.

SATURDAY, MARCH 5TH.

Royal Institution.

3 p.m. Afternoon Lecture IV., "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson, F.R.S.

P. and O. Batti-Wallahs Society.

6.30 for 7 p.m. Annual Dinner at Holborn Restaurant.

TUESDAY, MARCH 8TH.

National Electrical Manufacturers' Association.

2.30 p.m. Committee Meeting at Balfour House, Finsbury Pavement, London.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "The Short-Circuiting of Large Electric Generators and the Resulting Forces on Armature Windings," by Miles Walker.

WEDNESDAY, MARCH 9TH.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. At the University. "Some Notes on Standardisation of Electrical Machines," by R. Orsettich.

THURSDAY, MARCH 10TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. (1) "Short-Circuiting of Large Electric Generators and the Resulting Forces on Armature Windings." (2) "The Design of Turbo-Field Magnets for A.-C. Generators, with Special Reference to Large Units at High Speeds," by Miles Walker.

FRIDAY, MARCH 11TH.

Physical Society.

8 p.m. At Imperial College of Science. (1) "On Coherers," by Dr. W. H. Eccles. (2) "Earth-air Electric Currents," by G. C. Simpson.

SATURDAY, MARCH 12TH.

Royal Institution.

3 p.m. Afternoon Lecture V., on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson, F.R.S.

The Society of Engineers.—We have received a detailed statement with regard to the amalgamation of the Society of Engineers and the Civil and Mechanical Engineers' Society. The new body is called The Society of Engineers (Incorporated), and a Memorandum and Articles of Association, together with a new set of bye laws, have been drawn up, which embody several reforms. Reports of the discussions are also to be published in the *Journal* much more promptly than heretofore. Mr. A. S. E. Ackermann, who was secretary of both constituent bodies, continues in that capacity to the new society.

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NEW CINEMATOGRAPH REGULATIONS

A NEW series of regulations (dated February 18th) has been issued by the Home Office under the Cinematograph Act, and will be welcomed by supply authorities as clearing up the much-discussed point of the voltage permissible inside the fireproof enclosure containing the apparatus. The former regulations (dated December, 1909), which are now superseded, contained the clause: "No current at a higher pressure than 110 volts shall be used inside the enclosure," and, interpreted literally, would entail (as Mr. S. J. Watson pointed out at a recent meeting of the Manchester Local Section of the Institution of Electrical Engineers) the use of a motor generator when the lamps were worked from a 440-volt or even a 220-volt supply. It was held by many, however, that the real object of the rule was to exclude large series resistances from the enclosure, and that it was not intended to apply to open circuit voltages, but to actual potential differences when the lamp was alight. That this was the correct interpretation of the rule is shown by the new clause reading as follows: "When the cinematograph lamp is working, the pressure of the current across the terminals of the double pole switch inside the enclosure shall not exceed 110 volts." There may, of course, be cases in which the use of a motor-generator may be justified on the score of economy of power, but its use is not in any way compulsory.

The earlier part of the rules has been slightly rearranged, and extended mainly as regards general precautions to be taken against fire, and the section regarding electric lighting enters into greater detail and is in several ways more explicit, besides imposing further responsibility as regards the state of the electrical apparatus upon the operator.

The new section on lighting, so far as it relates to electric lighting, is given in full below.

Where the general lighting of the auditorium and exits can be controlled from within the enclosure, there shall also be separate and independent means of control outside and away from the enclosure.

Within the enclosure the insulating material of all electric cables, including "leads" to lamps, shall be covered with fire-resisting material.

There shall be no unnecessary slack electric cable within the enclosure. The "leads" to the cinematograph lamp shall, unless conveyed within a metal pipe, or other suitable casing, be kept well apart both within and without the enclosure, and shall run so that the course of each may be readily traced.

Cables for cinematograph lamps shall be taken as separate circuits from the source of supply and from the supply side of the main fuses in the general lighting circuit, and there shall be efficient switches and fuses inserted at the point where the supply is taken, and in addition, an efficient double-pole switch shall be fitted in the cinematograph lamp circuit inside the enclosure. When the cinematograph lamp is working, the pressure of the current across the terminals of the double-pole switch inside the enclosure shall not exceed 110 volts.

Resistances shall be made entirely of fire-resisting material, and shall be so constructed and maintained that no coil or other part shall at any time become unduly heated (*e.g.*, they should not become so heated that a piece of newspaper placed in contact with any part of the resistance would readily ignite). All resistances, with the exception of a resistance for regulating purposes, shall be placed outside the enclosure, and, if reasonably practicable, outside the auditorium. If inside the auditorium they shall be adequately protected by a wire guard or other efficient means of preventing accidental contact.

The operator shall satisfy himself before the commencement of each performance that all cables, leads, connections, and resistances are in proper working order. The resistances, if not under constant observation, shall be inspected at least once during each performance. If any fault is detected, current shall be immediately switched off, and shall remain switched off until the fault has been remedied.

Royal Meteorological Society.—This Society held its first meeting out of London on Wednesday, February 23rd, at the Physical Laboratory of the Manchester University. The Vice-Chancellor of the University welcomed the Society. Among the papers read was one by Mr. A. J. Makower and Miss Margaret White on the "Investigation of the Electrical State of the Upper Atmosphere," made at the Howard Estate Observatory, Glossop.

THE HOME OFFICE REGULATIONS FOR FACTORIES AND WORKSHOPS

A USEFUL handbook to the Home Office regulations for the generation, transformation, distribution, and use of electrical energy in premises under the Factory Acts has been issued in the form of a "memorandum," by Mr. G. Scott Ram, H.M. Electrical Inspector of Factories. This booklet deals with the regulations paragraph by paragraph, and is intended to assist occupiers and others in complying with the regulations by explaining in detail what precautions are required in the case of various types of installations, and in what circumstances exemption may be claimed. It will probably also be of considerable use in the education of factory inspectors without previous electrical experience, upon whom the enforcement of the regulations devolves. Incidentally, the publication is of interest as showing the official view taken as to the objects and interpretation of some of the clauses about which there has been a good deal of discussion.

It will be remembered that when a draft of the complete code of proposed regulations was put forward by the Home Office as a basis for discussion in August, 1907, much opposition was aroused, and in consequence Mr. James Swinburne, F.R.S., was appointed commissioner to conduct an inquiry, at which an opportunity of expressing their views was given to objectors. This inquiry, of which a full report was given at the time in ELECTRICAL ENGINEERING, continued for 10 days during March and April, 1908, and a provisional code was agreed upon as a sort of compromise between the different objectors. Mr. Swinburne issued his report in the following January, putting forward a further revised code, and this was adopted without alteration by the Home Office and came into force on July 1st, 1909, except as regards such parts of stations as were constructed before July 1st, 1908, in respect of which the provisions took effect at the beginning of the year. The regulations were given in full in ELECTRICAL ENGINEERING, Vol. V., page 57 (Jan. 21st, 1909).

The regulations apply to all premises coming under the Factory Acts, and thus embrace all generating stations supplying electricity "by way of trade," or giving a supply to any factory, but do not apply to railway and tramway stations generating electricity for power purposes only. If a lighting supply, however, is given, the station comes within the scope of the regulations. Generally speaking, they do not apply to street mains or transmission lines or to transforming pits other than actual sub-stations, or to inspection boxes on the line of such mains.

It appears to be required by the Factory Act that printed copies of the regulations should be posted up in all premises affected, and abridged copies of the regulations, containing all that apply in particular cases, can be obtained from factory inspectors. The exemptions are gone into at some length in the handbook, and it is shown how the applicability of some of the more important sections depends in certain cases practically on whether part of the system is earthed or not. This is of particular importance in connection with 25- or 50-volt auto-transformers for metal filament lamps. Subsequently to the issue of the regulations, an order has been made (under Exemption 3) which gives complete exemption to rooms in which electricity is used for lighting only at "low" pressure (*i.e.*, not exceeding 250 volts).

Many very practical notes are given under each individual regulation, throwing light on questions as to what methods will be especially regarded as "necessary to prevent danger," "efficient means," "reasonably practicable," or "adequate," and here, as is done annually in his report, the inspector places much of his valuable experience as to the causes of accidents at the disposal of those in charge of installations. Dangerous designs of switches and fuses are described, so that they may be avoided, and advice is given as to the rating of fuses and sub-divisions of circuits. In the same way, the regulation requiring means for switching off motors and stopping machines in case of danger is dealt with, and means are suggested which may be adopted to effect this. No recommendation is made, however, as to the provision of no-voltage releases to alternating-current motors, a requirement which, it will be remembered, was to have been compulsory under the original draft regulations. The section on portable apparatus connected to flexible leads is particularly worth reading. The danger of the ordinary patterns of wall plugs, except for lighting circuits, is insisted upon, and hints are given as to the construction of a satisfactory plug,

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which in Mr. Ram's opinion should be made for the leads to enter from below and not at the side, and should be provided with a guard disc between the handle and the contact pieces. In the cases where earthing the portable apparatus is required, the importance of arranging that, in plugging in and out, the earth connection is made before and broken after the circuit connections is emphasised, but methods of construction for hand lamps, switch lampholders, &c., with no exposed metal work are suggested, which obviate the necessity for such earthing.

The much-discussed switchboard regulations are commented on and explained in like manner, and it is made quite clear to what cases the limiting breadths of passage-way specified apply. In connection with Regulation 21, which requires adequate precautions to be taken either by earthing "or by other suitable means" to prevent any metal other than the conductor from becoming electrically charged, it is admitted that earthing has generally to be resorted to, as "other suitable means" are not often practicable. Various hints are given as to suitable methods of earthing in different circumstances, and considerable detail is gone into, as, for example, the recommendation that the rails of travelling cranes should be bonded. The remaining sections are treated in a similar manner, and a useful index of the subject-matter is provided. The memorandum is obtainable from Messrs. Wyman & Sons, Fetter Lane, E.C., or the usual agents, at the price of 3d.

FIRE AT MESSRS. JOHNSON AND PHILLIPS' WORKS

WE are glad to be able to inform our readers that the reports which appeared in the daily Press yesterday morning of a disastrous fire at the Victoria Works of Messrs. Johnson & Phillips, Ltd., of Charlton, were of a much exaggerated nature. From a personal inspection of the works yesterday we can state that the damage is confined to the top floor of the new two-storey building erected on the site of the fire some four years ago. On this floor are a large number of wire-braiding machines, and these have been completely destroyed, but as they represent only a portion of the plant of this nature, the fire will have no effect on the business of the firm.

The ground floor of the building in question is devoted to the braiding of large cables, and though this is littered with the débris of the floor and roof, men were actively engaged yesterday morning in removing this and cleaning the machinery, and it is expected that work will be resumed with these machines some time to-day. The steel and brickwork of the building are practically undamaged, but it will be necessary to reconstruct entirely the roof and the wood floor, and to install new wire-braiding machinery. When the fire broke out (about 8 o'clock on Tuesday evening) there was no one on the top floor, but men were working below. Had they had a sufficient pressure of water they could have easily extinguished the fire before any serious damage was done, but as water could not be carried up in sufficient quantities the fire had obtained a firm hold before the local brigade arrived. There were two or three drums of completed cable on the ground floor, but these have suffered no damage whatever. The wire-braiding machines are attended to by girls, and as only one girl is required for several machines, some twenty girls only will be throw out of employment. The cause of the fire has not been ascertained. Both the motors and lamps on the upper floor were switched off at the time of the outbreak, and the wiring was of the most modern description in steel conduit.

New System of Lead Jointing.—In our article describing the Metal Jointing Co.'s new system of jointing for lead-covered cables on p. 140 of our last issue, we said that the time for plumbing a large telephone cable is said to be reduced *by* about 30 minutes. This should have been "reduced *to* about 30 minutes."

Electrical Control of Ordnance.—In reply to a question by Lord C. Beresford in the House of Commons on Wednesday of last week, Mr. McKenna stated that H.M.S. *Invincible* was fitted with electrically-worked turrets, as an experiment. Two turrets were so equipped by different firms, but whilst working up for gunlayers tests last year numerous failures occurred with one of the gears, and in June certain modifications were decided upon by arrangement with the makers. In November last it was found that these modifications did not meet all the defects, and further alterations were made during December. As, however, the ship was an experimental one so far as the working of the turrets was concerned, the Government thought it very important that ample time should be given in order to get a fair comparison with the hydraulic system.

CORRESPONDENCE

THE INSTITUTION LIBRARY.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I have read with considerable interest "Londoner's" letter on above subject, and venture to submit the opinion that the statistics which he gives are a remarkable vindication of the urgent need that exists for increasing the usefulness of the Institution Library. At present the library is a reference library pure and simple, and the fact mentioned by "Londoner" that only 1·5 members per day use it as such is eloquent testimony that an alteration is desirable.

The suggestion offered was that the Council should take steps to alter its character and make it a Lending Library for all members. There is no reason to doubt that if this concession were granted, a much freer use would be made of the "most complete library of electrical science in England," not only by provincial members, but by London members as well.

I would point out that the recently formed Institution of Post Office Telegraph Engineers have such a lending library, and the members are encouraged to, and do, make considerable use of it.

In reply to "Londoner's" last paragraph, what is the benefit of being connected with the Institution of Electrical Engineers if you have to apply to a public library to grant facilities which the Institution ought to grant?

Yours faithfully,
Feb. 28th, 1910. ASSOCIATE MEMBER.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I am afraid that the figures given by your correspondent "Londoner" in your last issue, *re* the above, completely spoils his own case, because if they prove anything at all they simply prove that the library is not specially needed by Londoners, and is indeed neglected by them.

This is, of course, only what one might reasonably expect, seeing that within the environs of the metropolis there are so many and varied means of consulting the latest technical literature without having recourse to the Institution Library, but the ridiculously small number of readers who at present avail themselves of the Institution Library, as given by your correspondent, really makes it all the more difficult to understand on what grounds the present Lhassa-like seclusion of the library can be justified.

The remarks of "Londoner" advising provincial members to petition library committees in their respective towns to procure them any technical literature which might be required, is delightfully simple and delightfully absurd, and beside the question. The points as raised by your correspondents, "Associate Member" and "Provincial," and to which "Londoner" objects, is: Why should not all members of the Institution within the postal limits of the United Kingdom, who pay precisely the same annual subscriptions, have precisely the same facilities with regard to the Institution Library, subject, of course, to certain safeguards as to deposits, &c., which are merely a matter of detail, and I think that there can only be one answer to that question by any unbiassed person.

If the Institution Library was thrown open to all members alike, it would remove a sore point with a good many provincial members and prospective members, and at the same time the Institution would of a verity be carrying out its Articles of Association in "assisting in the advancement of electrical and telegraphic science and its application."

Yours truly,
Feb. 28th, 1910. J. E. D.

Message Recording Attachment for Telephones.—Three Danish engineers, MM. Dessau, Nyrop, and Thomsen, recently made public in Copenhagen a new invention by which any telephone subscriber can, in the absence of the called subscriber, send a telegraphic communication. The apparatus at the transmitting end comprises a keyboard like that of an ordinary typewriter, and the message is received at the other end on a tape printed in ordinary characters. It is stated that M. Johansen, manager of the Copenhagen Telephone Co., was very favourably impressed with the working of the device.

Competition *re* Method of Earthing.—Further particulars are to hand with regard to the £400 prize offered by the Italian Minister of Agriculture, Industry, and Commerce, referred to in our issue of Feb. 3rd, for an essay on efficient methods of earthing. Both the theoretical and the practical aspects of the subject must be dealt with, and the following points must be considered:—(1) The phenomena which occur when an electric circuit is earthed at any point; (2) the influence of the nature and composition of the ground at the earthing point; (3) the influence of the pressure and nature of the current; (4) the result and effectiveness of an earth, whether intentional and permanent or due to pressure rise; and (5) means of maintaining and testing earthing connections. The study, which must be written in either French or Italian, and must contain experimental data, must be submitted on or before December 31st, 1910.

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ELECTRICAL ENGINEERING
IN
MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "The Editor, Electrical Engineering, 203-206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

CORRESPONDENCE

A SAFETY GATE-END SWITCH FOR MINES.

To the Editor Electrical Engineering.

Sir,—May I draw your attention to the description of Mr. Fisher's switch contained in your paper of February 3rd? A full description of the leakage device marked D is contained in Patent No. 17161/08, entitled "Leakage Indicator for Mines" (See Electrical Engineering, July 22nd, 1909, page 678). This arrangement, adapted to an ordinary mining switch, has been in use since March, 1908.

This may be of use or interest, seeing that many are putting forward these arrangements as something new.

Yours truly,

T. McKie.

Ashington, Northumberland.
February 3rd, 1910.

CABLES IN SHAFTS AND MAIN HAULAGE WAYS.

To the Editor of Electrical Engineering.

Sir,—I read with interest the discussion on my article on the above. In reply to the first contribution, I may say I am quite aware of the corrosive waters met with in some shafts, but this does not refer to all shafts. If such waters exist in a shaft, the cables must be frequently coated with some preservative compound.

The eating away of the armouring of the cable mentioned may have been caused by corrosive effects due to chemical action, but it could also have been caused by electrolytic action, due to stray currents flowing between different points of the earth. Serious damage is known to have been caused to the armouring of cables from this source. It is well to remember that this action is much more pronounced in D.-C. cables.

I am rather surprised to find "One who has had experience" suggest the use of a 3 ft. 6 in. wood clamp in preference to the 1 ft. clamp, because there will be more cable surface covered, hence the greater action. In the latter part of the discussion he mentions the importance of insulation tests. I quite agree with him, for these are very important, but I must remind him of the difference he will find in the results at varying temperatures.

In reply to Mr. Preece's discussion, the steel tape armoured cable referred to was meant to be the well-known lock-coil armouring.

I may say I have not had any experience with the solid three-core bitumen cable, neither have I had any trouble, such as Mr. Preece mentions, with the jute-filled cables. I don't say that what he says is impossible, but I know that the same quality of cable is working under severe conditions; some of it is lying in the bed of a river.

I admit that Mr. Preece's cable will have a higher insulation resistance and dielectric strength, owing to the increased (insulation) distance between the cores and armouring; the only drawback is that this cable will have a larger electrostatic capacity.

Feb. 28th, 1910. J. P. Simpson.

Revision of the Special Rules.—The Departmental Committee appointed by the Home Secretary to inquire into the working of the existing special rules for the use of electricity in mines will commence hearing evidence on Tuesday next, March 8th. The committee is composed of three members, Mr. R. A. S. Redmayne, H.M. Chief Inspector of Mines, Mr. C. H. Merz, and Mr. Robert Nelson, H.M. Electrical Inspector of Mines, and will meet at the Home Office, Whitehall; the proceedings will be strictly private.

ELECTRICITY AND COAL-DUST EXPLOSIONS

On Monday, the 21st ult., at an informal meeting of the members of the Newcastle Local Section of the Institution of Electrical Engineers, Prof. W. M. Thornton (Armstrong College) gave a demonstration upon explosions of coal-dust caused by electricity, a subject which is to form the basis of a further communication at a later date.

Dr. Thornton proposed to show a series of experiments which might give answers to the following questions:—How do direct currents and alternating currents compare for safety; what are the values of voltage and current at which danger begins; how do dry and wet dusts differ under electrification; and is there a law of volumes? Many years ago Dr. Bedson showed that coal-dust explosion depended on the density of cloud and the temperature of ignition. The latter for inflammable dust he fixed at about 143° C. His experiments were, however, conducted by means of a continuous source of heat, whereas in the present demonstration the ignitions were to take place by momentary flashes.

Dr. Thornton then showed by placing dry coal-dust between two terminals ¼ in. apart at 480 volts P.D., that dry dust was practically an insulator, and said that solid coal was actually a better insulator than stone. Wet coal-dust was then placed between the same terminals and tested on D.-C. pressure. The mass warmed up, steamed, and ignited with violence. In order to determine if it was the moisture which formed the arc, wet sand was tried instead. This only steamed slightly. Dr. Thornton suggested that the ignition was due to a fine stream of sparks passing along the wet dust, which either carbonised the dust or caused gas to be evolved forming an inflammable mixture. Next, powdered coke (dry) was placed between the terminals. When loose there was no effect, but when pressed slightly ignition occurred. The same experiments were repeated with A.-C., the explosions being if anything a little worse. In order to see if it is the flame itself which short-circuited the terminals, a lighted taper was placed in the ¼-in. gap at 480 volts, and although flame has a good conductivity, no flash-over occurred. This was then tried on a "horn" lightning arrester placed in a 1,500-volt A.-C. circuit, and the flame of the taper was sufficient to cause a flash-over so long as the copper horns were clean.

In contrast to the last two experiments, a pair of terminals 1¼ in. apart were given 480 volts P.D. and a small fuse melted

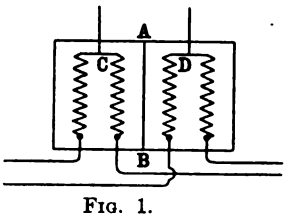


Fig. 1.

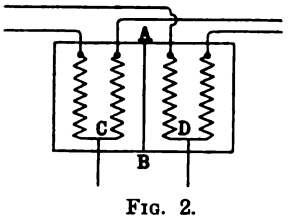


Fig. 2.

immediately beneath them. The metal vapour of the fuse was sufficient to cause a flash-over between the terminals. Hence if a flame contains metal vapour it can cause an arc across large distances. Although this is, or should be, well known, switchgear is yet manufactured which is badly designed in this respect.

Dr. Thornton drew attention to a common error in mine installations where it was a temptation to bring leading-in wires to a switch-box from the roof, as shown in Fig. 1. In the event of the dividing fin *AB* separating the compartments becoming broken, metal vapour in the breaking arc might cause a flash-over between *C* and *D*, which might easily cause an explosion. The correct way of leading in is as shown in Fig. 2.

A series of experiments was then conducted, showing the ignition of a mixture of coal-dust and air by the fusing of an electric circuit, and the opening of a quick-break switch, under varying conditions. In the apparatus used the terminals were about 2¾ in. apart, and for the fusing experiments 5-amp. lead

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fuse-wire was used. The coal-dust used was ordinary pit dust containing a good deal of heavy matter and sand. The duration of the flash was in the nature of one-tenth of a second, and ignition of the mixture in the enclosing box was marked by a tongue of flame in a long glass tube projecting from the box. The current was regulated by means of series resistances. Ignitions commenced with 480 volts D.-C. at about 10 amps., and became more certain at 15 amps. Ignitions were also obtained with the quick-break switch at the same currents, showing that there is not entire safety in using such switches in such an atmosphere.

Alternating current was then tried, but the results were not so consistent, as the effect depends on the part of the wave where the current is broken. As the result, however, of experiment it appeared that from this standpoint A.-C. was safer than D.-C. by about two to one, voltages and currents being equal. Fig. 3 summarises some results :—

Dr. Bedson had found out that the volume of the spark undoubtedly entered into the question, a fat spark igniting the mixture, while a thin, streaky spark, although higher in temperature, failed to effect ignition.

The effect of a very small current at 1,500 volts alternating was then investigated, and it was shown that whereas on lower voltages the fuse, to effect ignition, should blow in excess currents, with the high voltages a fuse blowing on its normal

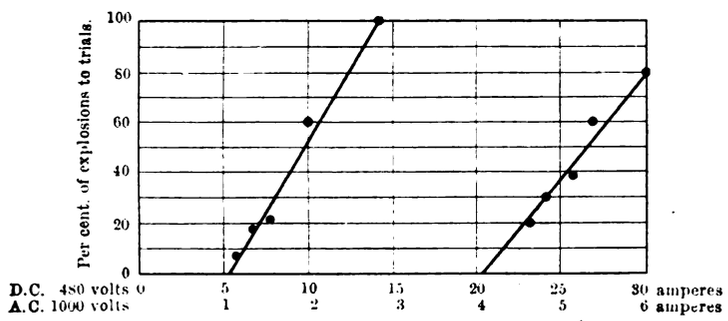


FIG. 3.

fusing current would give ignition. The experiment on trial with a 1-amp. fuse on 1,500 volts A.-C. showed instant ignition. A 100-volt supply was then taken, and it was shown that about 150 amperes were necessary to produce ignition, demonstrating that the lower voltages are immensely safer than the higher ones from the point of view of ignition. The experiment was repeated with A.-C. current at 40 ~. The explosions, though occurring, were not so violent as with D.-C. From experiment, Dr. Thornton deduces that 5-kilovolt amperes is about the lowest limit at which dust can be ignited.

In the ensuing discussion. Mr. FARADAY PROCTOR suggested that the reason that dry coke fired was that it contained carbonised tar, which was a very good conductor.

Mr. CLOTHIER (Messrs. Reyrolle & Co.) said that the demonstration had shown the danger of coal-dust explosions; there was equal if not greater danger in explosions of gas. He had arranged an experiment with two boxes to show the principle of proper enclosure of switchgear and accessories. Many colliery engineers ascribe explosions as due primarily to the ignition of gas, and secondly to the ignition of coal-dust from the flame of the gas. It was therefore important to prevent the flame of a gas explosion from reaching beyond the box in which a flash might have occurred. The first box had a rubber-ring joint, which was still common in mines, and sometimes described as "gas-tight." It was easy to get the ring cut, as in the example, and if a mixture of gas and air inside the box were fired by a spark a sheet of flame shot out which could ignite surrounding coal-dust. Where, as in many cases, there was an ordinary hinge on one side of the cover and cramping bolts on the other, it was still more difficult to get gas-tightness. The other box had a wide flange on cover and box, machined fairly roughly, and having a special hinge, which, together with the cramps used, secured equal contact all round. It was possible to fire a mixture of gas and air in this box without getting any flame or heat outside, due to the cooling action of the flange. (The relative properties of the two types of box were then demonstrated, and to indicate the force and instantaneous nature of the explosion in the box one charge was fired without the lid being bolted down. The lid jumped up slightly, but a vacuum, instantly formed, drew it down again.)

Mr. HODGE (British Westinghouse Co.) said that his own company had had for five years a box in a very fiery mine in this area which was practically the same construction, and which gave complete satisfaction.

Mr. RUTHERFORD, a colliery engineer, said that one question which was a subject of great discussion was the safety or otherwise of protective devices on cables in a colliery, and he thought that if experiments on a grand scale, with protective apparatus on the end of a cable 700 yards long and opened in an explosive atmosphere, could be undertaken they would go far to set the minds of colliery engineers at rest.

INSTITUTION OF MINING ELECTRICAL ENGINEERS

Formation of a Cumberland Branch

THE formation of a Cumberland Branch of the Institution of Mining Electrical Engineers was agreed upon at a meeting held on Saturday, February 26th, at the Grand Hotel, Whitehaven. About twenty-three gentlemen were present, and Mr. W. Leek (H.M. Inspector of Mines, West Cumberland District) took the chair. In his introductory remarks the chairman referred to the rapidly increasing adoption of electrical working, especially in the metalliferous mines in the district, and instanced the installation at the Lindle Moor mines.

So far as his own experience in electricity was concerned, he was very glad to say he had only investigated two accidents due to this cause, and he found both accidents were due to the carelessness of the injured persons.

The organising secretary, Mr. J. Glynn Williams, gave some details of the proposed arrangements, and stated that already they had some thirty members and prospective members in the district. The proposal for the formation of a branch was seconded by Mr. A. C. Scoular, and carried. The following officials, who will continue in office till the annual meeting in July, were then elected :

President: Mr. T. P. Martin (Workington). *Vice-President:* Mr. Robert Blair (Whitehaven). *Treasurer and Secretary:* Mr. J. Glynn Williams, 3 Moresby Parks, Whitehaven. *Council:* Messrs. W. H. Borlase (Threlkeld), A. C. Scoular (Workington), W. Leek (H.M. Inspector of Mines, West Cumberland Metalliferous Mines), Neville G. Barraclough (Workington), S. Turner (Whitehaven Collieries), A. Thom, Jun. (Moresby Collieries), R. Steele (Whitehaven Collieries). *Auditor:* Mr. Louis Darley (Frizington).

The meeting then proceeded to a brief discussion of Mr. Maurice's Paper on "Electric Shocks," a report of which appears on another page with that of the discussions before the other branches.

The National Association of Colliery Managers.—At a meeting of the Lancashire Branch of the Association on Feb. 4th, Mr. A. Tonge was asked to represent the branch by giving evidence before the committee on the revision of the special rules. The question of co-operation with the Institution of Mining Electrical Engineers in their inquiry into the causes and prevention of electrical accidents in mines was also discussed, but it was decided that, in the absence of any definite proposal, no action could be taken, although they were anxious to carry out any inquiry that would help the point at issue.

The National Electrical Manufacturers' Association and Electricity in Mines.—A meeting of manufacturers of motors and switches for use in mines was convened by this association on Thursday, the 17th ult., for the purpose of appointing witnesses to appear on behalf of the association as representing the manufacturing industry at the inquiry which is to be held by the Home Office for the purpose of modifying, if necessary, the rules for the installation and use of electricity in mines. A number of makers of this class of machinery were present, and six witnesses were provisionally appointed and various resolutions passed for the purpose of guiding them as to the evidence which is desirable.

Alleged Electrical Fatality at Auckland Park Colliery.—An inquest was held on February 12th on the body of W. H. Proud, a haulage-motor man, who was found dead in a haulage motor-house at Bolckow, Vaughan & Co.'s Auckland Park Colliery, on February 10th. Evidence was given to the effect that there was no exposed live metal near where the deceased was found, and Messrs. Bolckow, Vaughan & Co.'s electrical engineer stated that it had been found that it was impossible to get a shock off the machinery or near it. However, five doctors expressed the opinion that the symptoms were partly though not entirely those produced by electric shock. They admitted that not one of them could speak authoritatively on the point, but the jury found that the man died from an electric shock.

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A VISIT TO MESSRS. MAVOR AND COULSONS' WORKS

ON February 9th a large number of members of the Mining Institute of Scotland paid a visit to Messrs. Mavor & Coulsons' works (47 Broad Street, Mile End, Glasgow.) Most of our readers will be aware that this firm have for many years specialised in electrically driven mining plant of all kinds. Some new developments of both electrical and mechanical mining equipment of considerable interest were shown.

Of these, Messrs. Mavor & Coulsons' explosion-proof ventilated motor is an interesting example. All the firm's safety mining motors, whether A.C. or D.C., are provided with specially heavy ribbed carcases, designed on the lines of a gas-engine cylinder, to withstand an internal pressure of 100 lbs. per sq. in. In order to prevent flames from passing from the carcase, all joints, whether for the end cover or for access doors, are formed with wide machined flanges, and the arrangement and size of studs are designed for the pressure already mentioned. An additional precaution lies in the provision of a small leather liner "L" shaped in section (see Fig. 1) on the inner end of each bearing. The liners are just an easy fit for the shaft, and in the event of an explosion are forced on to it, so preventing flames from passing along the bearing joints or between the shaft and bearing. In the A.-C. slip-ring type of machine the slip-rings are enclosed in a special case made in two halves, bolted together with wide flanges. The ventilation is effected by means of a nest of brass tubes placed between the poles in the case of D.-C. machines, as shown in Fig. 2, and by single brass tubes spaced at intervals around the circumference of the outer portion of the carcase in the case of A.-C. motors. In the D.-C. machine each nest ends in a header. These headers, or, in the case of the A.-C. machines, the single tubes, on the one side communicate with an air chamber formed by the use of a supplementary cover made of sheet iron or a thin casting, and on the other with the outer atmosphere. The air chambers have small openings at the outer end, which openings form the inlet ports on to the blades of a small fan. The fan is attached direct to the motor shaft, and impels a current of air through the tubes during the whole period of working. When the warm air in the machine is not sufficiently agitated by the armature or rotor to give the best cooling effect, an additional fan is fitted inside the motor casing.

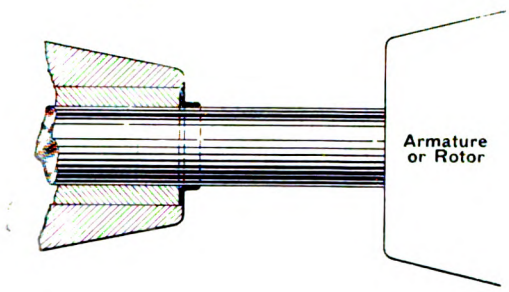


FIG. 1.—LEATHER PACKING TO SHAFT.

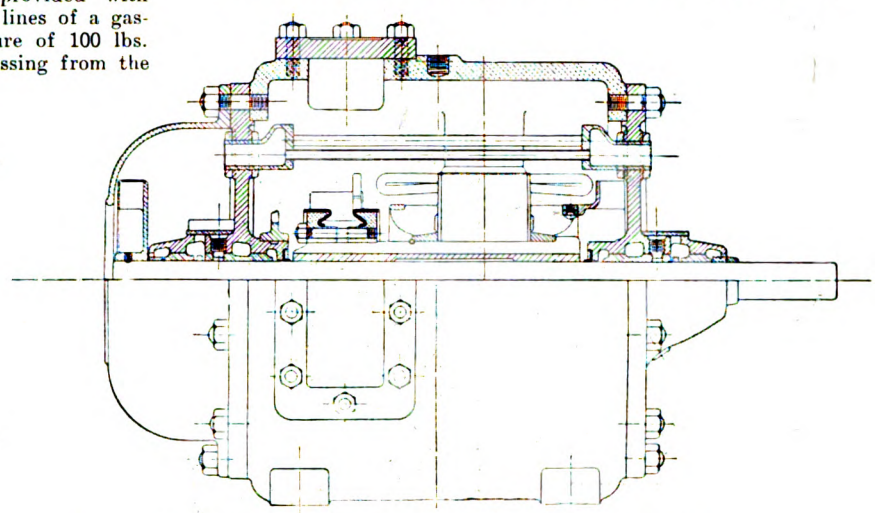


FIG. 2.—SECTION OF AN AIR-COOLED ENCLOSED MOTOR.

Mr. Mavor's "spinner" motor was shown driving a variable-speed fan, and this attracted a good deal of attention, the ease of reversal and the wide variation in speed given by the three-phase motor being of great interest.

The several forms of Pick-Quick bar coal-cutter, long and short wall types, and the Samson disc coal-cutter also were much discussed, but do not call for much description here, as the principal electrical features were the special explosion-proof motors already described. It may be of interest to mention that the "short wall" type of machine referred to is a new machine specially designed for use in pillar and stall workings. It is extremely compact and handy, and promises to fill a decided want in modern mining work.

The gate-end boxes made by the firm are of cast-iron with closed back and wide machined flanges, with heavy hinges and wing nuts. A special feature is the firm's safety plug, which is fitted in the cover of each box, and which consists of a brass ring containing several discs of lamp gauze, spaced a little apart from each other. A strong grid protects the gauze, and dust is excluded by a sheet metal cover, which is detached by a slight pressure from within, so allowing the products of combustion to escape. A simple but effective mechanical interlocking device prevents the opening of the box or the withdrawal of plug unless the switch is off, and it also prevents the switch from being closed until the lid is closed and the terminal plug of the trailing cable inserted.

The feature that attracted a good deal of attention was the "Gibb" underground conveyor, which consists of a train of long low jointed trucks, combined with a scraper conveyor travelling along the floor of the train and giving end discharge. The train can be made up in different lengths, and it consists of a discharging end section, a back end section, and as many intermediate sections as are convenient.

An advantage of this type of conveyor, from the colliery electrician's point of view, is that as the haulage gear and motor are placed apart from the conveyor and are only infrequently moved, they can be made with an ample margin of power and without any sacrifice of strength or cutting down of the size of wearing parts. This reduces the amount of jointing to be done or the number of boxes to be provided, and obviates the use of long trailing cables in awkward positions.

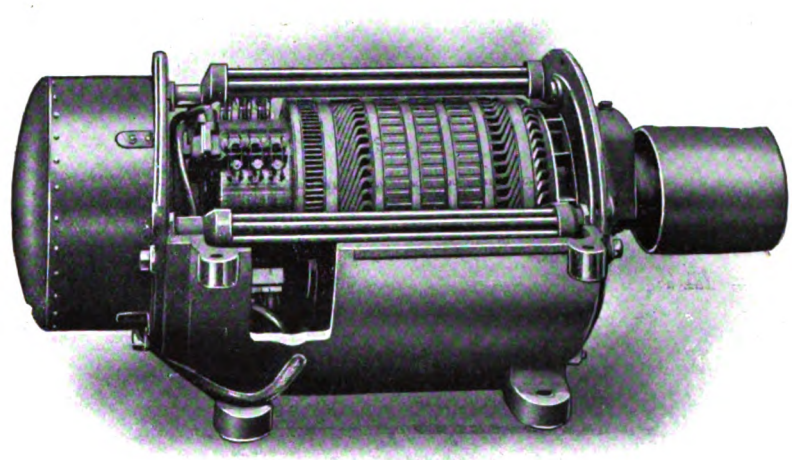


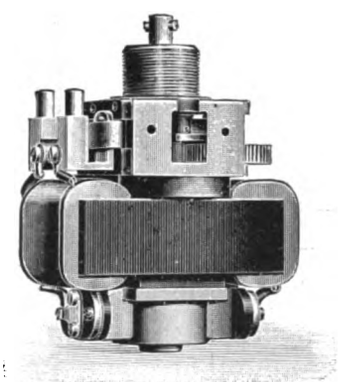
FIG. 3.—AIR-COOLED ENCLOSED MINING MOTOR.

Mining Legislation.—At the recent meeting of the Labour Congress at Newport, Monmouth, a resolution was passed advocating the registration of electricians employed in mines, the Glasgow representative, Mr. D. D. Gilmour, asserting that a number of recent accidents in mines could be attributed to the appointment of men who had not sufficient technical and practical knowledge to keep the electrical plant in proper order.

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ELECTRIC SHOT-FIRING

ELECTRIC shot-firing is rapidly becoming universal, not only in coal mines, but also in metalliferous mines and quarries, and its superiority over safety-fuse firing for shaft-sinking cannot be denied. There are two systems of electric shot-firing, the so-called "high-tension" and "low tension" systems respectively. In the former the igniting medium consists of a chemical mixture offering a fairly high resistance, and exploding when raised to a high temperature by the passage of the current through it. In the "low tension" system, a short piece of fine wire, called the fuse head, and embedded in gunpowder or other explosive material, is raised to a red heat by the passage of the current, and explodes the gunpowder. The latter is made up with the fuse head in the form of a small paper or metal tube, about 1½ in. by $\frac{5}{16}$ in., and is inserted into the cartridge proper. When explosives other than gunpowder, such as those of the nitro-glycerine, gelatine, and ammonium nitrate groups, are used, it is necessary to use a detonator to fire them. This consists of a metal capsule containing generally about 15 grains of fulminate of mercury, made up with an electric fuse.



INTERNAL CONSTRUCTION OF STERLING "DYNAMO" BLASTING MACHINE.

The Sterling Telephone & Electric Co., Ltd. (200 Upper Thames Street, London, E.C.), supply a number of different patterns of blasting machines for generating current to explode such electric fuses. Chief among these are the "dynamo" patterns for low-tension fuses. These machines are practically small series dynamos. A simple half-turn of the handle is all that is necessary to fire the shot. The machine is short-circuited until the end of the stroke, when the handle strikes against a stop, breaks a contact, and current is allowed to pass to the fuse. The armature slips the gearing, and continues to revolve by its own momentum. The machine has a detachable handle, which is kept by the shot-firer. The new 1910 pattern gives a current of two amperes at 20 volts, and will fire ten shots in series. It measures 5⅞ by 4⅝ by 2½ in. in its brass case, and weights only 6 lb. 2 oz. The internal construction is illustrated in the accompanying figure. The two series field coils are wound on a core of laminated iron, ensuring instant excitation.

A NEW MINING TELEPHONE

THE accompanying illustration represents a new design of magneto mining telephone which has been brought out by British Insulated & Helsby Cables, Ltd. The arrangement of the parts in the substantial gas- and water-tight case is such as to combine strength and accessibility with high insulation. The case is fitted with an oiled teak base, on which the terminals, wires, and induction coil are mounted. The generator is mounted on a separate teak base, which is screwed to the metal plate, while the bell magnets are fixed to the other side of this plate. This arrangement permits of a removal of the generator, bell, and inter-wiring without any trouble. The case is moisture-proof, and has a heavy door fitted with special linen-flax stuffed rubber tube packing, securely fixed in place on the door by thin metal strips and screws. Every connection and fixing screw is arranged within easy reach of a screwdriver. The wiring is of No. 18, S.W.G., D.C.C., vulcanised and taped copper wire, run in wax-filled grooves cut in the under side of the teak bases, on which the parts are mounted, thus giving an exceptionally high insulation resistance, no part of the cast-iron case forming part of the circuit. The magneto bell gongs are protected from possible injury by an apron cast as part of the door.

The generator has five magnets, and will ring thirty 1,000 ohm bells in parallel with a line resistance of 1,000 ohms. An extra heavy cast brass handle is provided and insulated from the frame of the generator. The magneto bell movement is mounted in a separate cast gunmetal box, having a machined face for the oiled leather packing. The coils and yoke-piece are held in position by a centrally-fitted screw, which permits adjustment from without, since by turning the screw the position of the electromagnet is altered. The armature is fixed to a steel spindle, a polished shoulder of which is truly ground and seated on the gunmetal, the other end being pivoted on a hardened steel screw inside the case. The shouldered end of the spindle is carried outside the case, and squared for the reception of the boss, which carries the striker. This boss is recessed into the gunmetal case, a good means thus being employed for the protection of the seating and spindle shoulder from moisture. Double-pole Post Office pattern receivers are used, fitted in heavy cast gunmetal cases. The cords are protected by a covering of durable pigskin leather, and are securely anchored within the instrument. The transmitter is of a solid back type (Patent No. 27178/06), the flexible leads being carried to their connecting points within the instrument by a special knuckle-joint fitting, which protects them from injury or strain. The switch hook is of a strong simple design, and the switch springs have platinum contacts. Four stuffing glands are provided, one for each receiver, and one each for the battery and line leads respectively.



WATERTIGHT MAGNETO MINING TELEPHONE.

Electricity in American Mines.—The *Electrical World* (New York) states that at a recent miners' convention in Indianapolis the opposition of mine workers to electric power, the introduction of which they consider against their interests, was manifested in a resolution declaring that the use of electricity in mines is hazardous, as the leakage from poorly insulated wires has a tendency to ignite mine gases, and frequently causes explosions.

Dispute re South Wales Colliery Plant.—The action by the Electrical Co., Ltd., against Oliver H. Thomas Son & Co., proprietors of the Llynvi Valley Colliery, near Maesteg, for the recovery of £2.707 for electrical plant delivered at the colliery, which commenced in December, is still being heard by Mr. E. J. Pollock, an official referee. The facts of the case, which have already been given, are that a counter-claim has been entered by the defendants for £30.100. The Electrical Co. contracted to supply certain electrically driven pumps for unwatering of the Llynvi Valley Colliery, which the proprietors allege were unsuitable and defective. The terms as regards payment were that 60 per cent. was to be paid on delivery, 30 per cent. on starting, and 10 per cent. in three months later. The amount of the claim, namely, £2.707, was balance of account. The counter-claim is on account of the alleged inability of the defendants to enter certain workings owing to obstruction by the machinery installed, and also for unreasonable delay in supplying one of the centrifugal pumps. The evidence for the plaintiffs has been concluded, and the case for the defendants is now being proceeded with. The hearing of the action has again been adjourned for a short time.

WINCHES
THE LONDON ELECTRIC FIRM, CROYDON
FOR ARC LAMPS AND OTHER LIGHT WEIGHTS

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PREVENTION OF ELECTRICAL ACCIDENTS IN MINES

THE Institution of Mining Electrical Engineers has discussed further at its various branches Mr. W. Maurice's Paper on "Electric Shocks," which forms the introduction to the first part of that Institution's inquiry into the causes and prevention of electrical accidents in mines (see ELECTRICAL ENGINEERING IN MINES, Feb. 3rd, page XXI.).

Newcastle Discussion

At the resumed discussion on Feb. 9th :

Mr. H. J. FISHER (Electrical Engineer to the Lambton Collieries) gave a summary of the experiments of Messrs. Siemens & Halske leading to the conclusion that a current of 0·03 amps. should be regarded as dangerous, and 0·10 amp. as deadly. Mr. Fisher gave the results of some tests taken by himself, showing resistances of the body measured from hand to hand under normal conditions varying from 9,000 to 110,000 ohms; from hand to feet, standing on damp ground under normal working conditions, from 11,000 to 30,000 ohms; and from hand to feet on damp ground with the hands damp, from 5,500 to 24,000 ohms.

Mr. H. W. CLOTHIER (of Messrs. A. Reyrolle & Co., Ltd.) referred to methods for the treatment of shock, drawing special attention to the preference given to the method of laying the patient on his face, and mentioning the use of traction of the tongue.

Mr. W. C. MOUNTAIN (Messrs. Ernest Scott & Mountain) had prepared figures from the Mines Inspectors' Reports of all electrical accidents in collieries since the introduction of the new rules (*i.e.*, from 1903-8 inclusive). There had been 39 total deaths underground : six due to gross carelessness, six from armoured cables, five from unarmoured cables, eleven from faulty earthing of other apparatus than cables, seven were pure accidents, and three were from improper or defective protection of live parts.

Mr. CLOTHIER, from records in the *Colliery Guardian*, found a total of 48 accidents up to June last year. Since proper investigations had been made the deaths due to electricity appear to have increased, owing either to previous faulty records or to the deterioration of electrical apparatus installed years ago. The total number of deaths in mines in 12 years was 12,500, or 1,041 per year. There had been in seven years 90 electrical deaths, or 12·8 per year. This gave an annual percentage of electrical to total deaths of about 1·2.

Dr. W. M. THORNTON (Armstrong College, Newcastle) suggested that in view of the danger in touching trailing cables, these should be supported from the pit props and boxed in some temporary manner.

Mr. FISHER thought this would be difficult, because machines working on a face are frequently moved; but he had used an insulating grooved bobbin running loosely on a support on the face pit-props, and carrying the cable, which was very good. He thought that no trailing cable should be armoured, but that mains and distributors should be. In the collieries he was connected with there had been no accident with 72,000 yards of such cables in operation. Copper bonds should be used with brass bolts and washers. Bitumen cables eight or nine years ago were sometimes poor in quality, and trouble had been caused. At Lambton Colliery double wire-armoured paper-insulated lead-covered cables were working at 5,750 volts, one cable going 1,800 yards inbye. The accidents they had had were entirely in the sub-stations, and not on the cables, in spite of falls of stone. One or two breakdowns on the cable had happened, due to shot-firing too near the cable. Trouble had occurred with lead-covered cables owing to the lead being unprotected just at the joint boxes. He recommended a type of box in which the armouring was carried right into the box. Sagging of the cables coming away from the boxes should also be avoided. With bitumen cables, trouble occurred either because the bitumen was too hard, the packing of jute not sufficiently impregnated, or insufficient compounding had been given to the cable.

Mr. W. R. MORTON (Messrs. W. T. Glover & Co., Ltd.) advised armoured cables. There should be a good earth and reliable joint boxes, and a little extra slack in the cable should be left near the boxes. The armouring of a cable was in some cases equal in conductivity to one of the cores. An armoured cable offered the opportunity of using selective protective devices, such as the Fisher device. Unarmoured cables did not show up their faults on test, as low resistance is often masked by the low insulation of the board to which they are connected, and a fault can go undetected till either an accident or another fault on another phase brings more trouble. He supported Mr. Nelson's recommendation that, except perhaps in pits containing corrosive water, armoured cables should be used; moreover, when a cable was fed from more than one point, protective devices could be used to isolate the danger zone.

Mr. W. W. WOOD said that shocks were due to three main causes; firstly, live terminals, to be cured by efficient protection; secondly, metal-work with a leak on it, to be cured by efficiently earthing all metal parts; thirdly, defective insulation on cables. Many collieries had at present unarmoured cables, and were not going to pull them out. How was it possible to protect these efficiently?

Mr. MOUNTAIN gave some data regarding the life of a cable in a mine from his own experience. He had installed some vulcanised bitumen cable twenty years ago which was still working without trouble. In another case a vulcanised bitumen cable, installed in place of a vulcanised rubber cable which had failed in twelve months, had lasted for seventeen years. He did not recommend lead-covered cables for continuous-current work. In wet shafts the cables should be coated every six months with a mixture of pitch and tar. The corrosion of lead-covered cables in one instance had led to a fire.

Dr. THORNTON pointed out the danger of bad dielectric in a three-core cable, in condensing the lines of static pressure between the cables upon a small area of the dielectric. Such lines chose the weakest path, and when this lay directly between the two cores there was great danger of puncture of the insulation.

Mr. FISHER recommended the burying of cables where they were likely to be caught by runaway tubs, as at curves and banks. They should be laid solid in the ground. Trailing cables should not be armoured, as the armouring was crushed beyond remedy if a fall of stone occurred, and any attempt to make a repair by binding over with galvanised iron wire usually resulted in puncturing the insulation of the cable with the ends of the wire. The trailing cables used by him, and described in his article in ELECTRICAL ENGINEERING IN MINES of Nov. 4th, 1909, were then mentioned. In reply to a question, Mr. Fisher said that in the Lambton Collieries every pump and haulage attendant had a daily report to fill in which indicated the behaviour of the electrical gear, including any unusual kicks, flashes, &c., and the daily indications of the leakage instruments. He also had to measure the gap between stator and rotor of his machine. The electrician of each colliery had to report weekly on the condition of the electrical gear, dangerous portions of the mine, falls of stone, &c., and in addition a monthly inspection of a very thorough nature was held. High-tension switching instructions were placed in each sub-station, and every man had to sign and carry a card with similar instructions. No man was allowed to work on a high-tension cable without a written assurance by the chief electrical engineer that the cable was isolated.

The question of earthing was next discussed, Mr. MOUNTAIN pointing out the difficulty of getting a really good earth, especially inbye.

Mr. FISHER stated that, in his group of collieries, each pit had its earth-plate buried in coke breeze, and all the colliery earth-plates were interlinked by copper conductors carried from pit to pit.

Sheffield Discussion

At Sheffield a meeting of the local members was held at the Victoria Hotel on Saturday evening, Mr. R. Holiday (Acton Hall Collieries, Featherstone) in the chair. Among those present were Mr. R. J. Frost (Branch Hon. Sec.), Mr. C. Henson (Dinnington Main Colliery), Mr. F. Marsland (Barrow Colliery), Mr. E. S. Shaw (Messrs. W. T. Henley's Telegraph Works Co.), Mr. J. N. Towell (Silwell), and others. With regard to methods of resusitation, several members expressed a preference for a "one-man" method, such as the Schaefer. The opinion was also freely expressed that the electrical engineer of a colliery should be a qualified man, and should have complete control over the electrical apparatus. One member who had had considerable experience expressed a preference for unarmoured cables when working with direct-current, and the Chairman emphasised the difficulty of maintaining a continuous earth to bank. It was most difficult to make an electrically continuous joint in the armouring, and thus it might happen that the armouring on the in-bye side of a fracture would be alive and not earthed. Some earthed the armouring at bank only, others also in the sump at the bottom of the pit. Another member suggested that the earthing of apparatus or armouring to rails should be prohibited, as they often laid on insulating strata, and dangerous conditions might arise. The Chairman stated that they had had armoured cables in the Acton Hall pits, but had taken them out, as they gave so much trouble. It was a very damp mine. He admitted that an armoured system was safer at first, but he had experienced frequent cases of leakage with armoured cables, which caused charring and eventually fire. Mr. Shaw stated that he was in favour of unarmoured bitumen cables for main ways and armoured cables for shafts. In hot pits, however, bitumen cables were liable to harden and crack, leaving the core exposed. He warned members from covering armoured cables with gas-tar; in one case the acid in the tar worked through the braiding and destroyed the wire armouring. Another member, describing an armoured cable system, said that he used an old haulage rope in the sump for the main earth below, and, further, he earthed the armouring to water-pipes at two or three places in every way. It was a three-phase system with neutral not earthed. The Chairman referred to a large mine in Cumberland where they had double-

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armoured cables, and, it was said, had experienced no trouble in spite of heavy falls. With regard to the nature of the armouring, one member preferred wire to tape, as after being pinched it sprung back; further, it was easier to attach earthing wires to wire. Mr. Shaw, however, preferred tape, as wire got worked into the bitumen. The Chairman pointed out that for perfect safety, when a section of cable was being worked on, the armouring as well as the conductors should be isolated from the main system. Recent statistics had shown that cable accidents were pretty equally divided between armoured and unarmoured cables, in spite of the fact that there were hundreds of miles more of unarmoured cables in use. It would seem, therefore, that armoured cables were more dangerous. Turning to the question of the effects of shocks, several members expressed the opinion that they would rather have a direct-current than an alternating-current shock for equal voltages. The general opinion was that coal-cutters were the greatest source of danger, and that D.-C. coal-cutters were more dangerous than A.-C. machines, as there were no loose connections in the latter case. A cause of breakdown in these machines was lowering of the armature by wearing down of the bearings; this caused the rotor laminations in some cases to be driven into the stator windings, which would result in the whole machine becoming alive. The only really safe way to work any apparatus, in one member's opinion, was to use a well-earthed system with loose-handle circuit-breakers. When a section of a system was being worked on, a danger-board was not sufficient; it was necessary to have fuses or links which could be taken out or locked up.

Nottingham Discussion

At the meeting of the Derbyshire & Nottinghamshire Branch at the University College, on Saturday, the chair was occupied by Mr. S. C. WARDELL, Colliery Engineer, Alfreton. Mr. F. CUSWORTH (East Kirkby, Hon. Sec.) said that the majority of electrical accidents in mines were due to cables, and that only a very small proportion could be traced to coal-cutting machines. It appeared that there were more accidents with low-tension than with high-tension cables. Mr. L. G. ROUTLEDGE (Eastwood) described an accident, fortunately without any fatal result, in which a trailing cable (unarmoured) got entangled in a coal-cutter chain and was cut right in two. It was a three-phase cable, but there was only a slight arc, because the trip-switch operated immediately. In their system the neutral was not earthed, and in consequence it was possible to go on working (under pressing circumstances) with one phase in contact with the earthed armouring, but this was, of course, not to be recommended. Discussing the armouring of cables, one member said that he preferred wire to tape, as the latter cut into the insulation. Some members preferred unarmoured cables. Mr. E. E. BEARDSMOORE (Tibshelf Colliery) thought that armoured cables increased the risk of stoppage, as it was often necessary to go on working in spite of a leak, and this was not safe when armoured cables were used, as the fault developed so quickly. One member suggested that the armouring should always be earthed frequently at wet places. Mr. R. LEE (Shirland, Alfreton) described how an earth-plate sunk 3 ft. deep in ashes had proved entirely ineffective; ashes were not so good as coke breeze. Mr. E. A. WILBRATAM (Ripley) said one could not have too many earths; he clamped on earthing wires at every wet place. There was, he thought, less danger with armoured cables if well earthed. Mr. CUSWORTH mentioned the case of a colliery using armoured cables, in which the stoppages due to electrical causes totalled only 3 hrs. 25 mins. in 1908, and 1 hr. 30 mins. in 1909. Mr. J. HIGHTON (Elkester) described the circumstances under which he received a bad static shock from a length of concentric cable which had been disconnected from the system by opening a double-pole switch. It was only 98 yards in length, a 19/16 cable working at 220 volts D.-C., but the shock was very considerable. Other speakers contributed to the discussion, and it was resolved that meetings should be held on the last Saturday of every month at the University, Nottingham, at 3.30 p.m. On account of the Easter holidays, however, the next meeting will be held on Saturday, March 19th.

Manchester Discussion

On Saturday, January 29th, a meeting of the Lancashire Branch was held at Manchester, with Mr. G. H. WINSTANLEY in the chair. After a few words from the Chairman, calling the attention of the members to the object of the discussion, Mr. W. B. SHAW pointed out with regard to the "limits of risk" of shock, that no limits could be fixed, as so much depended on the moisture of the skin, the strength of the constitution, the state of the ground, and whether the man receiving the shock gripped the live wire. In the latter case the man could not let go, as the muscles of his hand contracted. It was safest, he thought, to work with wire-armoured cables, which should be carefully bonded throughout and earthed. He urged that coal-cutter trailing cables should not be given too long a period of service, and should not be repaired underground, but by competent men on the surface. Mr. S. LEE thought that the limit of pressure for shaft cables should be 3,500 volts, and 500 volts for cables taken beyond the pit bottom. Mr. R. R. SMITH suggested that all earthing wires should be stranded, and that copper should be avoided in damp places; iron wire was preferable. Care should be taken that lighting wires did not rub against girders; it was best to run them on insulators. Mr. S. LEE thought that it was best to run an earth wire from bank to in-bye. Mr. W. B. SHAW thought that cables should be hung up with thongs, but that lighting wires should be supported on insulators. Mr. G. H. WINSTANLEY expressed approval for concentric cables. His experience with these extended over six or seven years, and they had had no accidents at all due to shock from these. Mr. J. H. BROOKING expressed a preference for braided unarmoured cables; canvas tape was even better than braiding.

Whitehaven Discussion

At the meeting at Whitehaven on Saturday, which was convened to consider the formation of a Cumberland Section of the Institution, and is referred to elsewhere in this issue, Mr. Barraclough opened the discussion by referring to the fact that the conditions under which a shock was received were of more importance than the pressure. Eighty volts had been known to kill, while men had survived shocks of 3,000 volts. The Chairman, Mr. Leek (H.M. Inspector of Metalliferous Mines, West Cumberland District) spoke of the importance of miners knowing how to deal with cases of electric shock, pointing out that good work was being done in Cumberland in this respect in connection with the St. John's Ambulance Association. Messrs. Blair, Rook, and Scoular also took part in the discussion.

Cardiff Discussion

The discussion of the Paper by the South Wales Section was resumed on Saturday at the Park Hotel, Cardiff. Mr. F. S. WALKER took the chair. The resignation of the Secretary, Mr. E. IVOR DAVIES, who is leaving the district, was accepted, and a resolution passed expressing the section's thanks for his work. Mr. GEORGE HUMPHRY was elected Local Secretary in his place. His address is 113 Clive Road, Canton, Cardiff. In opening the discussion on Mr. Maurice's Paper, Mr. RICHARDS said that the question of resuscitation from shock might more profitably be discussed by members of the medical profession. With regard to the question of earthing the system, he thought that could only be done by using a good continuous earth wire with the apparatus well bonded, as in tramway systems. Though the percentage of accidents attributable to the use of electricity in mines was low, it could be very much decreased by a properly organised system of inspection, and a properly trained staff of ambulance men.

Mr. STONE (Mountain Ash) thought that an efficient and positive acting earthing device was badly required. In the collieries of which he was in charge, he maintained a systematic daily logging of all the apparatus in work, and also a thorough examination and overhauling at different periods during each month. They generated at 3,500 volts, three-phase, but before entering the pit it was transformed down to a pressure of 550 volts. He advocated a centralised earth plate at the surface near the power station, and the connection of all apparatus to this. He found this was the most satisfactory method to adopt, and up to the present he had not yet had an accident of any kind due to leakage.

Mr. JAMES PHILLIPS (Tredegar Co.) supported the views set forth by Mr. Stone. With regard to earthing, at Tredegar they used three earth plates with isolating links, which enabled them to make periodical tests when required. Other members took part in the discussion, which was adjourned to March 19th.

ELECTRICAL MINING PATENTS OF FEBRUARY

AMONG the Patent Specifications published during February was one (No. 5,617 of 1909) by Messrs. Mavor & Coulson, Ltd., and R. C. Anderson for an improved driving gear for use in connection with disc coal-cutters. The construction described includes a special gear-casing providing extensive bearings for the working parts and giving facility for the removal of the gear from the casing, while, at the same time, providing a casing of narrow dimensions. A bevel driving wheel is mounted at the rear of the casing upon a longitudinally arranged shaft. The transverse driven shaft is driven through spur gearing on transverse spindles, and is furnished with a pinion at the head of the casing for driving the disc cutter and haulage gear. Patent No. 3,106 of 1909, taken out by Messrs. Simplex Conduits, Ltd., L. M. Waterhouse, and E. Sheppard, describes a water-tight switch suitable for lighting circuits in mines. This comprises a tumbler switch enclosed in a water-tight cover. The spindle of the operating handle passes centrally through the cover, and is provided with an L-shaped cam, which operates directly on the dolly-head of the switch. No. 7,714 of 1909, by C. Stuart-Bailey and H. L. Storey, covers a cartridge for mining purposes, which operates by the action of hot water on quick-lime, the lime being contained in a gas-tight casing. The lime and water are separated by a diaphragm, which ceases to be water-tight above the boiling point of water, and the water is heated electrically. An apparatus for igniting miners' lamps electrically underground is described by P. Buckley in Specification No. 8,112 of 1909. It comprises a stationary casing with an inner casing adapted to rotate within it. Both casings have openings, and the lamp is inserted when these coincide. Contact is made when the inner casing is swung round.

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RECENT ACCIDENTS IN MINES

On October 22nd last, an explosion of fire-damp in the Cadean Pit, Trimsaran, near Llanelly, South Wales, resulted in the death of four men, and at the inquest held on December 14th, evidence was given which showed that the gas had been ignited by the sparking of a semi-enclosed direct-current motor. It appears that a heading was being driven in advance of the air current, and in the neighbourhood of some old workings which were under water. As the water was percolating through and rapidly rising it was found necessary to have a pump running continuously, and a turbine pump coupled to a 25-h.p. 500-volt semi-enclosed D.-C. motor was set up at the entrance to the heading. The work had proceeded some 25 yards, and was nearly completed, when traces of fire-damp were detected by the fireman, who fetched a hand fan in order to keep the atmosphere clear while the last yard or two of the heading was being cut. The fan was stopped for a short time, however, in order to repair the handle, and the explosion followed almost immediately after it had been restarted. At the inquest it was elicited that the motor was in the habit of sparking badly, but that gas had not been observed in that part of the mine previous to the evening of the explosion, and that no official of the mine was aware of the presence of gas that evening. The inquest was attended by Mr. J. Dyer Lewis, H.M. Inspector of Mines, and Mr. R. Nelson, H.M. Electrical Inspector of Mines, and it was decided that sparks from the motor had ignited the gas. Apparently the fireman had made a grave error in continuing to run the motor after fire-damp had been observed coming away from the working-face, in view of the fact that the motor was in the return air current. As a result of a subsequent prosecution, the fireman, Evan Davies, was fined £2 for contravention of Electricity Special Rule 38, which provides for the cutting off of current from any electrical apparatus immediately on the appearance of fire-damp, and the manager of the mine, Mr. T. W. Evans, was fined £10 for providing inadequate ventilating arrangements, which made the explosion possible.

An electrician of the name of W. P. Silkstone, working at the Sutton Colliery, the property of the Blackwell Colliery Co., Stanton Hill, was killed by electric shock on February 2nd last. At the inquest, which was attended by Mr. Walker, Inspector of Mines, evidence was given to the effect that the deceased and a senior assistant, A. Slaney, were told off by the chief electrician to disconnect a certain 20-h.p. motor in a pump-house, and to remove it, together with its starter, &c., to another part of the mine. It appears that there was a gate-end switch, some 100 yards from the pump-house, and that this should have been opened before the work was commenced. It was left closed by the two men in order that they might use the lamps which were connected by loose cable to the live side of a double-pole switch on a board in the pump-house. This switch controlled the motor circuit, and was open. The starter which they were lifting off the board when the shock was received should therefore not have been alive, but it was suggested at the inquest that a lighting cable, bare at one point, was in contact with the frame of the starter. So long as the frame was in metallic contact with the board (which was earthed), nothing, of course, would be noticed, but directly the frame was lifted from the board, both men received a shock. Though this explanation is feasible, it would seem to be improbable that the men would allow the lighting wires to be entangled with the starter they were removing. It is possible that the bare place on the lighting wire came in contact with the iron frame of the board, and that this was ineffectively earthed. The deceased was standing on a wet plank, and death was instantaneous, but the other assistant, though standing on an iron plate, had wooden clogs on. The latter was rendered unconscious, however, and was badly burnt. The jury returned a verdict of death by electric shock. The coroner expressed the opinion that due precautions had not been taken, as the gate-end switch should have been opened.

On December 16th, a miner of the name of John McNaught was killed as the result of a shock received from an electric coal-cutter in the Hartley seam of No. 2 Pit at the Polmaise Colliery, near Stirling, owned by Messrs. Archibald Russell & Co. McNaught received the shock when leaning over the frame of the machine to regulate the travel. Power is distributed in the mine at 500 volts, three-phase, and the neutral of the system is earthed at the generating station at bank. It appears that the insulation of the auto-transformer starter of the machine in question had broken down some days before the accident, but had been repaired in the mine, as it turned out, inefficiently, with the result that it again broke down, causing the accident. The breaking down of the insulation caused the frame to become alive. Had the frame been effectively earthed, there would have been no danger, but it appears that though the frame was apparently connected to the wire armouring of the trailing cable, and that armouring to the gate-end switch-box cover, the latter was earthed by being connected to an old haulage rope laid along the roadway, but not connected to an earth-plate. This defect has since been remedied, and the haulage rope connected to the armouring of the shaft cables, which is earthed at bank. The cables running from the shaft bottom inbye are not armoured. The evidence at the fatal accident inquiry on February 11th showed that shocks from the coal-cutter had been frequent, but this obvious warning appears to have been neglected.

A serious fire, resulting in the death of a miner, J. Gainard, and injury to many others, occurred on February 1st last in the underground workings of the Easton Colliery, Bristol, and a report was circulated and published in the daily papers that it had been caused by the fusing of an electric wire. At the inquest on February 4th, however, it was conclusively proved that it was not originated electrically. The fire broke out on the evening of February 1st in an engine-house containing an electrically-driven haulage gear. Beyond this house is an incline which leads to workings below, in which some sixteen men were at work at the time of the fire. As the smoke was carried into these workings by the air current, the men had much difficulty in escaping, and Gainard was afterwards found dead in one of the passages leading out from the main incline. At the inquest it was elicited that the fire was started by the fall of a candle into a heap of cotton fluff. It appears that the haulage gear has a rope drive, and that some six weeks before the fire the cotton ropes had been renewed. An amount of fluff had worn off these and had collected in the race. The attendant had noticed that a holding-down bolt of the middle bearing of the haulage gear was slack and had switched off his motor to tighten it up. In order to see to do this he had placed a candle (the mine is a naked light one) on a bearing at the side, and this fell into the fluff and ignited it. The flames immediately spread to the timber supports, and the attendant left the house, and, after spreading an alarm, managed to escape. The fire was not under control until early the next morning. A verdict of accidental death was returned, the jury adding a rider that the engine-room should have been kept cleaner, and that a lamp should be used in future instead of a naked light.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during February.

February 3rd.—Supplement on electrical engineering in mines, opening with some correspondence on shaft cables. Abstracts of Papers recently read on "Machine Mining," by Mr. S. Mavor, and on "Electricity in Coal Mines," by Mr. R. Nelson, are given, and some practical notes are contributed by Mr. S. Skirrow. Illustrated descriptions appear of the Electric Construction Co.'s new coal cutter and a safety gate-end switch-box designed by Mr. H. J. Fisher. Special reports are given of the discussion at the Newcastle and Cardiff sectional meetings of the Institution of Mining Electrical Engineers on Mr. W. Maurice's Paper on "Electric Shocks," which forms the introduction to the first part of the inquiry into the causes and prevention of electrical accidents in mines being conducted by that Institution. A summary is also included of electrical mining patents published in January.

February 10th.—A special article on the leading makes of metal filament lamps. Descriptions of a number of novelties, including a new waterproof electric bell.

February 17th.—Description of an electric power station driven by suction gas. An illustrated article on the Dick-Kerr-Bergmann steam turbine.

February 24th.—An illustrated description of a large water-cooling plant in connection with a generating station. A new system of lead cable jointing.

Telegraph Traffic.—The Comoro Islands, off Madagascar, can now be reached telegraphically, offices having been opened at Mayotte, Mohéli, Grand Comoro, and Anjouan. Telegrams for places in Colombia, except Buenaventura, for any place in the Comoro Islands, in Costa Rica, Ecuador (except Guayaquil and Sta Elena) can only be forwarded at sender's risk. During the recent storms the superiority of underground lines was amply demonstrated, for the Commercial Cable offered uninterrupted service without delay.—The Perein-Obock cable was down on the 22nd ult., and telegrams were sent from Aden for Djibouti by boat.—Communication with Tangier Rabat, Casablanca, and Mogador is again interrupted.—The *viâ* Hanekin route ceased working on the 23rd ult., and on the next day direct working between Saigon and Bangkok was suspended, with consequent delay to telegrams. On the 25th ult. Moroccan communications were in working order again. On the 26th ult. the Bagdad and Bassorah line was in need of repair, but the *viâ* Hanekin route was again open to receive messages. The Saigon-Bangkok line was restored on the 27th ult. On Sunday last the Paramaribo-Cayenne cable failed again.—Negotiations between the Norwegian and British telegraph departments have resulted in an agreement concerning the cables between the two countries, the British Government making the necessary agreement with the Great Northern Telegraph Co. for the sale of the cable at value.—Reduction of the word rate to 2d. per word is to follow.—The Mackay Companies are said to have sold their entire holdings of stock in the American Telephone & Telegraph Co.—Mr. G. Ward, General Manager of the Commercial Cable Co., has announced that the Company will proceed immediately to lay an additional Transatlantic cable. This will be the sixth cable between Europe and America owned by the Company.

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ANNUAL DINNER OF THE MANCHESTER LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE annual dinner of the Manchester Local Section of the Institution of Electrical Engineers was held at the Midland Hotel, Manchester, on Friday last. The chair was occupied by Mr. S. J. Watson (Borough Electrical Engineer, Bury), Chairman of the Section, and the gathering included some 180 members and guests. Among those present and besides those who spoke were Dr. E. Hopkinson, Messrs. S. L. Pearce (City Electrical Engineer, Manchester), M. B. Field, T. L. Miller, W. Cramp, C. D. Taite, A. P. Wood, Dr. E. Rosenberg, and others.

After the loyal toasts, MR. HUGO HIRST (Managing Director of the General Electric Co.) proposed the toast of the Corporations of Manchester and Salford. He spoke of Manchester as the Mecca of the electrical and other industries, and paid a high tribute to the business capacity and wise government of the municipal authorities. Their electrical enterprise was the finest in this country, and its head, Mr. Pearce, was an ornament to the profession. In speaking of Salford, he referred to his own company's works, and acknowledged the assistance which they had derived from the municipality. In responding to this toast, the MAYOR OF SALFORD first expressed sympathy with Mr. V. A. H. M'Cowen (Borough Electrical Engineer of Salford), who had recently suffered a family bereavement, and had also been very seriously ill. After thanking Mr. Hirst for his kind appreciation of the work of the municipal authorities, he put in a plea for fair criticism of their work and expenditure, and complained that petty incidents were made much of while important and heavy expenditure was left uncriticised. Responding for Manchester in the absence of the Lord Mayor, MR. COUNCILLOR HOWARTH (Chairman of the Electricity Committee) praised the work of the staff of the Electricity Department. Manchester had reason to be proud of its undertaking, and was showing what could be done in that direction.

The toast of the Institution was proposed by MR. A. HOPKINSON, K.C. (Vice-Chancellor of the University of Manchester), who gave some amusing reminiscences of the early days of electricity, and referred to the astounding progress made by the industry. Responding to this toast, DR. GISBERT KAPP enlarged upon the aims of the Institution, referring to its charter, according to which it was formed to advance electrical science and its application. Some wished, he said, that the Institution should widen its activities, and correspondence had appeared in the electrical Press urging that the Council should assist a certain class. But the Institution could not be made a fighting machine for particular class interests. They could not deal with questions such as municipal trading nor tariff reform; the country and the members of the Institution were divided about these questions, and whatever action was taken would be bound to offend one section. Further, the Institution at present enjoyed the confidence of the Home Office and the Board of Trade, and any attempt to interfere in business or political matters would mean the loss of that confidence. There were many ways in which the Institution could further the interests of the industry, and he looked to the Manchester Section particularly with regard to the electrical driving of textile mills. The very unnecessary and unsatisfactory report of the Bradford Engineering Society should be counterbalanced by an investigation made by the Manchester Section, which should be a collection of reliable data and evidence of electrical working of textile mills.

The toast of the Local Sections was proposed by MR. W. M. MORDEY, who referred to the innovation during his period of office as President, whereby the Papers offered to Local Sections were submitted to the editing committee at headquarters. Some liked the old system better, but he thought that it prevented the reading of Papers either unsuitable or not up to the standard of the Institution. It was better that a few Papers by the best men only should be read and discussed all over the country, and he asked that the new system should be given a fair trial. Finally, he emphasised Dr. Kapp's remarks to the effect that it was necessary to resist all efforts to make the Institution of the nature of either a Masters' Association or a Trade Union. In replying to this toast, MR. S. J. WATSON said that Manchester might be looked upon as the eldest and heaviest child of the Institution. He would like to see the Local Sections having a larger representation on the Council of the Institution, and suggested that the Chairman, the Hon. Secretary, and two past Chairmen should represent each Section. Referring to the new Institution building in London, Mr. Watson pointed out that those in the provinces would have little share in it, and suggested that the library should be made of use to country members. Some people in Manchester were a little jealous of the London Conversazione, and he hoped that the Council would give its co-operation if they proposed to hold a similar function in Manchester.

The toast of the visitors was proposed by Mr. J. S. PECK (British Westinghouse Co.), and responded to by MR. W. T. STUBBS, President of the Manchester Chamber of Commerce.

THE ELECTRICAL TRADES' BENEVOLENT INSTITUTION

THE second festival dinner in connection with the Electrical Trades' Benevolent Institution was held on Wednesday of last week at the Hotel Metropole, London. The president, Dr. Gisbert Kapp, was in the chair, and among those present were Messrs. Justus Eck, H. Bevis, Hugo Hirst, H. H. Berry, J. S. Highfield, C. S. Northcote, F. H. Nalder, H. W. Butler, W. Davenport, L. G. Tate, W. Schmahl, W. B. Esson, G. Burney, E. Russell Clark, P. A. and G. C. Lundberg, C. Wilson, and others.

Before proposing the toast of "The Electrical Trades' Benevolent Institution," Dr. KAPP read a letter from Sir William Preece, in which he regretted his absence through ill-health, and assured the Institution of his continued support. He then announced that the secretary had received up to that evening a total sum of £262 in connection with the present festival dinner, and further donations amounting to over £45 had been received during the evening. The Institution, started in 1905, now had funds to the amount of £2,089 invested, and over £300 in cash. The income from regular subscriptions was a little over £100, and the donations last year amounted to £578, excluding a sum of £364 from the proceeds of the Manchester Exhibition. They had dealt with five necessitous cases during the year, the total amount spent being £63, or nearly all the interest from the invested funds. He thought it wise of the management not to spend the whole of the insured income, but to assist only urgent cases at present and build up a substantial fund in order that they might give pensions later. He admired the progress they had made, and thought they had outstripped the Benevolent Fund of the Institution of Electrical Engineers, in that they were increasing their funds at a faster rate. Many of the donors were firms who had funds for their own employees, and he admired their generosity in supporting this fund also. It had been suggested that this Institution and the Benevolent Fund of the Institution of Electrical Engineers should pool their funds and make one society, but he saw no reason for doing this; they would not increase the total receipts and they could not reduce the expenses, as there were none, owing to the voluntary work of the management. Again, the latter fund was only for members of the Institution, while this one was not so restricted. He thought it better that they should preserve a healthy rivalry.

Sir IRVING COURTENAY (Vice-Chairman), in response, said that with regard to the need of the Institution, the remarks of the Chairman were quite conclusive, as he hoped that the aid of the Institution would be extended to all those who had attempted to earn a livelihood in the electrical trades and needed help, irrespective of their class or whether they had been subscribers or not. It would be a misfortune if there were any idea of amalgamating.

Mr. HUGO HIRST also spoke in reply to the toast of the Institution and referred to the strenuous nature of competition in the industry, commenting how few in the electrical industry had reached a position of safety financially. He urged the importance of obtaining a large number of small subscribers. In his own firm (the General Electric Co.) they had a special sick fund for the staff only, and each member subscribed an annual sum, working out at ½d. per week. They paid out over £100 per year, and the funds now amounted to between £4,000 and £5,000.

Mr. JUSTUS ECK (Union Electric Co.) rose to propose the health of the President, and stated that they had already commenced to secure small regular subscriptions, a number of voluntary collectors having commenced work amongst the various electrical undertakings.

In response to this toast, Dr. KAPP said that he was fully in sympathy with the objects of the Institution, and was glad to see that the electrical Press were also in sympathy. He further emphasised the importance of obtaining a large number of small but regular subscribers.

Mr. GUY BURNEY (Sterling Telephone & Electric Co.) paid a tribute to the labours of Mr. Eck and the Secretary, Mr. W. Davenport, and these gentlemen briefly replied.

Indian Electricity Bill.—The bill to amend the law in India relating to the supply and use of electrical energy has been referred to a select committee, consisting of the Hon. Mr. S. P. Sinha, the Hon. Sir T. R. Wynne, the Hon. Mr. Jacob, the Hon. Mr. Kesteven, the Hon. Sir Vithaldas Thackersey, the Hon. Maung, the Hon. Mr. Graham, and the Hon. Mr. Miller. Mr. Frank Rawson, Manager of the Calcutta Electric Supply Corporation, has been appointed expert adviser to the Committee.

Faraday House.—An examination for a Faraday Entrance Scholarship, value 50 guineas per annum, and tenable for three years, will be held at the Electrical Standardising Testing and Training Institution, Southampton Row, London, on Wednesday, March 30th, and Thursday, March 31st, from 10 a.m. to 5 p.m., and on Friday, April 1st, from 10 a.m. to 4 p.m. Notice of intention to compete should be sent to the Secretary not later than March 21st.

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ELECTRIC DRIVING OF REVERSING ROLLING MILLS

Ilgner Patent Declared Invalid

IN the Chancery Division of the High Courts on Monday, Mr. Justice Parker delivered judgment in the action brought by the Donnersmarckhütte Oberschlesische Eisen- und Kohlenwerke Akt.-Ges., of Zabcze, Germany, against the Electric Construction Co., Ltd., of London and Wolverhampton, for alleged infringement of the fundamental patent No. 7,188 of 1902, for the Ilgner system of electrically driving reversing rolling mills. We reported the evidence and proceedings in our issues of Feb. 3rd and 10th.

Mr. Justice Parker said the object of the patent in question was the protection of the source of supply from sudden demands entailed in starting the rolling-mill motor, and economy in controlling the motor, the latter being obtained by dispensing with rheostatic control. The particulars in the specification relating to the excitation of the dynamo meant, in his opinion, controlling the working motor by varying the field of the dynamo, and suggested the Ward-Leonard system, involving, although it was not stated, separate excitation of the fields of both dynamo and working motor. With regard to the claim, a good deal of difficulty arose from the expression "on starting." It might mean simply when the rolling mill is started and the motor switched on, and this seemed to correspond with what the inventor stated in the specification was his first object. On the other hand, it was obvious that the same result would follow whenever there was an increase of load, so that the inventor might mean that whenever work, or extra work, was thrown upon the rolling mill, the corresponding current was never demanded from the source of supply at the same moment, but that the demand on the source was only gradually increased. Although clumsily framed, he thought the specification might fairly be construed to mean that the Ward-Leonard system should be adopted for the sake of economy, with the addition of a flywheel on the motor-generator set, in order that any extra demand on the source of supply might be met gradually, the extra power required meantime being supplied by the flywheel. This was the essential feature of the specification, the only practical direction being that the motor should be so constructed as to slow up with the increased load, which was an obvious necessity if the flywheel were to act at all. The question of infringement depended upon whether the advantages of this combination had been taken and used by the defendants, and also whether invention was necessary to arrive at the idea. The defendants had taken the Ward-Leonard system with the flywheel, but they did not secure a drop of speed in the flywheel motor by winding the field-magnets in any particular way. They had, however, an automatic regulator in the field circuit of that motor which came into operation when the demand reached a predetermined maximum. Then the regulator automatically increased the strength of the field, causing the motor to slow up. The resistance was so arranged that there was no demand on the source in excess of the predetermined maximum. In other words, the extra demand was not thrown gradually on the source of supply, but was prevented from coming on it at all, the power required beyond the predetermined maximum being supplied by the flywheel. He was of opinion, however, that if Ilgner's patent were valid, the defendants had taken the substance of it, and had therefore infringed.

On the question of whether Ilgner's patent was valid, Mr. Justice Parker said the principle of this had been applied before 1902. The introduction of the motor-generator set for dealing with variable loads was Ward-Leonard's idea, and he did not think that any invention was involved in recognising that it was possible to use a flywheel in the case of certain loads. This must have been fairly obvious. In 1895 Ferranti patented a system in which he interposed a motor-generator between the working motor and the source of supply with a heavy flywheel which stored up energy. Ferranti, it was true, did not specify how his working motor was controlled, but he did not think this was necessary. This patent could be used for any circuits where the demand was sudden, and where it was undesirable to interfere with the source of supply, and there seemed no reason why it should not have been applied to a reversing rolling mill. It would then have been necessary to arrive at some system of control for the working motor, but he thought Mr. Ferranti would have used the same thing as described in the Ilgner specification, viz., the Ward-Leonard system. Indeed, in his opinion, it was the obvious system to apply. It had been said, quite truly, that the combination of the well-known principle of the flywheel with the well-known Ward-Leonard system of control was a new combination, though both its elements were old, and that this was sufficient to afford subject-matter if there were invention in the idea of carrying the combination into effect, or if the combination led to a new result. In his opinion, however, it could not be contended that there was any invention in carrying this idea into effect, and he did not think the combination led to any new result. It had been said that the idea of combining a flywheel with the Ward-Leonard system had rendered possible what would otherwise be impossible, viz., the working of reversible rolling mills by electricity when the current used was drawn from a central station. He was inclined to think that the real reason why reversing rolling mills were not run electrically until after Ilgner's patent was because electrical plant heavy enough for the purpose had not been brought to the requisite state of perfection. When this stage was eventually reached, it seemed to him that any competent electrical engineer would, without any aid from Ilgner, have said the only practical system of control was the Ward-Leonard, and that a flywheel was desirable. No invention was required to see that any falling off in speed in the working motor could be counteracted by varying the field of the intermediate dynamo. He therefore came to the conclusion that the patent was invalid for want of subject-matter, and the action failed.

MUSIC-HALL ELECTRICITY

IN the Appeal Court on Thursday, before the Master of the Rolls and Lords Justices Fletcher-Moulton and Buckley, the appeal of Samuel Murphy Bodie, known on the music hall stage as "Dr." Walford Bodie, against a judgment of Mr. Justice Darling, was heard. We gave full details of the case in ELECTRICAL ENGINEERING, Vol. V., pp. 953 and 970. "Dr." Bodie describes himself as a hypnotist and mesmerist, a bloodless surgeon, and a medical electrician, although he is not a qualified medical man in this or any other country. In 1903 he became acquainted with a young man named Irving, who signed an agreement to pay him £1,000 to serve as his pupil for three years at a salary of £2 10s. per week. In his performances upon the music hall stage "Dr." Bodie claimed to cure persons of paralysis and similar complaints, whilst under hypnotic influence, and also presented certain spectacular electrical effects. He also claimed to be able to withstand a higher voltage than any other person living. The whole of the performance, however, the plaintiff declared to be a fraud, and he claimed for the return of his £1,000. In this he was successful. All three Appeal judges expressed strong opinions upon the case, referring to the appeal as a hopeless one, and dismissing it without calling upon counsel for Mr. Irving. The Master of the Rolls said "Dr." Bodie was an ignorant, unscrupulous quack at the time he received the £1,000, and there was no doubt that the plaintiff had been swindled.

Advertising Electricity in London.—In connection with our article on this subject last week we omitted to state that the sub-committee appointed to deal with the details of the publicity scheme of the London Companies and Borough Councils is as follows:—Mr. H. B. Renwick (Chairman), County of London Electric Supply Co.; Mr. E. Cunliffe Owen, Metropolitan Electric Supply Co.; Mr. A. C. Cramb, Croydon Corporation; and Mr. E. Sayer, Hampstead Borough Council. We have just been informed that the proposal that provincial authorities should join the scheme has received very considerable support. The following is a list of those places who have so far signified their intention of doing so:—Loughborough, Harrogate, Nuneaton, Lowestoft, Midland Co. (Leamington), Aberdeen, Blackpool, Gosport, Leatherhead, Newmarket, Weymouth, Wolverhampton, Dundee, Derby, Devonport, National Electric Supply Co. (Preston), Mansfield, Grimsby, Tunbridge Wells, Ipswich, Northampton, Southampton, Hanley, Ross, Bournemouth, and Coatbridge.

Illumination.—In the second of the three Thursday afternoon lectures on this subject at the Royal Institution, London, Prof. S. P. Thompson dealt with the subject of sources of light. After referring to the work of Tyndall and the later researches of Langley on the distribution of radiant energy in the spectrum, the lecturer pointed out that for every temperature of the radiating source there was a dominant wave-length of radiation. The sun, at an estimated temperature of 5,880° C., gave a dominant wave-length of 50-centimetres, just the wave-length to which the eye was most sensitive. The dominant wave-length from the arc crater, at a temperature of 3,800° C., was 72 mcm.; that from the Nernst blower was 128 mcm. The visible region was between 40–80 mcm. The dominant wave-length radiated from a perfectly black body was inversely proportional to its absolute temperature. All bodies radiated less than a perfect black body, but gave out a greater proportion of rays within the visible region, and were therefore more efficient as illuminants. There were two ways of increasing the light emitted from a hot body. One was to increase its temperature, and the other was to use a body which gave out specific radiations, that is light rays of one or more definite wave-lengths. An example of the former was the substitution of tantalum and tungsten for carbon in filament lamps, as the former could be run at a much higher temperature without disintegrating, and an example of the latter was the use of salts in arc-lamp carbons, where an increase in the amount of light given off in the visible spectrum was obtained without an increase of temperature. This was demonstrated by projecting a flame arc-lamp spectrum on the screen showing the bright lines produced from the glowing gases. The salts used for this purpose were those of barium, sodium, and calcium, according to the colour desired.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Feb. 24th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

2,733/09. **Circuit-breaker.** J. E. SPAGNOLETTI. The simple circuit-breakers described in ELECTRICAL ENGINEERING, Vol. V., page 1038. Four claims, six figures.

3,191/09. **Resistances.** A. H. CURTIS and ADAMS MANUFACTURING Co. A long strip of resistance metal is stretched zigzag between two insulated heads with radial arms. These heads are carried loosely on a central rod, and forced outwards by springs, thus keeping the strip in tension. The strip is wound so that its flat sides are radial to the rod, thus assisting cooling. Tape of woven metal wire may be used instead of strip. Four claims, fourteen figures.

4,164/09. **Tungsten Filaments.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). Agar-agar is chopped fine and boiled with water to form a solution containing 3 per cent. carbonaceous material and 97 per cent. water. Tungsten powder is added in the proportion of one part tungsten to five parts of solution, and the mixture is kept alkaline by addition of ammonia. The mixture is squirted hot through a water-cooled die at a low pressure. The threads produced are initially conductive, and only require reducing in an atmosphere of H and N. A diamond die is not needed as the mixture is so soft. Four claims.

15,421/09. **Commutators.** BRITISH THOMSON-HOUSTON Co. and W. F. DAWSON. To provide efficient ventilation, and thus obviate expansion of the bars in commutators held together by shrink rings, the latter are supported from rigid rings on the shaft, at either end of the commutator. A space is left between the segments and the boss, holes are provided in the end rings, and the insulation between the bars is omitted, except at the ends. Air drawn in under the bars is forced out between them radially to the commutator. Three claims, one figure.

16,170/09. **Cascade Induction Motor.** L. J. HUNT and THE SANDYCROFT FOUNDRY Co., LTD. This specification describes a modification of the well-known cascade motor, in which there are two windings in stator and rotor, giving two different numbers of poles, and interconnected in such a way that they will work in cascade. Extra windings are inserted in the slots left free by the omission of certain bars which neutralise one another, and these are connected to the rotor windings and to slip rings. When the slip rings are short-circuited, the rotor as a whole produces only one number of poles, and this gives another economical speed. Five claims, sixteen figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: HOLMAN, 3,371/09; MILLAURO, 14,165/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: PECK, FAYE-HANSEN, and LUSTGARTEN [A.-C. distribution system] 3,046/09; MONNIER [Distributing box] 13,129/09.

Dynamos, Motors, and Transformers: SCHULZ [Unipolar turbo-dynamo] 2,755/09; PECK [Motor control] 3,533/09; LANCASHIRE DYNAMO & MOTOR Co. and STELLING [Rotors of A.-C. motors] 6,477/09; HIRST and KRAUSE [Fan motors] 9,706/09; MCLEAN [Brush-holders] 12,774/09; HÖHME [Brush-holders] 24,276/09.

Electric Ignition: MUELLER [H.-T. magnetos] 17,663/09.

Electrometallurgy and Electrochemistry: BACKUS [Electroplating apparatus] 8,734/09; COWPER-COLES [Regenerators for electro-zincing process] 11,842/09.

Heating and Cooking: FENNELL and PERRY [Radiators] 3,554/09; GOLD [Vehicle heating] 3,730/09; BERRY [Heating apparatus] 17,353/09.

Incandescent Lamps: WESTINGHOUSE METAL FILAMENT LAMP Co. (*Lederer*) [Metal filaments] 6,936/09; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Lamp-making machines] 8,351/09.

Instruments and Meters: DANNATT [Meters] 3,176/09; PALATINE ENGINEERING Co. and ANTHONY [Clocks for recording instruments] 3,296/09.

Storage Batteries: GARDE and ADAMS [Plates] 2,749/09; FRIEDRICH [Regenerating accumulators] 19,111/09.

Switchgear, Fuses, and Fittings: RAWLINGS [Switch] 373/09; BAERLOCKER [Motor controller] 2,715/09; RORKE and RORKE [Switches] 2,754/09; THOMAS [Controller] 2,943/09; SIMPLEX CONDUITS, LTD., and ELLIOTT [Switches and lamp adapters] 3,105/09; DANNATT [Automatic switches] 3,176/09; BOWRON [Lamp-holder locking device] 3,674/09; SEDGWICK [Lamp-holders] 8,077/09; KENNEDY-MCGREGOR [Circuit-closers] 9,094/09; BRAZIL and COOCH [Protective devices for A.-C. systems] 10,663/09; CHARLES H. PUGH, LTD., and BULL [Wiring conduit fittings] 10,739/09; MACDIARMID and BATES [Switches] 12,335/09; DUSSERIS [Switch for electromagnetic clutch] 20,413/09; WATERHOUSE [Coupling] 24,771/09; BRAMPTON and OSBORNE [Conduit fittings] 24,892/09; RAWLINGS [Tumbler switch] 27,446/09.

Telephony and Telegraphy: SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) [Telephone exchanges] 24,812/09.

Traction: WHITELEY [Tramcar lifeguard] 2,787/09.

Miscellaneous: BLAND [Mariners' compass] 2,637/09; CREESE [Clocks] 3,851/09; REASON and REASON MANUFACTURING Co. [Winding devices for time-switches, &c.] 3,854/09; PEARSON [Textile fabrics with electrical properties] 4,677/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: HEIMANN and SCHAFFER [Series burning] 2,362/10.

Dynamos, &c.: MILTON [A.-C. generator] 27,033/09.

Electric Ignition: BRIGGS, 2,438/10.

Instruments, &c.: FELTEN & GUILLEAUME LAHMEYERWERKE A.-G. [Checking consumption of lamps] 2,432/10.

Traction: BEAUDENON [Automatic switch] 2,533/10.

Miscellaneous: SPECIALFABRIK FÜR ALUMINIUM SPULEN UND LEITUNGEN GES. [Production of insulating film of oxides on wires] 2,711/10.

Amended Specification Published

The following amended Specification can now be obtained.

12,739/02. **Lamp Cap.** A. SWAN (General Electric Co., U.S.A.). This specification describes a lamp cap with a glass button uniting the contacts and interlocked with the shell. See ELECTRICAL ENGINEERING, December 30th, 1909, Vol. V., p. 1104.

Opposition to Grant of Patents

21,580/08. **Flywheel Load Equaliser.** AKT.-GES. BROWN, BOVERI & CIE. The grant of this patent has been allowed in spite of opposition. A three-phase commutator motor is connected in cascade with an induction motor coupled to the flywheel, and an automatic regulator is inserted in the field circuit of the commutator motor.

16,328/09. **Tungsten Filaments.** C. H. WEBER. Opposition has been entered to the grant of this patent. The specification was abstracted in ELECTRICAL ENGINEERING, January 6th, 1910, p. 16, and describes a process for treating tungsten powder with pyridine or quinoline to render it less liable to oxidise.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

5,274 of March 9th, 1896. **Electroplating.** A. S., T. A., R. J., and S. SMITH and T. DEAKIN. Apparatus for producing a bright deposit of nickel in one operation. The articles to be plated are put in a rotating drum immersed in the electrolyte. The rotation caused them to rub against each other and against copper cathodes in the drum.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: W. J. DAVY [Hot-wire mechanism] 24,235/03; A. HESS [Arc with incandescent mantle] 23,035/05.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON Co. (*C. P. Steinmetz, U.S.A.*) [Regulation of three-wire systems] 22,533/99.

Dynamos, &c.: BRITISH THOMSON-HOUSTON Co. (*C. P. Steinmetz, U.S.A.*) [A.-C. generator] 22,534/99; E. A. CAROLAN (*General Electric Co., U.S.A.*) [Regulation of synchronous motor-generator sets] 24,715/02; A. F. HILLS, D. URQUHART and A. E. HONEY [Strip field coils] 24,464/04; A. P. WOOD and LANCASHIRE DYNAMO & MOTOR Co. [Flywheel load equaliser] 22,654/05.

Electric Ignition: F. R. WADE [Commutators] 24,356/03; G. H. SMITH (*A. P. Boulanger*) 22,802/05.

Electrometallurgy, &c.: F. E. ELMORE [Combined unipolar dynamo and electrolytic apparatus] 24,330/02; F. BAGNALL [Electroplating] 22,901/05; W. TISCHNOFF [Making joints by electro-deposition] 23,094/05.

Switchgear, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Loose-handle switch] 22,856/05; D. BACON [Control of lifts and machinery] 22,939/05; A. STEWART [Lifting magnets] 23,016/05.

Telephony, &c.: L. L. HARTVIGSON [Submarine telegraph cable] 23,411/98; L. KAMM [Printing telegraphs] 22,874/05; W. P. THOMPSON (*Ges. für Drahtlose Telegraphie*) 23,211/05.

Traction: W. BRIERLEY [Signalling] 24,841/96; P. R. WILLIS (*G. W. Whitman, U.S.A.*) [Rail-bonds] 22,686/05; E. LAWRENCE [Operating points] 23,083/05.

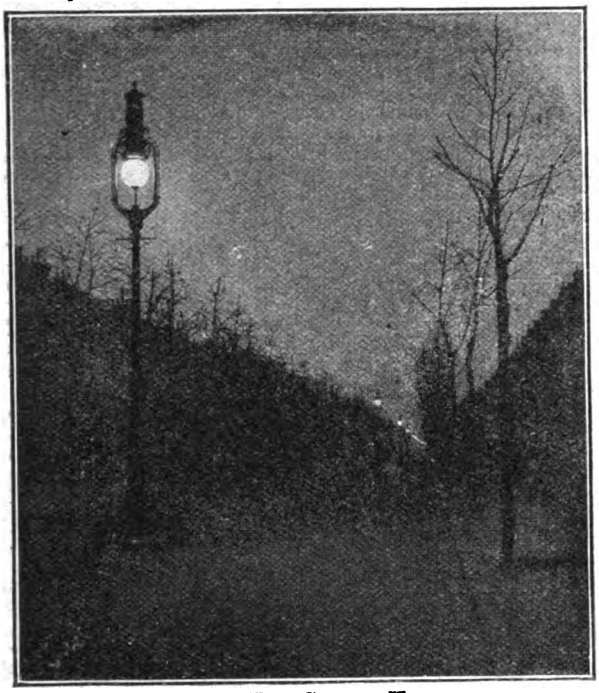
Miscellaneous: J. WETTER (*Elektrizitäts A.-G.*) [Iris shutter for signalling lamps] 23,399/98; J. Y. JOHNSON (*A. Wolf & Co.*) [Thermo-electric batteries] 24,177-8/04; G. A. GRANSTRÖM [Magnetic separating] 22,731/05; T. HARRISON and A. S. FRAZER [Indicators] 22,741/05; F. H. HADFIELD [Ships' telegraphs] 22,819/05; J. OWEN [Fire-alarm] 22,861/05; C. BRIGHT [Receipt register] 22,897/05; T. H. LARGE [Electromagnetic hammer] 23,075/05; J. MOORES [Fire alarm] 23,194/05.

For Patents relating to Electrical Engineering in Mines, see p. XXV. of Supplement.

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OSRAM LAMPS FOR STREET LIGHTING

EVIDENCE is gradually accumulating of the very great value of metal filament lamps for the lighting of streets and other open spaces. In The Grove at Hammersmith, a wide busy thoroughfare, 400-c.p. Osram lamps have been fitted in the arc lanterns, and at a recent meeting of the Hammersmith Borough Council the Electricity and Lighting Committee reported that, by converting the system as indicated, the cost of the electricity department for lighting The Grove has been reduced by no less than £40 per annum, equivalent to a saving



Osram Lamps in The Grove, Hammersmith.
(*Photograph taken at night.*)

of £2 16s. per lamp per annum. This testimony, coming as it does from absolutely independent and unprejudiced sources, confirms the optimistic predictions that were originally made for Osram lamps for street lighting, and there now seems no doubt whatever that its wide adoption for this purpose is assured. With regard to the life of Osram lamps for street lighting, records to hand show that they burn for an average of over 3,000 hours, which entirely disposes of the suggestion that has frequently been made, that these lamps would not withstand the vibration in busy thoroughfares due to heavy traffic.

We hope to give from time to time the cost of using Osram lamps for street lighting in other London districts.

ELECTROMETALLURGY AND ELECTRO-CHEMISTRY

A RECENT number of *Metallurgical and Chemical Engineering*, which is the new name given to the journal formerly known as *Electrochemical and Metallurgical Industry*, contains an interesting article by Assar Grönwall on why electro-steel is sometimes non-homogeneous. He states that in one and the same ingot, the one end may be of high quality, while the other end may be quite inferior. Most of the high grade steel which is produced in the electric furnace has been made from cold raw material—from pig and scrap iron. The furnaces employed are mainly of the following types:—(1) Single-phase electrode furnaces with two adjustable electrodes (Héroult type); (2) single-phase electrode furnaces, with one adjustable electrode and one bottom electrode (Girod type); (3) induction furnace. The author considers the want of uniformity of the steel produced is due to unequal heating. In the Héroult furnace, for instance, the metal is heated by conduction through the slag; the surface is thus hotter than the metal at the bottom, because the hotter metal is lighter than the cooler. With the Girod type of furnace, where there is one electrode above and one below, this is less likely to happen, but the side portions may not be equally heated. With induction furnaces, if the cross-section of the bath is perfectly uniform, the heating should be uniform, but if after use a part of the lining is eaten away, enlarged cross-section ensues at that point, and less heat is developed just where more heat is required because there is more metal at this point. The Swedish Elektrometal Company have recently patented and placed on the market a new type of electric steel furnace. The furnace contains four electrodes, two at the bottom and two adjustable ones vertically suspended. The electrical energy is supplied in the form of two-phase current. The adjustable electrodes have each one of the terminals of the two-phase supply connected to them; the other two terminals are connected to the bottom electrodes. A rotating magnetic field is produced in the bath, causing a circulation of the metal which it is claimed is sufficient to obtain homogeneous mixing and uniform temperature at all parts of the bath. Finally, Mr. Grönwall remarks, "The attendance of an open hearth furnace is never left to a person with less than one year's experience. . . . The electric furnace has been in practical use for too short a time. There are to-day not yet many men thoroughly familiar with the running of an electric steel furnace for high-grade steels. But after some years' experience the electric furnace will displace the crucible furnaces which are uneconomical."

A works for the production of nitrates by the Pauling process has been at work for some time at Patsch, near Innsbruck, Tyrol. The plant was supplied chiefly by the Felten & Guilleaume-Lahmeyerwerke A.-G., of Frankfort, and consists of 24 furnaces taking 400 kw. each at 4,000 volts, and delivering 60 gms. of nitric acid per kw.-hr. The 1,600 K.V.A. 11,000v./4,000v. single-phase transformers used are of the water-cooled oil pattern. For starting and controlling the arcs, auto-transformers of the same type are employed; these deliver 165 amp. at 2,000 volt. Full details of the process were given in Electrical Engineering, Nov. 11th, 1909, Vol. V., p. 964.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."]

TELEPHONE SWITCHBOARDS.—A leaflet from British Insulated & Helsby Cables, Ltd. (Prescot), describes a new wall pattern board, with plugs and drop indicators, for private branch exchange up to ten lines. A new magneto mining telephone, of which details are given in our supplement on Electrical Engineering in Mines is also described.

METAL FILAMENT LAMPS.—A price sheet, which supersedes page 5 of the latest lamp catalogue of the Electrical Co., Ltd. (Lamp Department, 121-124 Charing Cross Road, W.C.), gives notice of a general reduction in the list prices of Aegma lamps. The principal reductions are as follow:—16-c.p. 60 to 130 volt lamps, from 2s. 9d. to 2s. 6d.; 25-, 32-, and 50-c.p. 60 to 130 volt lamps, from 3s. to 2s. 6d.; and 50-c.p. 200 to 260 volt lamps, from 4s. to 3s. 6d. The prices of the 16-c.p. low-voltage and 25-c.p. high-voltage lamps remain as before.

TECHNICAL BOOKS.—The latest catalogue from Lewis's Medical and Scientific Circulating Library (136 Gower Street, W.C.) contains a section on electrical and engineering works which has been brought up-to-date by various additions.

PREPAYMENT METERS.—A handsomely got-up catalogue from Messrs. Ferranti, Ltd. (Hollinwood, Lancashire), gives very full particulars of the Ferranti prepayment meter in all its forms. Excellent illustrations are given of the complete prepayment mechanism, as well as its component parts, with particularly clear explanations. The general principle of the prepayment attachment was explained in Electrical Engineering, Oct. 29th, 1908 (supplement, page 40), in connection with the Manchester Electrical Exhibition.

ACCUMULATORS.—An effective showcard, with a boldly drawn representation in black and white of an accumulator cell, is being issued by Messrs. Pritchetts & Gold (58 Victoria Street). A copy will be sent post free upon application to them.

Reduction of Prices of Tantalum Lamps in Germany.—Messrs. Siemens & Halske have decided to reduce the price of all sizes of tantalum lamps in Germany after March 10th. The 25, 32, and 50 c.p. 100-130 volts lamps will be reduced to 2mk. (approx. 2s.) each, and the other sizes proportionately.

Statue of Lord Kelvin.—A meeting of the Executive Committee for the Lord Kelvin Statue Fund was held at the City Chambers, Glasgow, last week. Three models in clay were exhibited for inspection, and in the design accepted Lord Kelvin is seated, and is wearing his professional robes. The consideration of the site upon which the statue is to be erected has been postponed for the present.

Wireless Telegraph Notes.—The Pacific Radio-Telegraph Co. proposes to link up the islands of the Pacific Ocean by wireless telegraphy. It is stated that the British Radio-Telegraph & Telephone Co. propose erecting a wireless telegraph station on the South Wales coast with a radius of 150 miles. At present there is no wireless station on this coast.

The *Times* Vienna correspondent states that the new Austrian wireless telegraph station at Pola was opened on Sunday. The normal range is 500 kilometres.

Marconi's Wireless Telegraph Co. have received instructions to equip ss. *Mesaba, Manitou, Menominee,* and *Morquette,* of the Atlantic Transport Line; the *Samland* and *Gothland,* of the Red Star Line; the *Afric, Medic, Persic, Runic, Suevic, Athenic, Orinthic,* and *Ionic,* of the White Star Line; and four steamers of the Cestrian class in the service of the Leyland Line.

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LOCAL NOTES

BECKENHAM: *"Free" Wiring.*—At the last meeting of the Council, Mr. A. H. Dykes, who recently resigned the chairmanship of the Electricity Committee, gave his reasons for so doing. He said he was dissatisfied with the policy of the Committee in continuing their present system of "free" wiring. At present they were spending 23s. 3d. per lamp installed, although the original estimate was 12s. They had £22,613 locked up in "free" wiring and fittings, and so far from the rentals approximately balancing the interest and sinking-fund payments, the rentals last year amounted to only £935, whilst the interest and sinking-fund charges were no less than £2,643, leaving a deficit of £1,708, which was included in the accounts under general repairs. The average cost throughout the country for wiring and fitting of this description was 15s. or 16s. Further, the Committee recently decided to allow such consumers not only to further reduce their bills by putting in transformers and metal filament lamps, but the department was actually bearing the expense of the lamps and the transformers. In conclusion, Mr. Dykes expressed the opinion that it was impossible to manage a highly technical trading department with a board of nineteen members. An Executive Committe of not more than three members seemed to him the best solution of the problem.

BRIGHTON: *"Free" Wiring.*—The proposal of Messrs. Page & Miles, Ltd., to undertake the wiring of small premises, the Corporation charging an additional 1d. per unit, which is to be paid over to the wiring contractors, has been adopted by the Corporation on the understanding that any wiring contractor in Brighton may undertake similar work on similar terms. When the consumption reaches 240 units per point installed, the fixtures become the property of the owners of the premises.

CHICHESTER: *Street Lighting.*—The Chichester Electric Light & Power Co. have asked the Council's permission to tender for the street lighting of the city.

DUNDEE: *Opening of New Power Station.*—The new Carolina Port power-house of the Corporation was opened by Professor J. A. Ewing on Wednesday last week.

GUERNSEY: *Telephone Accounts.*—The accounts of the States Telephone Department for 1909 show a net profit of £436, after setting aside £1,215 to depreciation.

HALIFAX: *Trolley Omnibus.*—The Soyland District Council have petitioned the Tramways Committee for an extension of the tramways on the railless traction system. The communication has been referred to the Tramways Sub-Committee.

Tramways.—It is stated in the local papers that important recommendations in regard to the more effective and complete management of the tramways and electricity works are to be submitted by the Tramways and Electricity Committee to a "Council in Committee" to be held shortly.

INDIA: *Electricity Supply.*—The Punjab Government have granted a licence to the Simla Municipality for the supply of electrical energy for all purposes.

LEICESTER: *Tramway Accounts.*—After meeting all capital charges the accounts of the tramways undertaking for the past year show a net profit of £10,699, which is less than the amount in the previous year by £651. The Council supply power from their tramways station, and as there is every appearance of a greatly increased demand in the present year, extensions to the generating plant are recommended.

LONDON: *London County Council.*—A new tramway route between the "Plough," Clapham, and Queen's Road, Lavender Hill, was inspected last week on behalf of the Board of Trade by Colonel Yorke, and the public service was begun on Saturday.

Highgate Hill Tramway.—Trial cars have been run up and down Highgate Hill over the reconstructed track. The new brake which has been specially designed for this line worked satisfactorily.

Bermondsey: Power Supply.—Having regard to the fact that the Electricity Committee have three strong competitors (the two electric lighting companies and the gas company) ready to take advantage of the publicity given to negotiations about to be undertaken by the Committee in relation to electric supply, it has been decided that the Committee is to have power to make special terms with large consumers, subject to full particulars being reported to the Council. No publication of the information will be made.

Hampstead: Street Lighting.—It has been decided to substitute Oliver magazine flame arc lamps in Finchley Road for the arc lamps at present in use, and to extend the arc lighting of that road to Platts Lane. One hundred and fifty-nine street gas lamps in Cricklewood, Kilburn, and West End districts are to be converted to electricity, each lantern to be fitted with two 35-watt metallic filament lamps. This is the first step towards the conversion of the whole 2,237 street gas lamps in the borough to metallic filament lamps. The Electricity Committee report that this will bring about an immediate saving of £587 per annum, and a saving of £2,749 per annum after the end of eight years.

Marylebone: Telephone System of Charging.—The highest demand allowed for in the Council's telephone system of charging is 200 kw., in respect of which the standing charge is £4 10s. per kw. per annum. The committee have now decided to reduce this charge to £4 for consumers whose demand is over 400 kw.

MACCLESFIELD: *Electric Supply and Tramways.*—In connection with the recent decision of the Council not to put into force its electric lighting powers, a deputation from one of the trolley omnibus companies has visited Macclesfield with the object of putting forward a scheme of railless cars in conjunction with the supply of electricity

SOUTH SHIELDS: *New Electric Plant.*—At the last meeting of the Corporation a resolution was moved to rescind resolutions previously come to by the Corporation empowering the Electrical Committee to accept tenders for new plant at the electricity works, at an estimated cost of £8,500. Councillor Henderson, who moved the resolution, said he did so in consequence of a statement by the Borough Electrical Engineer that, if he had known that a certain prospective consumer would not take power from the Corporation, he would not have recommended the additional plant in question. The Chairman of the Electricity Committee, however, stated that whether this particular consumer did or did not take power from the Corporation, the extensions were absolutely necessary, as at present there was only a spare in the power-house of 7 per cent. The previous decision of the Council was adhered to on a division.

SUNDERLAND: *Supply to Messrs. Laing & Sons.*—In the Chancery Division on Thursday the Corporation appealed from the refusal of the liquidator in the reconstruction of Messrs. James Laing & Sons, Ltd., to admit a claim of the Corporation in respect of electricity. The firm entered into an agreement with the Corporation for the supply of electrical energy for a term of fifteen years at a minimum rent of £1,500 per annum, and the transforming plant which the Corporation installed upon the premises of Messrs. Laing cost £21,000. The firm disputed the agreement on the ground that it did not bear the seal of the Corporation, although the arrangement had been carried through by an official of the Corporation. Mr. Justice Nevill took the view that the Corporation had never expressed its assent to the contract by attaching its seal to it. The liquidator's refusal to admit the claim must stand.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BARKING.—The Electrical Engineer is to prepare a report upon alternative schemes for extending the present plant or removing the works to a riverside site.

FALKIRK.—The Town Council have decided to extend the electricity works at an estimated cost of £12,000.

HESTON AND ISLEWORTH.—The Engineer is to prepare plans to provide for 250 kw. extra in readiness for the next winter.

LONDON: *Fulham.*—Application is to be made to the L.C.C. for sanction to borrow £6,880, made up as follows:—Mains extensions, including transformers, switch-gear and sub-stations, £2,880; electricity meters, £1,000; house connections, £3,000.

Hackney.—The Finance Committee of the L.C.C. recommend a loan of £7,137 for electrical extensions.

Islington.—The Finance Committee of the L.C.C. recommend a loan of £4,778 for electrical extensions.

Shoreditch.—The Finance Committee of the L.C.C. recommend a loan of £2,234 for electrical extensions.

Stepney: The Finance Committee of the L.C.C. recommend a loan of £16,300 for electrical extensions.

LONDONDERRY.—A scheme of the Borough Electrical Engineer for extensions of the electricity undertaking to meet the requirements of the next five years has been approved, as follows:—Steam turbine, piping, &c., £3,950; alternative, reciprocating engine, &c., £3,040; switchboard extension panels, &c., £220; economiser, piping and flues, £571; feeder cable, &c., £530; additional boiler, setting of same and piping, £650—total, with turbine, £9,091; total, with reciprocating engine, £8,181.

NORWAY.—Tenders are invited by the Christiania Electric Works for the supply of cables. Copies of the specifications can be seen at the Board of Trade Office, 73 Basinghall Street, London, E.C.

RHYL.—The Local Government Board have sanctioned a loan of £4,000 for electrical extensions.

SOUTHAMPTON.—A further loan of £3,000 is to be raised for mains and services with regard to a supply for power to Messrs. Day, Summers & Co., Ltd.

WALTHAMSTOW.—Application is to be made to the Local Government Board for sanction to borrow £1,210 for extensions at the electricity works.

WARRINGTON.—Tenders are to be invited for new generating plant.

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Miscellaneous

BELFAST.—The Harbour Commissioners invite tenders by March 9th for twenty-two electric arc lamps. Particulars from the Harbour Engineer.

POWELL DUFFRYN STEAM COAL CO.—Tenders are invited for the supply of electrical stores for the year to March 31st, 1911. Particulars from the Secretary, 101 Leadenhall Street, London, and tenders by March 14th.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

N.—Tenders are invited by the L.C.C. for the wiring and fitting of the Camden Street Central School. Particulars from the Chief Engineer to the Council, and tenders by March 23rd.

W.—Electric theatre, Praed Street, W. M. S. Ward, architect, 104, Victoria Street, S.W.

Shops, Uxbridge Road, Shepherd's Bush (£6,600). F. H. Witts, architect, 60 Uxbridge Road, W. Builders, Kingerlee & Sons, Oxford.

S.E.—Lecture hall at Horniman Museum, Forest Hill, S.E. (£4,500), for Emslie J. Horniman, Garden Corner, Chelsea Embankment, S.W.

Building, High Street, Peckham, for the Electric Theatres Bureau, Ltd., 18 Charing Cross Road, W.C.

S.W.—Roman Catholic School, Earlsfield, S.W. (500 places). Trustees, St. Gregory's Church.

PROVINCES.

ACTON.—School (£10,000). Architect, Education Committee, Acton.

BARNSTAPLE.—Public baths (£3,500). E. Y. Saunders, Borough Engineer, Barnstaple.

CHESTER.—Baths (£3,000). Architect, W. T. Lockwood, Foregate Street, Chester.

COVENTRY.—Additions, Radford School (£4,000). Builder, A. J. Lord, Wolston.

DARLINGTON.—Additions to workhouse (£3,300). Architects, Palliser & Son, Crook, co. Durham.

Co-operative premises (£3,000). Architects, Clark & Móscrop, Priestgate, Darlington.

School (£4,000). G. Winter, Borough Surveyor, Town Hall, Darlington.

DARTFORD (Kent).—Additions to Darenth Asylum (£5,250). Architect, T. W. Aldwinckle, 20 Denman Street, E.C.

DOVER.—Club, Eythorne (£1,200). Architects, Worsfold & Hayward, Market Square, Dover.

Baptist Sunday Schools (£3,250). Architects, Worsfold & Hayward, Market Square, Dover.

DUNDEE.—Extension, Balfour Street School (£4,500). Architect, J. H. Langlands, 81 Murray Gate, Dundee.

DUNFERMLINE.—Workshops and offices, Woodhead Street (£5,000). Architects, Normand & Thomson, 21 Queen Anne Street, Dunfermline.

EXMOUTH.—Post offices and block of shops (£4,322). Architect, E. E. Ellis, Polslow Road, Exeter. Builder, Mr. Hayman, Exmouth.

SOUTHEND-ON-SEA.—Congregational Hall and school, Crowstone Road (£6,000). Builder, F. B. Woodham, Southend.

SHREWSBURY.—Slaughterhouses. Architect, A. Williams, High Street, Shrewsbury.

SWANSEA.—Theatre. Architect, C. Ruthen, Heathfield Street, Swansea.

WARRINGTON.—School (£14,000). Architect, T. A. Butts, Morley.

WALSALL.—Factory (£6,000). Builders, Brodrick & Son, Walsall.

WEST BROMWICH.—School (£18,000). Wood & Kenwick, High Street, West Bromwich.

WALTON (Liverpool).—Laundry at workhouse (£19,000). Architect, C. H. Lancaster, Brougham Terrace, Liverpool.

TENDERS RECEIVED AND ACCEPTED

ASHTON-UNDER-LYNE.—The following tenders are recommended for acceptance: Condensing plant, Messrs. W. H. Allen, Son & Co., Ltd.; cooling tower, The Blasberg Engineering Co., Ltd.; turbine generator, Messrs. Willans & Robinson, Ltd., Rugby, with Bruce Peebles dynamo; balancer, The Phœnix Dynamo Manufacturing Co., Ltd.

AUSTRALIA.—The tender of the General Electric Co., Ltd., through their Melbourne agents, has been accepted for the equipment of the Hawthorn Telephone Exchange at £14,317.

BRITISH COLUMBIA.—Four 4,000-kw. generators are being supplied to the British Columbia Electric Railway Co. by the Allis-Chalmers Co. These generators will be direct coupled to Doble impulse water-wheels.

LONDON: *London County Council.*—The following tenders have been received for the supply of 880 yards of plough leads for electric cars:—India Rubber, Gutta Percha & Telegraph Works Co. (accepted), £147 5s.; St. Helens Cable & Rubber Co., Ltd., £150; Callender's Cable & Construction Co., Ltd., £155 6s.; Johnson & Phillips, Ltd., £155 6s.; alternative tender, £159 2s.; British Insulated & Helsby Cables Co., Ltd., £155 6s.; alternative tender, £159 2s.; W. T. Henley's Telegraph Works Co., Ltd., £155 6s.; alternative tenders, £159 2s. and £163 6s.; Siemens Bros. & Co., Ltd., £155 5s.; Craigpark Electric Cable Co., Ltd., £163 6s.; W. T. Glover & Co., Ltd., £190.

The tender of Messrs. Kirk & Randall, of Woolwich, has been accepted at £39,883 for the track-work of the tramways from Streatham to Tooting Junction, and also in Wimbledon Road.

MORECAMBE.—The following tenders have been received for the supply of superheaters at the electricity works:—McPhail & Simpson (*recommended*), £135; A. Bolton & Son, £147; Galloway's, Ltd., £150; James Gordon & Co., £154; T. Sugden, Ltd., £155; Tinkers, Ltd., £160; John Thompson, £175; Musgrave & Sons, Ltd., £179; Mechan & Sons, £189; Heenan & Froude, Ltd., £329.

PLYMOUTH.—The tender of Messrs. Walter Scott, Ltd., of Leeds, has been accepted by the Tramways Committee for the supply of 100 tons of tram-rails at £8 per ton, and fish plates at £10 per ton.

SOUTH AFRICA: *Johannesburg.*—The tender of Mr. H. Rainey, of Johannesburg, at £43,408, has been accepted for new tramway trackwork.

SOUTHAMPTON.—The Council have accepted the tender of the United Electric Car Co. for six Brill trucks for the Tramway Department, at £40 each.

SUTTON COLDFIELD.—The tender of Messrs. Callender's Cable & Construction Co. has been accepted at £3,419 for cables for supplying the Wylde Green district.

UXBRIDGE.—The Council have accepted the tender of Glenfield & Kennedy at £50 10s. for an electrical tell-tale apparatus for the waterworks department.

COMPANIES' MEETINGS AND REPORTS

DIRECT UNITED STATES CABLE CO.—The accounts for the half-year to December 31st show a net profit of £35,047, in addition to £3,595 brought forward. After meeting the interim dividends of 4s. per share on the half-year, the sum of £7,500 has been added to reserve fund, and the balance of £6,859 carried forward.

CHATHAM & DISTRICT LIGHT RAILWAYS CO.—The report for the half-year to December 31st shows a balance of £9,358, including £1,730 brought forward. The sum of £4,000 has been transferred to reserve for depreciation, and dividends at the rate of 5 per cent. per annum on the ordinary shares for the year, are recommended. The sum of £298 is carried forward. The traffic receipts show an increase of £763 compared with the corresponding half-year of 1908, whilst there is a reduction of £949 in the expenses.

LIVERPOOL OVERHEAD RAILWAY CO.—The accounts for the December half-year show a net profit of £8,965. The five per cent. preference dividends are recommended, and a balance of £4,514 is carried forward. Although the number of passengers carried during the half-year increased, there was a decrease in the revenue of £380. There was, however, a reduction in working expenses of £1,345.

WESTMINSTER ELECTRIC SUPPLY CORPORATION.—There is a net balance of £55,622 for 1909. The full dividend on the preference shares is recommended, in addition to 10 per per cent. on the ordinary shares, carrying forward a balance of £21,116. The cash award in the arbitration with the L.C.C. in connection with their acquisition of the company's Millbank Street station was, exclusive of the exchange of site, £188,471, and this has been applied to the equipment of the new power-house in Horseferry Road.

TYNESIDE TRAMWAYS & TRAMROADS CO.—There is a net profit of £2,715 for the December half-year. After meeting preference dividends, and 1½ per cent. on the ordinary shares, and placing £600 to reserve for renewal and depreciation, a balance of £521 is carried forward. At the meeting last week the report and accounts were adopted. The passengers carried increased by nearly a quarter of a million compared with a decrease in the previous year of 559,000.

BRITISH ELECTRIC TRANSFORMER CO.—There was a net profit of £11,774 for 1909, in addition to £1,120 brought forward. Depreciation fund is credited with £1,000, and reserve fund with £4,000, and after meeting the dividend on the 6 per cent. preference shares and 5 per cent. on the ordinary shares, a balance of £1,254 is carried forward. At the annual meeting last week, Mr. J. F. Allbright, who presided, said that within the year the company had entered into licences in two very important directions, and had further negotiations of somewhat similar character and effect. Without giving details, he mentioned that these did not tend to the formation of trade ring or pool, or to the inflation of prices, but while they were specific in some directions and general in others, the objects aimed at were to see how makers of transformers could work together instead of against each other.

LONDON ELECTRIC SUPPLY CORPORATION.—There was a profit of £50,686 for 1909, to which has to be added £3,408 brought forward. After meeting interest on temporary loan, debenture interest, the dividend on the 6 per cent. pre-

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ference shares, 2 per cent. dividend on the ordinary shares, and adding £5,000 to reserve, a balance of £3,418 is carried forward. In spite of the expiration during the year of the contract with the L.C.C. amounting to £16,158, the total decrease in revenue was only £2,523. The supply to the L.B. and S.C. Railway had been maintained without a failure of any kind. A contract was now being negotiated with the railway company for a further supply of power.

SMITHFIELD MARKETS ELECTRIC SUPPLY CO.—The net profit for 1909 was £307, which has been added to depreciation and reserve fund account. There has been a reduction in gross profit due to the use of metal filament lamps, and the Board decided to increase the charge for current from January 1st, 1910. The directors regard the new contract with the City Corporation (Electrical Engineering, November 25th, 1909, Vol. V., p. 1003) as satisfactory. No dividend is recommended.

ISLE OF WIGHT RAILWAYS.—At meetings of the Isle of Wight Central Railway Co. and the Isle of Wight Co. last week, the question of converting the lines to electric traction was referred to. It was stated that no definite scheme has been proposed, and the object of the proposals which had been made seemed to be to throw the whole of the risk upon the railway companies. Their financial position did not warrant this, and in view of the fact that the railways continued to make satisfactory progress, it was not thought that the small extra traffic shown by the proposals in question would justify the expense in fault.

NATIONAL TELEPHONE CO.—At the annual meeting on Thursday, the reports and accounts were adopted. Mr. George Franklin, the President, stated that negotiations with the Government for an earlier purchase of the Company's undertaking than 1911 had not come to anything. The staff had for some time been engaged in the preparation of an inventory of the plant and assets connected with some 1,600 exchanges, in order to prefer the Company's claim in 1911. The Railways and Canals Commissioners will act as arbitrators, if no agreement is arrived at.

WESTMINSTER ELECTRIC SUPPLY CO.—At the annual meeting last week, Mr. W. Hayes Fisher, who was in the chair, said that they had written off the whole of the expenditure connected with the old Millbank Street Station.

APPOINTMENTS AND PERSONAL NOTES

Mr. Charles Bright, F.R.S.E., has been appointed Consulting Electrical Engineer to the Australian Government.

Mr. Ernest Bennett has been appointed assistant engineer at the Dudley Corporation electricity works at a commencing salary of £104 per annum.

The salary of Mr. A. J. Lander, chief-assistant in the tramways department of the Middlesex County Engineer, has been increased from £450 to £475 per annum.

Mr. Archibald Robertson, Manager of the Rothesay Electric Tramways, has been appointed Manager of the Scottish undertakings of the British Electric Traction Co., with the headquarters at Greenock. The Rothesay Tramways will be managed by Mr. Hill, the present Electrical Engineer.

Mr. Frank Rawson, Manager of the Calcutta Electric Supply Corporation, has been appointed an additional member of the Indian Imperial Legislative Council. He will act as expert adviser to the Committee on the Indian Electricity Bill.

Mr. Frank Crooks, Chief Clerk at the Wakefield Electricity Works, has been appointed Chief Clerk at the Bridlington Electricity Works, at the salary of £90 per annum, rising to £120.

At the last meeting of the Bridlington Town Council the proposal that the Borough Electrical Engineer, Mr. A. J. Beckett, should have a commission of 1 per cent. upon all new work exceeding £200 in value was passed. A similar proposal made a short time ago was referred back.

The High Commissioner for Australia, Sir George Reid, has been appointed, says Reuter, to fill the vacancy in the Commonwealth representation on the Pacific Cable Board.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £61 15s. to £62 5s. per ton (last week, £61 15s. to £62 5s.).

SIEMENS BROS'. TELEPHONE EXTENSION.—Owing to the enormous increase in their Tantalum lamps and fittings business, Messrs. Siemens Bros'. Dynamo Works, Ltd., Tyssen Street, Dalston, have found it necessary to instal an additional telephone line. There are now four lines at this address, viz., 8587, 8388, and 8389 Central, and Dalston 4.

CHANGE OF ADDRESS.—Messrs. Electrical Installations, Ltd., of Bassishaw House, Basinghall Street, London, E.C., are removing to larger premises on March 25th at 27 Martin's Lane, Cannon Street, London, E.C.

DIVIDENDS ANNOUNCED.—Cambridge Electric Supply Co., 4 per cent. on the ordinary shares for 1909.

Newcastle-on-Tyne Electric Supply Co., 4 per cent. on the ordinary shares for 1909, transferring £16,500 to depreciation.

DISSOLUTION OF PARTNERSHIP.—The partnership between C. D. Copland and E. Cardin, consulting electrical engineers, 16 John Dalton Street, Manchester, has been dissolved. E. D. Cardin will continue.

AGENCY.—Messrs. Marryat & Place, of 28 Hatton Garden, London, advise us that they have appointed Messrs. Marshall, Osborne & Co., of 55 Newhall Street, Birmingham, as agents for the sale of their automatic lifts in the Midland district.

CANADIAN AGENCY WANTED.—A Yorkshire manufacturer of electrical and mechanical engineering appliances seeks suitable Canadian representatives.

Particulars, &c., may be obtained from the Office of the High Commissioner for Canada, 17 Victoria Street, London, S.W.

Stop-valve Explosion at Londonderry.—A Board of Trade report has been issued regarding the stop-valve explosion which occurred at the Londonderry Corporation Electric Supply station in November last. The explosion is ascribed to water-hammer action, and it is stated that alterations in the drainage of the steam range are to be effected which should prevent the recurrence of an accident of this nature.

OFFICIAL ANNOUNCEMENTS AND SMALL ADVERTISEMENTS.

Official Advertisements are charged at the rate of **9d.** per line (column width).

Small Prepaid Advertisements of Situations Vacant and Wanted, Plant for Sale or Wanted, &c., are inserted at the rate of **1/-** for the first 12 words and 1d. per word afterwards. Three insertions for the price of two. Advertisements can be received up till Wednesday morning first post.

Letters should be addressed to The Kilowatt Publishing Co., Ltd., 203–6, Temple Chambers, London, E.C.

COUNTY OF LONDON.

THE LONDON COUNTY COUNCIL invites tenders for wiring and fittings for electric lighting at the Camden Street Central School.

Full particulars, and also information as to the conditions to be observed by tenderers, will be given in the London County Council Gazette of 7th and 14th March, 1910. The Gazette, which is published weekly, contains particulars of all the tenders invited by the Council, and can be obtained from Messrs. P. S. King & Sons, 2 and 4, Great Smith Street, Westminster, S.W., price 1d., post free 1½d. an issue, or for the whole year a prepaid subscription of 6s. 6d.

Tenders must be upon the official forms to be obtained on and after 7th March, 1910, from the Chief Engineer of the Council at the County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of £1 for the specification, etc. This deposit fee will only be returned if a *bona fide* tender is submitted. No tender received after 11 a.m. on Wednesday, 23rd March, 1910, will be considered.

The Council does not bind itself to accept the lowest or any tender, and it will not accept the tender of any person or firm who shall on any previous occasion have withdrawn a tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall,
Spring Gardens, S.W.
28th February, 1910

ELECTRICAL ENGINEER (young) seeks situation as improver, 4½ years, all-round experience, within distance of Boro' Polytechnic preferred. W. F., 42, Falmouth Road, Boro', S.E.

A FULLY QUALIFIED ELECTRICAL ENGINEER, A.M.I.E.E., Assoc. A.I.E.E. having had varied experience in British Columbia, returning to England for one month, will be glad to communicate with any English firm wishing to do business, Hydro-electric Power plants, etc. Address, W. C. Chappell, c/o H. M. Hobart, Consulting Engineer, Norfolk St., Strand, W.C.

C. JENNINGS & CO. can supply woodwork of any description at short notice, Stairs, Balusters, Newels, Handrails, Sash bars, Mouldings, Joinery. Support British Industry, and refuse Foreign doors. We compete. Electric casings and underground troughing also supplied. Jennings & Co., 955, Pennywell Road, Bristol.

ELECTRICAL ENGINEERING BOOKS AT HALF PRICES!! Books on Electrical, Engineering, Technical, *and all* other subjects supplied. Sent on approval. State wants. Catalogue No. 98, Post Free. Books bought. W. & G. Foyle, 135, Charing Cross Road, London, W.C.

GAS RETORT CARBON for Sale. Pitch, Insulating Material, Creosote. We supply the Trade.—V. Dasnieres, 10, St. Mary Axe, London, E.C.

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ELECTRICAL ENGINEERING

NO. 167 [VOL. VI., NO. 10] THURSDAY, MARCH 10, 1910. [PRICE ONE PENNY.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

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Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON AND WESTMINSTER BANK (Temple Bar Branch).

A SUPPLEMENT "ELECTRICAL ENGINEERING IN MINES" IS INCLUDED (GRATIS) IN "ELECTRICAL ENGINEERING" ON THE FIRST THURSDAY OF EVERY MONTH.

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SUMMARY

IN our special monthly article on new electrical supplies and accessories, a number of new fittings by various makers are illustrated. Some designs of hand lamps to comply with the Home Office Regulations are also described, and details are given of a new long burning flame arc lamp without magazine. Other novelties described include a portable electrically-driven air compressor for cleaning electrical machinery, a motor and gear for domestic purposes, a special motor generator for cinematograph installations, and a small alternating to continuous current converter. (Page 161.)

THE wiring of the new offices for the Commissioners of Woods and Forests in Whitehall, which has been carried out in galvanised screwed seamless steel conduit is briefly described on page 164.

A PAPER by Mr. J. Finlay, read recently before the Birmingham and District Electric Club, described in full the manufacture of tungsten filament lamps, giving interesting details of the preparation and mounting of the filament, the methods used for exhausting, which are somewhat different from those employed for carbon lamps, and the procedure for testing the completed lamps. Comparative tables of the cost of lighting by 25-c.p. 220-volt tungsten lamps and 16-c.p. 220-volt carbon lamps are given. (Page 165.)

A PAPER by Mr. R. D. Gifford, read recently before the Birmingham Local Section of the Institution of Electrical Engineers, contains an account of a research on the cooling of transformer plates, leading to the result that the most effective method of cooling transformers is by oil, assisted by water circulation. (Page 167.)

A PHOTOGRAPH, illustrating the damage done to some of the braiding machinery at the cable works of Messrs. Johnson & Phillips, Ltd., is given on page 169.

THE Paper read before the Institution of Electrical Engineers in London in November last, by Messrs. H. W. Handcock and A. H. Dykes, in which the authors suggested a fixed price per lamp per annum for small consumers, and a dusk-to-dawn supply in scattered districts, was again read and discussed in Manchester on February 22nd. Several speakers referred to the growing importance of the power load and the higher standard of lighting, both of which were acting to counterbalance the reduction in revenue due to the use of metal filament lamps. Speakers differed on the subject of free wiring, and several urged the necessity for a simple system of charging which all consumers could understand. Mr. Watson spoke highly of the rateable value basis, and was supported by Mr. Handcock. (Page 169.)

A PROCESS for the manufacture of cast-iron permanent magnets is referred to on page 170.

IN his concluding lecture at the Royal Institution on illumination, Dr. S. P. Thompson considered the relative efficiency and costs of illumination by various

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means, and emphasised the necessity for adequate lighting in schools. The various means for scattering light and preventing glare by indirect lighting or holophane globes were also described. (Page 170.)

THE first Board of Trade inquiry under the Kitson clause in an electric power company's Act of Parliament, was recently held at West Hartlepool. The result, which is now public, is that the Cleveland & Durham County Electric Power Co. are given authority to supply the Hartlepool Electric Tramway Co., whose lines run into West Hartlepool, where the Corporation at present supplies electrical energy. (Page 171.)

MR. JUSTICE PARKER delivered judgment yesterday morning in the action brought by the "Z" Electric Lamp Manufacturing Co., Ltd., against Messrs. Marples, Leach & Co., Ltd. (now Adnil Electric Co., Ltd.), for infringement of their patent covering the use of phospham to remove the carbon from metal filaments. His Lordship said that it was clear that the carbon combined with the nitrogen in the ammonia liberated on heating the phospham, and that although chemically pure phospham would not give off ammonia at the comparatively low temperature necessary, yet commercially prepared phospham did, and he considered the patent a good one. He also held that it was a useful process, and that the defendants had infringed. (Page 171.)

AMONG the specifications published by the Patent Office on Thursday last was one by the Lancashire Dynamo & Motor Co. and A. R. Stelling, for a short-circuiting device for induction motors, in which the brushes are shifted axially from the slip-rings to stationary brush rests at the same time as the short-circuiting contacts are closed.—The Westinghouse Metal Filament Lamp Co. protect a method of decarbonising tungsten filaments, which consists in heating them to a temperature of 1,200° C. in dry hydrogen.—An automatic machine for sealing the stems and filament-carriers of lamps into the bulbs is described by the British Thomson-Houston Co.—A. F. Berry has protected a heater for rooms, in which the heating coil is supplied with a large current at low pressure from a transformer; special radiating surfaces are provided on the secondary winding.—Opposition has been entered to the grant of three patents. The first is by C. E. Steinweg, for tubular soldering sticks of a cadmium alloy of aluminium for soldering aluminium; the second is a combined lamp and fan standard by J. Keith; the third is by Dick, Kerr & Co., and covers a magnetic track brake, comprising a number of separately excited electromagnets linked together.—A patent by J. O. S. Elmore, for an apparatus for refining copper electrolytically, expires during the current week, after the full life of fourteen years. (Page 172.)

WE are informed that a number of gentlemen have decided to constitute themselves into a provisional committee for the furtherance of the legislative, industrial, and commercial interests of the electrical industry.—A letter from a manufacturer of fire appliances comments on the fire at Messrs. Johnson & Phillips's works. (Page 173.)

THE Aberdeen Suburban Tramways Co. have accepted an offer of the Town Council for a supply of electrical energy at 1¾d. per unit.—It is proposed to run trolley omnibuses in the western suburbs of Berlin.—The Brighton Corporation have rejected a proposed scheme for wiring houses, the capital being found by wiring contractors.—An application has been made to the Board of Trade by the Gateshead & District Tramways Co. for permission to use trailer cars.—A London firm proposing to erect calcium carbide works have asked the Monmouth Corporation for a supply amounting to 500 kw. (Page 174.)

FINCHLEY COUNCIL propose to borrow £10,000 for mains; Burnley Corporation, £5,000; and Wednesbury Council, £2,095. Extensions are proposed at Blackburn, Stretford, Swansea, Goring, and West Ham. Tramway extensions are proposed at Edinburgh, Burnley, and Southampton. Electrical stores are required at Southampton and Bray. (Page 174.)

AT the annual meeting of the Charing Cross, West End & City Electricity Supply Co., the question of purchasing foreign plant was discussed. The large expansion in the foreign and Colonial trade of W. T. Henley's Telegraph Works Co., Ltd., was referred to at the meeting last week. (Page 176.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MARCH 10TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. (1) "Short-Circuiting of Large Electric Generators and the Resulting Forces on Armature Windings." (2) "The Design of Turbo-Field Magnets for A.-C. Generators, with Special Reference to Large Units at High Speeds," by Miles Walker.

FRIDAY, MARCH 11TH.

Physical Society.

8 p.m. At Imperial College of Science. (1) "On Coherers," by Dr. W. H. Eccles. (2) "Earth-air Electric Currents," by G. C. Simpson.

SATURDAY, MARCH 12TH.

Royal Institution.

3 p.m. Afternoon Lecture V., on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson, F.R.S.

TUESDAY, MARCH 15TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology. "A Modern Telephone Exchange," by J. P. Garner and R. L. Bell.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. Discussion on "The Measurement of Light and Illumination."

WEDNESDAY, MARCH 16TH.

Institution of Electrical Engineers: Yorkshire Section.

7.15 p.m. At Sheffield University. "Rating and Testing of Motors for Intermittent Working," by Dr. R. Pohl.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At 92 Victoria Street, London. "Isolated Electrical Plants," by R. C. Plowman.

THURSDAY, MARCH 17TH.

Institution of Naval Architects.

7.30 p.m. At Royal Society of Arts. "The Substitution of the Electric Motor for Marine Propulsion," by W. P. Durtnall.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. Adjourned discussion on Mr. Miles Walker's Papers read to-day.

SATURDAY, MARCH 19TH.

Royal Institution.

3 p.m. Afternoon Lecture VI., by Sir J. J. Thomson, F.R.S., on "Electric Waves and the Electromagnetic Theory of Light."

Junior Institution of Engineers.

3 p.m. Visit to the new engineering laboratory at Finsbury Technical College, London.

Telegraph Traffic.—The Chief of Telegraphs in Gaboon announces the opening of a new office at Cabinda, in Portuguese territory, which is now connected with Loango.—The Bagdad line was restored on the 2nd inst., only to fail again on the 5th inst.—Censorship on telegrams to Paraguay has been cancelled.—The Perim-Obok cable, interrupted since the 22nd February, was repaired on the 7th inst., and perhaps, now that the repairing steamer is in the neighbourhood, the Assab-Perim cable, interrupted since 8th July last, will be attended to.—The Dukon-Conakry cable, down since 19th August last, continues so, as well as the cable between Tourane and Amoy, which has been in need of attention since 27th December last.—No doubt the *Pouyer Quertier* is now engaged in the restoration of the broken link at French Guiana.—The Telegraph Construction and Maintenance Co.'s steamers are about to proceed with the laying of the Western Telegraph Co.'s cables between the Argentine and St. Helena.

Parliamentary.—The following Bills have been read a second time in the House of Commons:—Bradford Corporation, Middlesbrough Corporation, Middleton Corporation, Rhonnda Council (Tramways Extensions), Warrington Corporation, Devonport and District Tramways, Southampton Corporation, and Warrington Corporation.

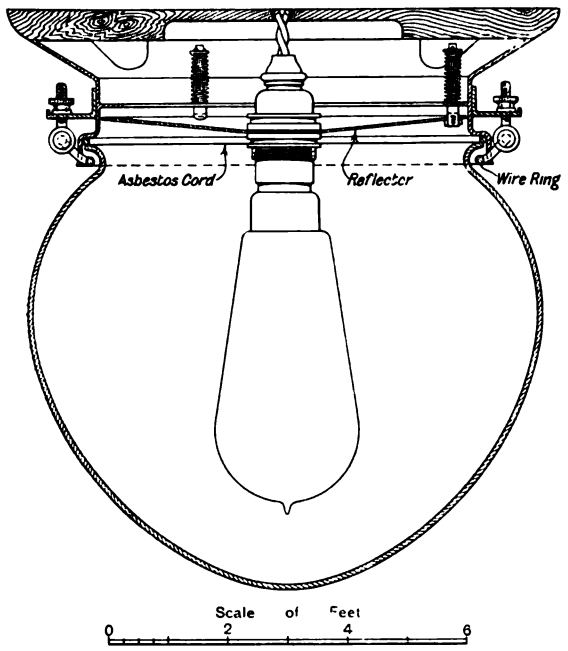
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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Fittings, Switches, and Accessories.

Until recently ceiling fittings for electric lighting have been much neglected. The reason may or may not have been a conscious or unconscious knowledge, on the part of the consumer, as well as the contractor and fittings maker, of the law that the illumination on a surface varies inversely with the square of the distance from the source of light. This law, however, takes no account of the fact that the illumination is more effective both for practical purposes, and for comfort if evenly distributed, and in many cases the consumer feels that he has "better light" if the lamps in his room are raised. Another advantage of using ceiling fittings is that lamps of a larger candle-power can be employed, with a consequent reduction of the points to be wired in the case of new work. In some cases the employment of larger units of light in ceiling fittings, instead of a greater number of smaller lamps in pendants and brackets, may result in an increase in the current consumed, but even if this is so, the economy of the metal filament lamp makes the difference of little importance to the consumer.

Mr. J. S. Highfield, of the Metropolitan Electric Supply Co., has recently given much attention to the matter, and has designed a patent ceiling fitting (manufactured by the General

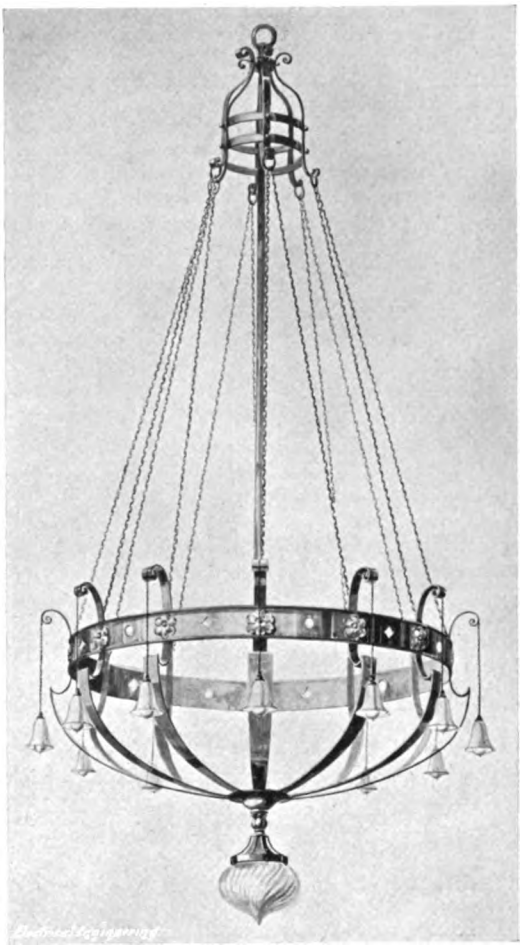




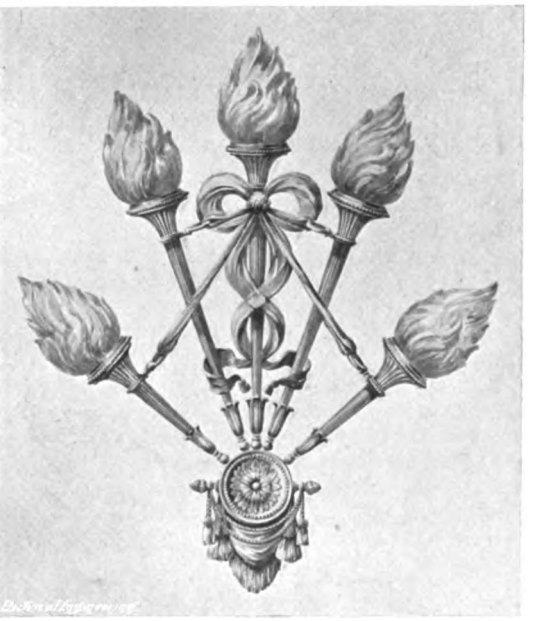
Cross-section showing Spring Suspension, &c., and General View of Highfield Ceiling Fitting.
(General Electric Co.)

Electric Company, Ltd., 71 Queen Victoria Street, E.C.), which, in addition to being of plain and elegant appearance, and not extravagant in price, has the advantage of embodying a device which protects the lamp from any severe vibration caused by the movement of animate or inanimate objects on the floor above.

One of our illustrations shows the general appearance of one of the fittings, and the other is a section indicating its construction. The silvered reflector attached to the lampholder, and moving in the cylindrical body of the fitting, in conjunction with three helical springs, gives the effect of a slow-acting spring suspension on account of the natural air-damping when the reflector moves. Another point to be noticed is that the base of the fitting has a broad flange to prevent any dust carried upwards by air currents from the warm globe from being deposited on the ceiling. A twisted plain flint glass globe is usually supplied with the fitting, and this is secured



1,200-c.p. Electrolier at the Maida Vale Skating Rink (General Electric Co.).



Five-light Torch Bracket (General Electric Co.).

by a two-part metal ring, which holds it against an asbestos cord washer. A modification of the same fitting is made in the form of an outside weather-tight lantern, whose appearance recommends it for the porches of shops, &c.; this is

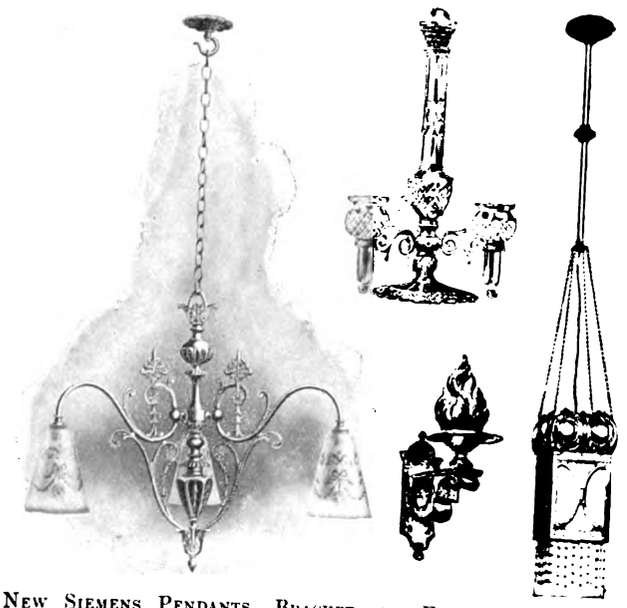
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arranged with outside plug terminals for convenience in installing.

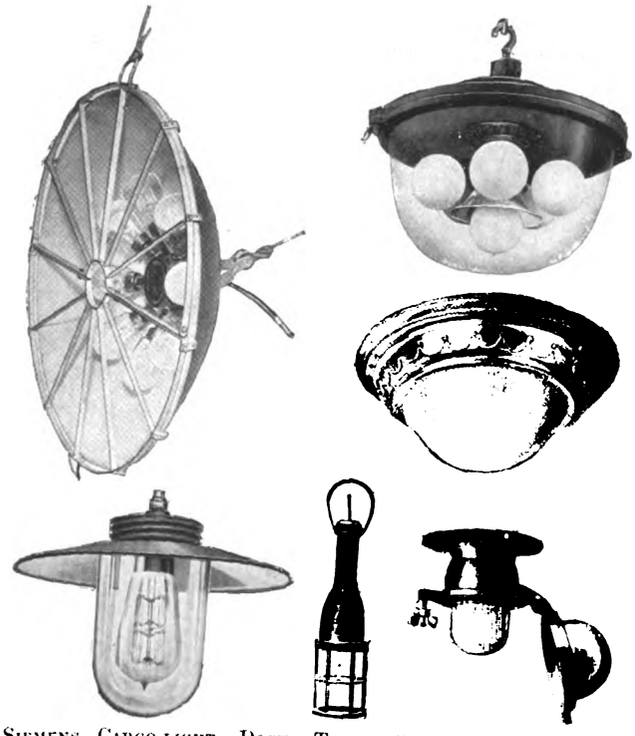
The General Electric Co. has supplied some fine electroliers for the new Maida Vale Skating Rink. The rink is 500 ft. long, with a skating floor 375 ft. long, and 106 ft. wide, and is lighted with six large electroliers 7 ft. 6 in. in diameter, placed along the centre line of the hall, and 34 smaller electroliers 3 ft. diameter, 17 down each side. The larger electrolier, which we illustrate, has one 600 c.p. Osram lamp in the clear twisted flint glass globe at the bottom, and 12 50 c.p. Osram lamps in "Lettice" globes. The smaller electroliers are of the same general type as the one illustrated, and have each a 400 c.p. lamp and six 50 c.p. lamps.

We also illustrate a very pleasing design of five-light torch bracket (in what may be called a free interpretation of Empire style), which is a recent addition to the General Electric Co.'s showrooms.

We are able to illustrate a few examples out of a large variety of new fittings specially adapted for tantalum lamps



New Siemens Pendants, Bracket and Flower-glass Table Lamps.



Siemens Cargo-light, Dock, Train, Shop and Cattle-deck Fittings, and Insulated Hand-lamp.

introduced by Messrs. Siemens Brothers' Dynamo Works, Ltd., during the past month, which we have had the pleasure of inspecting at their works at Dalston. The first group shown comprises a particularly artistic brass three-light electrolier, a novel hall-lantern with bead fringe, a very solidly made brass wall-bracket with crinkled shade, and a fine piece of cut glassware in the form of table standard with flower vases. In the second group are shown some fittings of a different character made for special purposes where strength and utility are of more consequence than attractive appearance. The cargo-light cluster on the left can be made for any number of lamps up to twelve, and is arranged so that it can be suspended at any angle. Alongside this is shown a new application of the popular wireless cluster in watertight case, also useful for dock and harbour purposes. Train lighting is represented by the roof-light with small-sized holophane bowl; and three novelties to which special attention should be directed are shown in the lowest row. On the left is a remarkably simple fitting for exterior shop-lighting or similar purposes. The glass is formed with a thread and screws into the substantial iron shade, which is in one piece with the body of the fitting. The lamp-holder, as in many of the new fittings, is of aluminium, and we should mention that the complete article is listed at the low price of 3s. The hand-lamp shown is of special design to meet the Home Office requirements, and, having no exposed metal-work, does not require earthing. The body and handle are of black fibre, while red fibre is used for the cage. The fitting in the right-hand corner is designed for the decks of cattle-boats; it is fully watertight, and a heavy cast-iron cap is provided which can be closed over the lamp when the light is not required. Among other new fittings are some for indirect lighting, with large reflectors and hidden lamps, and a variety of watertight fittings for various purposes. Recently, too, the firm have developed a special series of fittings for use in hospitals, &c.

Among recent developments in the fittings department of Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.), which is now under the management of Mr. N. E. Beves (late of the British Prometheus Co.), are several new applications of the



Simplex Rose-bowl with "Spookie" Shade.

company's "Spookie" shades. They were originally introduced about twelve months ago, and are now made of linen and parchment in a variety of designs and colours so as to give an effect of stained glass. Not only are numerous new designs being introduced for the coming season, but improvements have been made in the method of manufacture. We illustrate here an effective combination of one of the shades with a rose-bowl standard.

Among new designs of fittings recently introduced by the Edison & Swan United Electric Light Co. are a series of handsome cast-brass pillar table standards, which are illustrated in a new leaflet. A number of new fancy glass shades have been added to the already long list, some etched designs with satin finish being particularly attractive.

Another novelty of the same firm is the portable hand-lamp here illustrated. This has been designed to meet the Home Office recommendations. The body is of ebonised wood, with an interior cup which totally encloses the lamp-holder and lamp-cap. An earthing terminal for the wire guard is provided. A special flexible with earthing wire is supplied for use with this lamp. This has twin conductors formed of No. 40 S.W.G.

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plain H.C. copper wires, lapped cotton, one lap of pure Para rubber, one lap of vulcanised rubber (total thickness of dielectric, 23 mils.), and one earthing conductor of same strands, cotton-covered. The three conductors are made circular (wormed) braided overall, and coated with preservative compound. This wire can be supplied braided and compounded, spirally armoured, or armour - braided. An insulated switch lamp-holder with no exposed metal parts is also made. This, of course, dispenses with the necessity of an earthing wire.

A new pamphlet from Messrs. Falk, Stadelmann & Co. (83 Farringdon Road) describes a series of "Aladdin" lanterns specially designed for groups of metal filament lamps or single lamps of large size for shop-fronts, doorways, railway stations, &c. The larger lanterns are also suitable for general illumination of open spaces and for street lighting.



Ediswan Hand-lamp.

Arc Lamps.

The Globe Electric Co., Ltd. (11 Farringdon Avenue, London, E.C.), have introduced a new multiple-carbon flame arc lamp under the name of the "Multax" lamp. This has been designed to give long burning hours with a short overall length and without resorting to the magazine principle. A special form of multiple carbon is used, consisting of two impregnated cores surrounded by a hard carbon shell of oval section, and joined by a narrow bridge of the soft impregnated material. The arc burns at one core until a certain limiting length is reached, and then travels along the bridge to the other core. The bridge not only ensures that the arc will travel from core to core without flickering, but also prevents any change of colour due to the arc burning from the hard carbon and not being fed with salts. A full-sized sketch of the carbons is shown in the accompanying figure, together with a general view of the mechanism of a lamp for D.-C. circuits. The lamp is made in two sizes. The small size has an overall length of 2 ft. 9 in., takes 16-in. carbons, and gives 18 to 20 burning hours, while the large size, with an overall length of 3 ft. 3 in., takes 24-in. carbons and gives 34 to 36 burning hours. In the direct-current lamp the mechanism comprises a single pulley, over which passes the woven copper cord for supporting the weighted carbon holders. This pulley is attached to a train of wheels, the star-wheel of which engages with a detent fixed to a rocking frame. Attached to the frame at opposite ends are two armatures which float over the poles of the series, and shunt magnets respectively. The vertical lever for adjusting the position of the swinging carbon is also attached to the frame, the movements of the system being controlled by a dash-pot and a spring. In the alternating-current mechanism the detent engaging the star-wheel is fixed to a pivoted lever. This lever is attached at one end to the plunger of a solenoid, comprising both a shunt and a series coil, and at the other end to the dash-pot. The economiser is of cast iron. An automatic carbon switch is provided for breaking the shunt circuit when the carbons are burnt out. A strong current of air up the inner surface of the globe prevents the formation of any deposit. These lamps take from 8 to 10 amperes, the voltage across the lamp being from 45 to 47 volts. An exactly similar lamp, with a triple-core carbon giving 54 burning hours with 24-in. carbons, will shortly be available, and should be especially useful for street lighting.



Interior View of Mechanism.

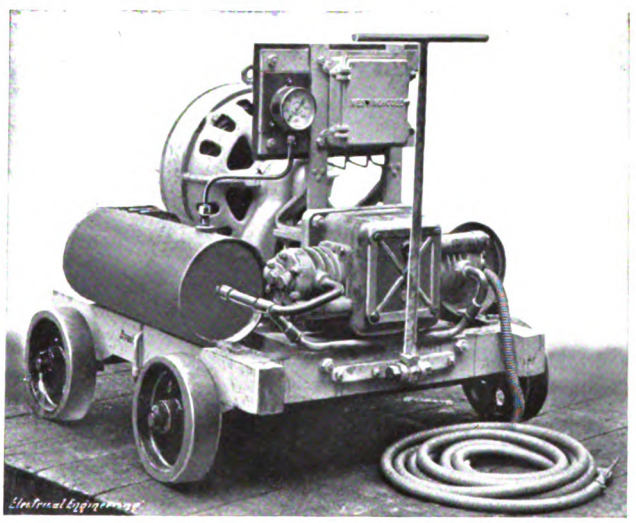


Sections of Double-cored Carbons.

The "Multax" Flame Arc Lamp.

Miscellaneous.

The accompanying illustration shows a small portable air-compressor equipment recently supplied, through Mr. C. J. Wharton, Consulting Engineer, London, to the Rio de Janeiro Flour Mills & Granaries Co., Ltd., by the British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), which firm a short time before carried out the complete electrical equipment of these mills. The set is used for blowing out the 600-h.p. motors and for cleaning the other machinery. It consists of a standard Westinghouse air-brake compressor, driven through single reduction gearing by a 3-h.p.



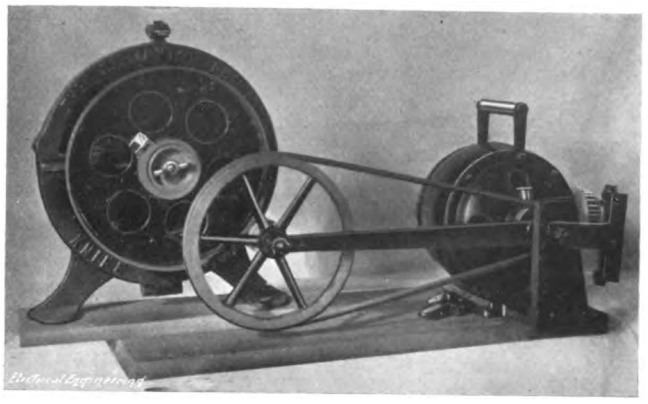
Portable Westinghouse Electrically-driven Air-Compressor.

three-phase Westinghouse squirrel-cage motor, complete with control panel mounted on a strongly built wooden trolley with rubber tyres, so that it can be easily moved from point to point. The current for operating it is taken from plug-boxes on the walls by means of a flexible cable to a three-pole, double-throw enclosed switch on the control panel, which is constructed of slate and mounted on strap-iron framework; whence the supply is led to the motor through a unit-type fuse-box. The connections are so arranged that when the motor is thrown on the line at starting, the fuses are cut out, and after the motor has attained a fair speed the switch is thrown over to the other side, putting the fuses in circuit.

Mr. R. Borlase Mathews (Bank Buildings, Kingsway, London, W.C.) has called our attention to a novel device for domestic use comprising a small motor combined with a special patented gear for driving domestic appliances. It is intended that the one motor shall be employed to drive all the appliances in the house from a washing or wringing machine to a rotary brush for polishing silver or boot-cleaning, and it is found that a 1/7 h.p. motor is sufficient for any such apparatus. The accompanying illustration shows the motor and the gear which comprises a lever 18 in. in length pivoted at a point in line with the axis of the motor. Springs are fitted at the end of the short arm of the lever, and a large pulley is fitted at the end of the long arm, giving a speed reduction from the pulley

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on the motor shaft of 1 to 7. The motor runs at about 2,000 r.p.m. A 1¼-in. rubber friction pulley on the spindle of the large pulley is brought to bear against an 8¼-in. driving pulley on the machine to be driven, and this latter is thus driven at a speed of about 60 r.p.m., which is found to be the speed at which most domestic appliances are constructed to work. In order that this driving wheel may be fitted on any appliance, it has a central hole with a fixing screw, and various bosses are provided suitable for the spindles of the different ordinary appliances. When driving a vacuum cleaner or a mangle, the gear is dispensed with, the motor driving direct through a



Domestic Motor driving a Knife-cleaner through Patent Friction Drive.

leather cord. For such comparatively heavy work the motor takes about 120 watts, but when driving a buff wheel (by means of a flexible shaft with a simple attachment for fixing to the spindle of the motor) the consumption is only about 70 watts. The motor has ball bearings, and therefore requires little attention. Among the appliances suitable for driving by this apparatus are knife machines, coffee grinders, meat choppers, dish washers, sewing machines, &c. One or two large firms are already interested in the device.

The Phœnix Dynamo Manufacturing Co., Ltd. (Thornbury Works, Bradford), have brought out a special single-armature double-commutator continuous-current converter to meet the requirements of arc lamps for theatrical and cinematograph work, to which the name of the "Cineconverter" has been given. The machine is of the semi-enclosed type with expanded metal covers and is fitted with ball-bearings. It is specially designed to run without sparking even under the heaviest fluctuations of load. The brush gear is particularly simple, requiring little or no attention, and any risk of flash-over is prevented by the great distance between adjacent brushes. Considering that in the case of a 460-volt circuit a 60-ampere cinematograph arc will only draw 10 amperes from the mains when one of these converters is used, the saving available is obvious. Three stock sizes are listed for 3½, 5, and 9½ kw., the last of which is intended to run stage side arcs at the same time as a cinematograph. Six other sizes have also been designed.

Owing to the success of their 100-watt alternating to continuous-current converter combination, which was introduced about five years ago, the Crypto Electrical Co. (155-159 Bermondsey Street, S.E.), has brought out a larger machine built on the same lines, but with an output of 350 to 400 watts. The continuous- and alternating-current parts are electrically quite distinct, but are arranged with a single shaft with only two bearings in a single case, giving great advantages as to weight, efficiency and size over an ordinary motor-generator. The dimensions of the machine are 28 by 26½ by 17½ inches, and the weight is only 196 lbs.

International Refrigeration Congress.—The second International Refrigeration Congress will be held at Vienna from October 6th to 12th next. Mr. R. M. Leonard, 3 Oxford Court, Cannon Street, London, E.C., is Hon. Secretary for the United Kingdom.

District Railway Rolling Stock.—With regard to the new rolling stock about to be ordered by the Metropolitan District Railway, it is satisfactory to note that, while most of the original rolling stock of the company was built abroad, invitations for tenders for the new stock are being confined to British firms. The company will shortly order 32 motor-cars and 20 trailer cars, and these will be built entirely of steel. All unsightly rivets will be concealed by an outer sheet of steel, giving the exterior a perfectly smooth finish. The new cars, like the older ones, will have electrical equipments by the British Thomson-Houston Co.

WIRING OF NEW GOVERNMENT OFFICES

THE handsome new edifice adjacent to the new War Office building in Whitehall is to be the head office of the Commissioners of Woods and Forests. It has been built to the plans of the architect, Mr. John Murray, and the electrical installation is being carried out by Messrs. Leo. Sunderland & Co. (39 Victoria Street, Westminster), to the plans and specifications of the Office of Works. The supply is taken from the three-wire D.C. system of the Charing Cross, West-End & City Electric Lighting Co., at a pressure of 200 volts across the outers. The service cable terminates at a main switch in the cellar, and from there an armoured lead-covered 0·2 sq. in. concentric cable leads to the main switchboard in a special compartment in the basement. The board consists of two marble panels, and contains, besides a three-pole switch and fuses, two meters and eight double-pole switches with fuses; seven of these are for the 100-volt lighting circuits of the seven floors, and one is spare. A 200-volt power circuit for two ventilating fans and two lift motors is controlled from a separate double-pole switch.

The wiring is carried out in galvanised, seamless, screwed steel conduit, and every pair of cables runs in a separate conduit to a distribution fuse-box on each floor, supplying from 10 to 13 circuits. The pipes are provided with brass bushes at the ends near the board, and with ebonite bushes inside the boxes. Inspecton boxes are provided at all elbows and T-joints. All the ¾-in. pipes for the lighting circuits are bonded together and to the 1½-in. pipes from the board by means of stranded copper wire sweated into thimbles, which are attached to screw clips on each pipe. The 1½-in. pipes are in turn bonded together and to the lead covering of the service cable in the basement in the same way, thus ensuring that the whole system is effectively earthed. The power circuits are in 1-in. pipe.

The passenger lift is operated by an eight h.p. motor, and a five h.p. motor runs the service lift. The ventilation system consists of ducts through the walls, with inlet and exhaust openings, the air being blown in at the bottom by a 1½ h.p. fan, and exhausted by a three h.p. fan on the roof. In all there will be some 350 metal filament lamps, but the fittings are not yet put in. An intercomunication telephone system will be installed, and for this purpose two 1½-in. pipes have been run along under the floors, with a box at the outside of the door to every room; from these boxes two 1-in. pipes run under the flooring into the centres of the rooms.

A Direct Reading Accelerometer.—An electrical accelerometer which has the advantage over inertia instruments of being independent of the effects of gradients, was described in a recent Paper read in America by Mr. C. R. Moore, of Purdue University, and abstracted in the *Electric Railway Journal* (New York). A special continuous-current magneto-generator is driven by the car, and its main terminals are connected through a delicate centre zero milliammeter to a condenser. The machine is constructed to give an E.M.F. proportional to the speed. Assuming no leakage, no current will pass when the speed, and therefore the voltage is constant, but there will be a current into or out of the condenser, whenever the voltage rises or falls, so that the reading of the milliammeter will be a measure of the direction and magnitude of the acceleration. Leakage is compensated for by a current from an auxiliary commutator on the generator, connected through an adjustable resistance to a second moving coil on the milliammeter.

Electrically-driven Ploughs.—In a pamphlet issued recently by the Allgemeine Elektricitäts Gesellschaft of Berlin, some interesting particulars are given of their electric ploughing system. The equipment comprises a heavy motor waggon, a tension waggon, the plough, and two rope carriers. An endless steel rope passes over a drum on the motor waggon and round a horizontal pulley on the tension waggon, the two waggons being placed at opposite sides of the field to be ploughed. The plough is attached to the rope, and is drawn to and fro across the field; the other portion of the rope runs over the carriers. The motor on the waggon is from 38 to 72 h.p., according to requirements, and is used for propelling the waggon as well as driving the drum. When the plough is making the return journey to the motor waggon, the tension waggon moves along a short distance automatically. Power is supplied to the motor waggon by means of a trailing cable carried on a special waggon from the power station or portable transformer station. Only two men are required to work the small equipments, four for the largest. In twelve hours some 45 acres can be ploughed with an 8¾-in. deep furrow, the power consumption being about 12 kw.-hrs. per acre. For a 14½-in. furrow the area ploughed is 34 acres per day, with a current consumption of 21 kw.-hrs. per acre. The total costs are dependent upon a number of circumstances, chief among which is the facility for obtaining power.

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THE MANUFACTURE OF METAL FILAMENT LAMPS

A PAPER was read by Mr. James Findlay (Managing Director, Rugby Lamp Co., Ltd.), on February 12th before the Birmingham and District Electric Club, in which an interesting description was included of the manufacture of tungsten filament lamps.

Manufacture of the Filament.

The metal tungsten occurs in wolfram or tungstate of iron, and in scheelite or calcium tungstate. The native calcium tungstate is digested in hydrochloric acid, and the soluble calcium salt washed out with water. The resulting tungstic acid may be dissolved in ammonia evaporated to dryness and heated in contact with air. Tungstic oxide is thus obtained. With this yellow powder the work of making the filament for incandescent lamps begins. A common method is to take tungstic oxide, mix it to a stiff paste with glucose or starch or other material to bind the powder together. The paste is put into a mould, in the bottom of which is a diamond die, and pressure is brought to bear on the paste to extrude it through the die. Difficulty is encountered in the first place in getting the tungstic oxide powder into a fine enough state of subdivision. When it is remembered that the aperture of the die is sometimes less than two thousandths of an inch in diameter, it will be readily understood that the powder must be very fine indeed before it can be made into a paste which will pass through. Then it is a comparatively easy matter to mix this powder into a paste, but this paste must be wet enough to pass through the die, and yet dry enough to hang together in thread form after it has passed through. The usual practice is to catch the thread on cardboard or similar material as it comes from the die. The board is passed back and forth beneath the die so as to spread out the thread in long hair-pin form. The filaments or threads are then dried in a gas oven, after which they are placed in boats and put into a furnace tube through which hydrogen gas is allowed to flow. Sometimes the air is exhausted from this tube by means of a vacuum pump before the hydrogen is introduced, but the hydrogen is generally left to displace the air. A considerable heat must be maintained in this furnace for several hours, the result of which is partially to reduce the tungstic oxide to tungsten. The next step completes this reduction.

The filaments are supported under a bell jar which is evacuated—hydrogen gas is admitted and the electric current passed through the filament. A current equal to four or five times that which the filament will take when made into a lamp is passed through the filament, the strength of the current varying with the pressure of the gas under the bell jar. The effect of this strong current is to burn off any remaining portion of the binding material, to complete the reduction of the oxide, and to sinter or melt the particles of metallic tungsten closely and solidly together. In order to give the filament a symmetrical shape, it is customary to hang a small weight on it during this sintering process. The weight pulls the filament straight and makes the bend small, so that the filaments may be placed close together. Care must be observed to have a weight which, while heavy enough to give the desired shape to the filament, is not too heavy, or, while the filament is very hot, the weight will drop through. The weight must also be of a material that will withstand the very high temperature of incandescent tungsten, otherwise the weight will be melted to the filament. The filament is now ready to be attached to the leading-in wires. Owing to tungsten being very soft while incandescent, it is necessary to support the filament at both ends, and to provide such a means of support so that when the filament becomes soft and extends one limb will not come into contact with another limb. This and the low resistance of tungsten renders necessary a much more expensive internal construction for the lamp than is necessary for carbon filaments.

Mounting the Filament in the Bulb.

The various steps in the manufacture of the filament support are as follows :—The leading-in wires consist of a piece of copper wire to which is welded a very short piece of platinum, which again is welded to about half an inch of nickel wire. The purpose of the short piece of platinum wire is, of course, to prevent any air leaking along the wires and so impairing the vacuum. Many substitutes for platinum in this connection have been suggested, and while some of the proposed substitutes equal platinum in having practically the same coefficient of expansion as glass, none of them is quite equal to platinum in freedom from oxidisation in the flame used to melt the glass around the wires. A piece of glass tube is rotated in a gas flame, a carbon pencil is inserted in the end which the flame has softened, and by a slight movement the end is flanged out. The flanged glass tube and the leading-in wires now go to a machine where they are sealed together.

This machine has four heads, which rotate around a common centre so arranged that each head comes in succession opposite the operator who puts the glass tube and wires in place, then into a preliminary fire to heat up the glass, then into a final fire, where the glass is melted, and while in this condition the operator, by means of a foot pedal, pinches the molten glass around the wires. Another movement of the machine brings the part into a position where it may cool down before it comes again in front of the operator, who removes it and puts in position the new parts of another. The central glass rod is placed in position. The enlargement in which the wires are embedded is made by rotating the rod in a pointed flame, at the same time gently pushing the ends together. After the wires are inserted the filaments are secured in place. In a carbon filament lamp the carbon is attached to the leading-in wires by a little carbon cement. This method, however, will not answer with a tungsten filament. Carbon is a very bad thing to have inside a tungsten lamp. The ideal way is to have an all-metal connection. This is very neatly effected as follows :—A paste of nickel oxide is used to hold the filaments to the wires. The mount is pushed up into a bottle through which a stream of hydrogen gas is made to flow. The leading-in wires of the mount are connected to one pole, and a platinum point, which is inserted through the side of the bottle, is connected to the other pole.

Current is supplied through a small step-up transformer, so that when the push-button is touched a high-tension arc is made between the point at which the filament is pasted and the platinum point. The heat of this arc and the hydrogen reduce the nickel oxide to metal, which forms a small globule around the filament, securely welding it to the leading-in wire. The mount is turned around, bringing each joint in front of the platinum point, so that the joints—sometimes over twenty in one lamp—are all made in a few seconds. The mount is now ready to be sealed into a bulb, but some preliminary work must first be done on the bulb. As received from the glass house, the bulb, of course, has no pip and it has a long neck. The first operation on the bulb—after washing it—is to make a small hole in the centre. This is done by playing a very pointed flame against the centre of the bulb, at the same time bringing air pressure to bear inside the bulb, so that when the flame has sufficiently softened the glass the air pressure blows it out into a hole.

A short tube is now sealed on over the hole. This tube is afterwards used to connect the lamp to the exhaust pump. The bulb is now held upright in the centre of a ring of pointed gas flames, arranged so that the flames play on the neck at the point at which it is wished to cut it off. The bulb is slowly rotated so that the neck may be equally melted all around. As the flames soften the glass the neck is pulled down by its own weight, so that in a few seconds it drops off and the thin glass closes over the opening. Air pressure is at once introduced into the bulb, and the thin glass bursts outwards. The bulb and mount are sealed together on a machine which has a spindle to carry the mount and frames to support the bulb.

The mount is first put in position and then the bulb is placed over it, great care being necessary to avoid breaking the very fragile filaments. The mount spindle and bulb frame rotate together as one piece, and the machine consists of four arms with a mount spindle and bulb frame on each arm. This arrangement allows the operator to place the mount and bulb in position, rotate the machine, and thus bring the lamp parts into the fire, at the same time bringing another arm with its mount spindle and bulb frame in front of the operator. When the parts of another lamp have been placed in position the machine is given another quarter revolution, and the original mount and bulb are now brought into a hotter fire, where the sealing of the two together is completed. When the lamp is removed from this machine it is placed in an annealer to prevent it cooling too rapidly, and so obviate as far as possible the danger of cracking. The lamp is now ready to be exhausted.

Exhausting the Bulb.

Different methods are followed in exhausting metal filament lamps from carbon lamps.

A pump which is coming into very general use for this work is the Gaede rotary mercury pump, although some manufacturers prefer to use the old style Sprengel mercury pump. The rough-and-ready means of connecting the lamp to the pump by

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means of a rubber joint, which is found satisfactory for carbon lamps will not answer for tungsten lamps. The only entirely satisfactory method is to seal the lamps to the pump by means of the torch. Six lamps are generally put on a pump at one time. The lamps are so arranged that in addition to being connected to electric supply they can be enclosed in a heater and brought up to a good heat while they are being pumped. Very few manufacturers use any chemical to assist the exhaustion of tungsten lamps in the way that red phosphorus is used in carbon lamps. The lamps must therefore be left much longer on the pump, and for this reason they are not connected up singly, but in batches of six or more.

A tungsten lamp requires a much more careful exhaustion than a carbon lamp, and it is necessary to use a gauge of some sort to indicate when the vacuum is good enough to permit the lamps to be lit up. For this purpose some manufacturers use a spark gauge. As the exhaustion proceeds the discharge is first ribbon-like, and then spreads into a luminous glow. The glow then disappears and the glass fluoresces, the discharge finally refusing to pass. As the degree of vacuum indicated by these changes varies with the size and condition of the spark coil used, some manufacturers prefer to depend entirely on a McLeod gauge. In this gauge the highly rarefied gas in a bulb which has been connected to the lamps and pump is compressed by allowing mercury to flow in, the compressed gas or air being collected into a carefully calibrated tube over the bulb. The total capacity of this tube and bulb are known, and the pressure in the bulb before the mercury was admitted is calculated. It is good practice to have a vacuum of about 0·0006 mm. of mercury before lighting up the lamps. The lamps are on the pumps about 40 or 50 minutes, and a vacuum equal to about 0·0002 mm. of mercury should be obtained before sealing the lamps off. The test by a spark coil used for carbon lamps is of doubtful value. Tungsten lamps may not show the slightest glow on the coil, and yet not have a good enough vacuum.

Testing and Rating.

All lamps are tested on the photometer for candle-power, and most of them are also read for current consumption. The photometer most used in factory work is the common Bunsen grease-spot. A working standard is set up at one end of the photometer. This should be an incandescent electric lamp burning at an efficiency which will match in colour with the lamps which are to be tested on this photometer in largest quantity. The reference standard is placed in position at the other end of the photometer bar, and is carefully brought up to the voltage necessary to give its rated candle-power. The resistance in series with the working standard is varied until the working standard and the reference standard give a balance on the photometer head, which is placed exactly midway between the two lights. The reference standard is now withdrawn and a lamp to be tested is put in its place. This reference standard is used several times each day to keep the working standard true.

Lamps are tested either at candle-power for voltage or at voltage for candle-power. In the first case—for voltage—the spot box is fastened in place for the candle-power desired, and the voltage over the test lamp is varied until balance is obtained. In the other case—for candle-power—the voltmeter needle is held steady at the voltage desired, and the spot box is moved back and forth until balance is obtained. The photometer is furnished with a scale based on the law of inverse squares, which shows the candle-power of the lamp under test for different points on the photometer bar.

It is impossible to supply tungsten lamps which will all at their marked voltage give exactly their rated candle-power, but it is well known that tungsten lamps do not change so much in candle-power, &c., with change of voltage as do carbon filament lamps, but these figures show that even here the change is considerable.

Table I.

Tungsten Lamps.—25 c.p., 220 v., 35 watts.

Volts.	C.P.	Watts.	Watts per C.P.	Life (Hours).
240	34	40	1·18	500
235	31¾	38¾	1·22	700
230	29½	37½	1·27	900
225	27¼	36¼	1·33	1000
220	25	35	1·40	1000
215	32¾	33½	1·47	
210	21	32¼	1·54	
205	19	31	1·63	
200	17½	30	1·72	

Of course much longer experience has been had with the carbon lamps than with the tungsten lamps, so that while we can say with tolerable certainty how a batch of carbon lamps will average in performance under different circumstances, we cannot be so precise in out statements regarding tungsten lamps. The figures in Table II. are probably very nearly right.

Table II.—*Cost per Thousand Hours of* 25 *C.P.* 220 *Volt Tungsten Lamps.*

Efficiency Watts per C.P.	Total Watts per Lamp.	Lamps, 4s. 3d. each Current, 4d.			Lamps, 3s. 4d. each. Current, 1d.			Lamps, 3s. 4d. each. Current, ½d.		
		Lamps.	Current.	Total.	Lamps.	Current.	Total.	Lamps.	Current.	Total.
1·18	29½	102	118	220	80	29½	109½	80	14¾	94¾
1·22	30½	81	122	203	57	30½	87½	57	15¼	72¼
1·27	31¾	57	127	184	44	31¾	75¾	44	16	60
1·33	33¼	51	133	184	40	33¼	73¼	40	16½	56½
1·4	35	51	140	191	40	35	75	40	17½	57½

Table III.—*Cost per* 1000 *Hours of* 16 *C.P. Carbon Lamps.*

Efficiency Watts per C.P.	Total Watts per Lamp.	Lamps, 9d. each. Current, 4d. per unit.			Lamps, 6d. Current, 1d.			Lamps, 6d. Current, ½d.		
		Lamp.	Current.	Total.	Lamp.	Current.	Total.	Lamp.	Current.	Total.
3·1	49·6	47 4	198·4	245·8	31·6	49 6	81 2	31·6	24 8	56 4
3·3	52·8	31·6	211·2	242·8	21·1	52·8	73 9	21·1	26·4	47·5
3·55	56·8	21·0	227·2	248·2	14·0	56·8	70·9	14·0	28·4	42·4
3·8	60·8	14·0	243·2	257·2	9·3	60·8	70·1	9·3	30·4	39·7
4·1	65·6	9·0	262·4	271·4	6·0	65·6	71 6	6·0	32·8	38·8
4·48	71·5	5·6	286·1	291·7	3·7	71·5	75·2	3·7	35 7	39·4
4·74	75·8	3·6	303·4	307·0	2·4	75·8	78·2	2·4	37 9	40·3
5·26	84 2	2·2	336·6	338·8	1·5	84·1	85·6	1·5	42 0	43·5

Table III. gives similar figures for 16 c.p. carbon lamps. A comparison of the figures given shows that while it certainly pays to use tungsten lamps where the current has to be paid for at ordinary lighting rates, it is not clear that any advantage is to be gained by using tungsten lamps where current is cheap—at any rate, not where high-voltage lamps have to be used. On high-voltage direct-current circuits where transformers cannot be used to get lower voltage, lamps are sometimes burned in series to get smaller and cheaper units. This may often be done successfully, but it generally, sooner or later, leads to trouble. Very few people realise how carefully lamps must be matched for current consumption before they will give satisfactory service in series.

Experimental Analysis of Losses in Machines.—The Institution of Electrical Engineers has accepted for publication in the *Journal* an original communication by Dr. Gisbert Kapp on the experimental determination of the moment of inertia of a continuous-current armature. This last is required in order to be able to analyse the frictional and other losses of a machine by the "running-out" test. Dr. Kapp first describes briefly the brake and flywheel methods of determining this factor, and then explains a new electrical method which does not require any special apparatus. The machine is run light as a motor, but while the field excitation is constant, the armature is connected in series with a resistance across a portion of a resistance connected across the mains. If this portion is suddenly reduced to zero, the armature is short-circuited across the other resistance, and will quickly run down, the kinetic energy of the armature being dissipated in friction, iron, and C^2R losses. If, on the other hand, the portion is not entirely reduced to zero, but a small E.M.F. supplied to the armature circuit, the time of running out is prolonged, enabling a series of readings to be taken. Two sets of observations are made, with acceleration and retardation of the armature, and the readings of armature E.M.F. and current are plotted against time in each case. The moment of inertia is deduced by means of a formula, from the difference between the currents for that value of the time at which the two E.M.F. curves cross, and the tangents of the angles made by these curves at that point. Dr. Kapp states that he has tried the method on machines up to 30 kw., and has found the values obtained to agree with those obtained by the brake method. The method would seem to be specially advantageous for large flywheel sets and large machines generally where an extra flywheel or a brake is impracticable.

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THE COOLING OF TRANSFORMERS

An experimental research into the influence of various cooling media upon the rise in temperature of soft-iron stampings was described in a Paper by Mr. R. D. Gifford, read on Wednesday, Feb. 16th, before the Birmingham Local Section of the Institution of Electrical Engineers. The experiments were directed to the measurement of the conductivity to heat flow existing between the surface of a cylinder made up of soft iron and such cooling media as air and oil under various conditions. The apparatus is shown in Fig. 1; it consisted of about 300 soft iron discs, and having 32 holes punched near the circumference, and a central hole. The discs were clamped tightly together by four temporary bolts through the small holes. The cylinder was then wound in Gramme-ring fashion—that is to say, up an outer hole and down the centre, the bolts being removed as occasion demanded until all the holes were wound. At the top and bottom of the cylinder, on the circumference, fibre washers were placed, to insulate as far as possible the flow of heat longitudinally, and also to protect the winding from damage by the wooden end discs. The two free ends of the winding were brought out at the top through the disc, and the whole bolted firmly together by means of a ½-in. bolt. The case, in which the tests with air blast and oil cooling were conducted, was made of cast-iron. The energy absorbed was measured by the "three-voltmeter" method, but the same instrument, a Duddell thermo-ammeter, was used with suitable resistances to measure the three voltages and the current.

The temperature rise was measured by thermo couples of Eureka wire and copper at suitable points, and the E.M.F.'s were observed by a new method, in which they were balanced

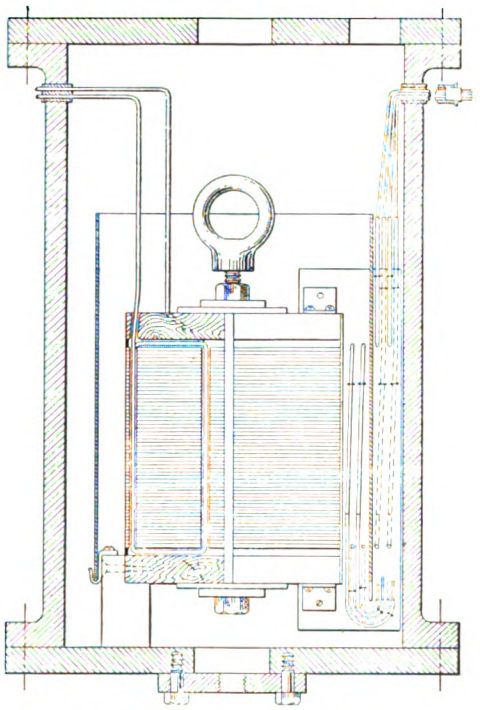


Fig. 1.—Section of Apparatus.

by the drop produced by an adjustable current over a standard resistance. This arrangement avoids errors due to Peltier effect and also effect of the drop in the leads.

The paper passes on to give a full explanation of the method of calculation of the conductivity to heat flow from iron to air. The heat carried away by conduction, convection, and radiation are all considered separately, and a formula for the total coefficient of conductivity, taking account of all three, is worked out.

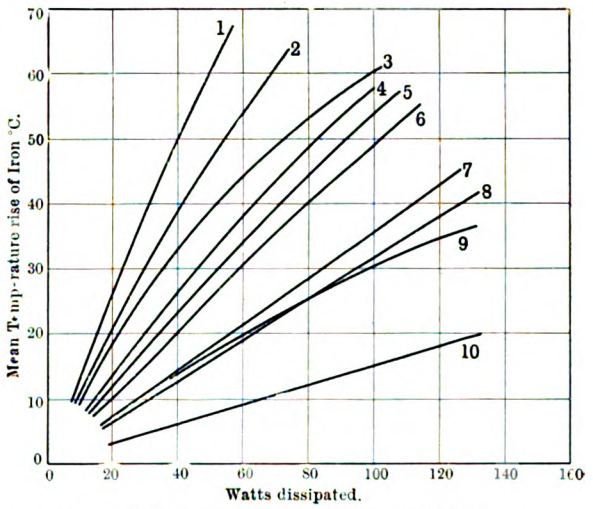
In the first experiment, the temperature rise of the iron stamps free in air was observed. The iron was heated up quickly by cutting out the main regulator, and when a suitable temperature was reached the watts were adjusted to about the right value to maintain this temperature, and then kept constant, readings being taken at intervals of half an hour until the temperature assumed a final value.

The average temperature rise of the iron and the watts are shown, together with the result of other experiments in Fig. 2 (Curve III.); the calculated coefficients are found in the table.

The apparatus was then placed in an iron case cooled by air, and similar observations were made. The temperature rise in this case shows a large increase over that for the free iron for the same watts dissipated, due, of course, to the fact that there is not a fresh supply of cold air constantly coming in contact with the iron. Also, the difference in temperature between the top and bottom of the iron is very much more marked, as the hot air now collects in the upper part of the case.

Results are given in Curve II., Fig. 2, and the table.

Measurements were also made of the air temperatures, which show a very rapid fall near the iron, becoming less steep as the distance increases. The sudden drop in temperature between the iron and air shows that the heat flow experiences a high resistance in passing from the iron to the air—that is, at the surface of the contact. This is, no doubt, partly due to the relative molecular densities of the iron and air. The number of molecules in a lamina of unit area in the air is very much less than for the iron, so that the heat passes from the iron to the air only with difficulty—that is, there must be a large temperature drop from iron to air. With oil as the cooling medium the contact will be much better than for air, therefore we should expect the temperature drop at the surface to be less than for air. This is actually found to be the case. In a further test the separating sheet was inserted midway between the iron and the case. The object of this sheet is to assist the cooling by aiding convection, the heated air flowing up between the hot iron and sheet, and flowing down between the sheet and cool



Curve 1. Air-cooled in Case, with separating Sheet.
,, 2. Air-cooled in Case, without Sheet.
,, 3. Air-cooled free in Air.
,, 4. 1st Air Blast.
,, 5. 2nd ,, ,,
Curve 6. 3rd Air Blast.
,, 7. Oil-cooling.
,, 8. More Oil.
,, 9. Oil-cooling with separating Sheet.
,, 10. Oil-cooling with Water Worm.

Fig. 2.—Curves of Results.

case. The temperature rise is plotted against watts dissipated in Curve I., Fig. 2, and shows a large increase in temperature over those for the last test, instead of a decrease, as was anticipated. This is probably due to the reflection of the radiant heat back on to the iron, and also to a small extent to the resistance at the new surface to the escape of heat by conduction. These results therefore show that the insertion of a separating sheet, although no doubt assisting convection currents, is not, on the whole, a useful cooling agent.

In the next test, blasts of air of different intensities were blown through the case. The central plate at the bottom of the case was removed, and the whole placed upon a box-like structure having a small electric fan in front. The supply of air was measured by an anemometer placed over the hole at the top of case, and the rise in temperature of the blast was measured by thermometers placed at the entrance and exit. The watt-temperature curves for the three tests may be taken as straight lines.

The temperature attained by the iron when cooled by an air blast will depend upon the volume of the blast per unit of time and the velocity of the air. This will depend upon the volume of blast and upon the sectional area of its path, *i.e.*, the dimensions of the apparatus and case. If the area is large and the volume of blast of medium value, then the velocity may be reduced to the order of that of convection currents, in which

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case the cooling will be similar to that of the test, where the iron was exposed freely to the air. It will also depend on the temperature of the ingoing blast, and the direction of the air blast with respect to the surface of the iron. This will be cooled more effectively if the cold air impinges normally upon its surface than if it flows parallel to the surface, for not only will the contact between the air and iron be better in the former case, but the agitation of the air will be much greater, thus bringing a constant stream of cold air against the iron. For these reasons it is impossible to generalise to any extent upon the results of this test.

Owing to the high value of the coefficient of heat conduction of oil in comparison with that of air, an oil-cooled transformer has a much larger output than that of an air-cooled transformer. Oil cooling is therefore more economical than air cooling, since the amount of material in the transformer is less for the same output. Another advantage attending the use of oil is due to its high specific heat. The energy loss in the transformer is absorbed by the oil, whose temperature rises slowly. Hence when working intermittently, for instance, during the day only, the transformer may never reach its steady final temperature corresponding to the watts lost. The high specific heat of the oil also allows of the transformer being worked at a high overload for a considerable time without overheating. Other advantages of oil over air are :—Its high insulating properties. Its high dielectric strength (about five times that of air). The prevention of particles of dirt and moisture getting into the windings. These have a very detrimental effect upon the insulation of the transformer, especially if working on high-tension circuits.

Tests similar to those already described were therefore made, using oil as the cooling medium. The curves of mean temperature rise of iron and case against watts dissipated were found to be practically straight lines, and the conductivity coefficient worked out at about three times its value for free-air cooling with case, showing the great superiority of oil as a cooling medium The temperatures of the oil show a large temperature drop between the iron and the oil at the surface, although not so marked as in air cooling. The drop in temperature down the oil at the top of the iron is very slight. This is not only due to the good conduction coefficient of the oil, but also to the fact that the hotter oil near the iron is in motion and mixes with the cooler oil at the case, so giving an almost uniform temperature horizontally. At the bottom of the iron the oil temperature near the case is slightly higher than near the iron. This is due to convection, some of the hot oil at the top sinking as it is cooled by the case and displacing cold oil from the bottom. The final mean temperature of the case is proportional to that of the iron, the temperature rise of the iron being roughly 2½ times that of the case. The ratio of the iron temperature at the top to that of the oil in contact with it is about 1·6, and at the bottom is 1·7, or we may say that the ratio of the mean temperature rise of the iron to that of the oil is 1·65.

In a further test a separating sheet was put in as in one of the tests with air cooling. It was found that the curves with and without this sheet was at about 25° C. Below this temperature the effect of the sheet is to increase the temperature rise of the iron. Above 25° C. the sheet exerts a cooling effect upon the iron. This is the result of the additional circulation of the oil, which takes place with the sheet dividing the oil into two separate portions.

The influence of different quantities of oil in the case was investigated. Typical results are given in Fig. 2 and Table I. The final tests dealt with oil cooling assisted by a water worm (see Curve X., Fig. 2), and showed how exceedingly effective this method of cooling is, as the water rapidly absorbs the heat from the oil without rising greatly in temperature, due to its high specific heat.

General Summary of Results.

Condition of Cooling.	Coefficient of Conductivity.	Coefficient of Resistance.
Iron free in air... ..	$1{\cdot}3\times10^{-3}$ to 2×10^{-3} for temperature rises of 20° to 60° C....	770 to 500
Iron enclosed in case.	$1{\cdot}125\times10^{-3}$ to $1{\cdot}35\times10^{-3}$ for rises of 20° to 60° C..	900 to 740
Iron cooled by air blast	$1{\cdot}9\times10^{-3}$ to $2{\cdot}4\times10^{-3}$ depending upon volume of blast	525 to 410
Oil Cooling.		
Iron to oil	$9{\cdot}4\times10^{-3}$	106
Oil to case	$4{\cdot}5\times10^{-3}$	220
Case to air	$1{\cdot}7\times10^{-3}$	600
Oil to water through metal piping ...	$4{\cdot}5\times10^{-3}$	220

In summarising the practical bearing of his results, the author remarks :—

By far the most effective method of cooling transformers is that of oil cooling, assisted by the circulation of cold water through a coil of pipes immersed in the oil. As the water absorbs a high percentage of the total energy loss, it is unnecessary to provide a case with a large cooling surface. This method should, therefore, be adopted for large transformers when there is a good supply of cold water available. If this is not available the same water can be used continuously with the use of an outside cooling arrangement and a circulating pump. If, owing to a temporary breakdown of the pump, the water supply is stopped, no great danger need be apprehended, as the enormous thermal capacity of the oil and the water in the coil prevents any large rise in temperature for a considerable time. On no account should a joint be made in the coils inside the case, as this leads to a liability to leakage, the slightest trace of moisture in the oil reducing its dielectric strength very considerably. With regard to unassisted oil cooling, this is much more effective than any type of air cooling, as the conductivity of iron to oil is so much greater than to air. Dealing with the use of the separating sheet to assist the cooling of the transformer, it is very probable that more satisfactory results would have been obtained if the surface of the sheet had been of a dull black nature instead of the comparatively bright brass used, as a dull black surface is a worse reflector of heat than a bright surface. The cooling by air blast, although effective, necessitates the use of blowers and air filters, and further, if for any reason the blast be stopped, the temperature of the transformer will quickly rise to a dangerous degree. Natural cooling in air is simple and economical, but this method can only be applied to transformers of small size, as the energy loss, for the same induction and frequency, is proportional to the cube of the linear dimensions, whereas the cooling surface is only proportional to the second power, and therefore the heat to be dissipated per sq. cm. of surface rises rapidly with increase in size, producing a higher temperature rise of the transformer.

Discussion.

Mr. R. R. Morcom remarked that the results in the Paper agreed well with experiments of his own on the cooling of high-speed bearings with oil, water, and air blast.

Dr. C. C. Garrard (General Electric Co.) was of the opinion that the improvement effected by the trans-separating sheet was masked by the reflection of the radiant heat from the iron stampings; good cooling could be obtained by arranging ducts in the core, and circulating air through these.

Prof. Kapp (Birmingham University) referred to an arrangement where the oil itself was used as the cooling medium instead of water. The oil worm, when it emerged from the transformer case, was immersed in a tank of water, which was kept cool by adequate circulation. This avoided the risk of escape of water into the oil in the transformer case.

Electric Driving of Reversing Rolling Mills.—A large reversing mill will shortly be erected at the Italian iron and steel works at Terni by Messrs. Schneider & Co., of Le Creusot, France. The electrical equipment will be supplied by the Felten & Guilleaume-Lahmeyerwerke, of Frankfort, and will be on their own patented system. The mill will be capable of dealing with 100-ton ingots, and will be driven by two coupled continuous-current motors, delivering 15,000 h.p. at 90 r.p.m. Current will be supplied from three generators connected in series, and coupled to a 2,600 h.p. water-turbine. A 50-ton flywheel will be provided on the turbo-generator shaft. This will vary in speed between 450 and 360 r.p.m., and thus supply energy to the generators to smooth out the fluctuations in the demand.

Ontario Power Co. Extensions.—Considerable extensions are being made to the generating station of the Ontario Power Co. at the base of the Horseshoe Fall, Niagara. This station was described and illustrated in Electrical Engineering, January 13th, 1910, page 21, and contains at present seven 12,000-kw. three-phase generators coupled to horizontal Francis turbines. Current is supplied at 12,000 volts to a distributing station at the top of the cliff, from which it is distributed at 62,000 volts. A second 18-ft. steel water conduit is now being constructed, and excavations are being made for two more. The recently installed seventh generating set is working satisfactorily, and plans are in hand for another new set. The filling in of the windows overlooking the river, where the water entered a year ago and damaged the machinery, is nearly completed, and no more trouble from that source will be possible. With the completion of the second water conduit, 150,000 h.p. will be available. A bulk supply to the adjacent transforming station of the Hydro-Electric Power Commission of Ontario will be given at 12,000 volts. The cables will be laid in an underground conduit, and a maximum demand of 60,000 h.p. has been arranged for. The current will be transformed up to 110,000 volts for transmission by the Commission.

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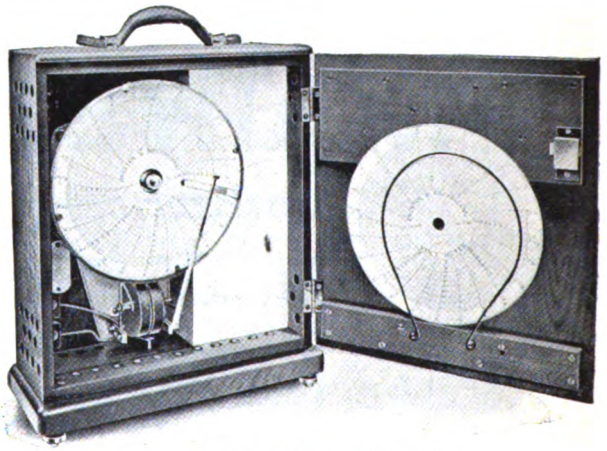
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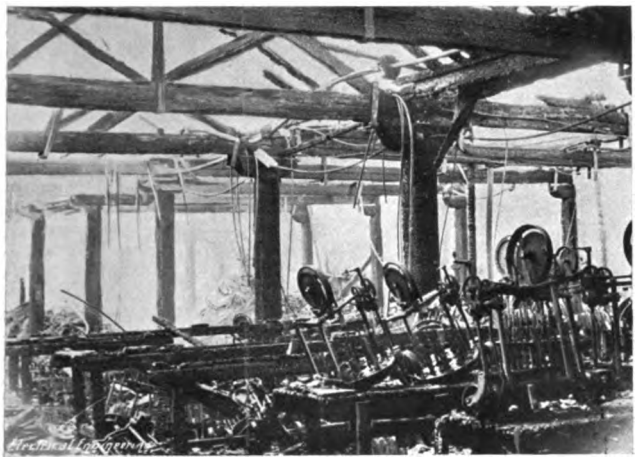
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THE FIRE AT MESSRS. JOHNSON AND PHILLIPS' WORKS

THE accompanying photograph gives a good idea of the extent of the damage done by the fire on Tuesday of last week at the cable works of Messrs. Johnson & Phillips, Ltd., Charlton. As stated in our last issue, the fire was confined to the top floor of the new two-storey building erected on the site of the fire some four years ago. On this floor were a large number of small machines for braiding wires, and as shown in the photograph, these were completely destroyed. It will be necessary to reconstruct entirely the roof and wood floor, and to instal new braiding machinery, but work has already been resumed with the cable braiding machinery on the ground floor which was fortunately not damaged by the fire.



Remains of the Braiding Machines after the Fire.

CHARGING SMALL LIGHTING CONSUMERS

THE Paper by Messrs. H. W. Handcock and A. H. Dykes, entitled "The Present Aspect of Electric Lighting," and read before the Institution of Electrical Engineers in London on November 25th last, was again read and discussed at the Manchester Local Section on February 22nd. An abstract of the Paper and the discussion in London was given in Electrical Engineering, December 2nd, 1909, Vol. V., p. 1025. The Paper again brought up the question of the influence of metal filament lamps upon supply undertakings, and the advisability of altering methods of charging in certain cases. The contract system of a fixed price per lamp per annum was recommended for small lighting consumers, while for scattered districts a H.-T. A.-C. supply, discontinued during the daylight hours except during periods of fog, was suggested. An earthed-neutral three-wire 50- or 100-volt distributing system with house transformers was recommended for outlying consumers.

At Manchester, Mr. C. C. Atchinson (Borough Electrical Engineer, Rochdale) opened the discussion by pointing out that the authors had considered mainly small A.-C. stations chiefly for lighting. In the north they looked forward to the time when there would be a larger income from power than from lighting. He thought the metal filament had done them good in Rochdale. There was no doubt that the standard of illumination had increased remarkably during the last four or five years. Shops especially nearly maintained their old bills, as they had realised that good lighting was an effective advertisement. His large private consumers averaged about 7·6 units per annum per 8-c.p. lamp installed, this corresponding to some 11 units per 12-c.p. lamp, as against the authors' estimated 15·6 units per annum. The return per lamp installed from large houses was poor in comparison with that from small houses. He thought the suggested annual lump sum payment would be a source of trouble, in spite of the low cost charged per unit. With regard to the wiring difficulty in the charge per lamp system, consumers should give the supply undertaking the opportunity of advising them so that they should not be wired with too many points. There was not much to be saved in service costs by reducing the service cable standards. He would like to see rows of buildings wired from a single service. Limited supply-hours were impractical directly a motor was connected.

Mr. R. B. Slacke (Key Engineering Co.) said that millowners do not like substituting electricity for gas for lighting, particularly in weaving sheds, as it warmed the rooms and saved heating by other means. He would like to know the dividing line between a small long-hour consumer and a large consumer to determine who should be charged on the contract system, and who should be charged on a uniform charge per unit.

Mr. P. P. Wheelwright (Borough Electrical Engineer, Blackburn) asked the rent of a house where the contract demand system was likely to be financially successful. His experience with cottage and small property lighting was that the tenants complained that they could not afford to replace the broken lamps. With regard to losing unremunerative consumers, he had found that the loss of a single consumer, whatever the cause, had very far-reaching results. Special lamp-holders to prevent the use of higher c.p. lamps would be impracticable. It was not correct to say that all supply undertakings had suffered so severely by the advent of the metal filament lamp. The use of house transformers ought never to be advised. He was satisfied that the simpler the rate, the more likely one was to get consumers; when his Corporation some six years ago offered a flat rate for lighting as an alternative to the maximum demand system, which had been in force for some eight or ten years, only 40 consumers out of some 1,200 remained on the maximum demand system even when the cost was known to be higher, as they had the satisfaction of knowing how the figures were obtained.

Mr. J. Frith said that he had analysed his lighting bills for the last three years. He had 32 lamps installed, with an average consumption of 36 watts per lamp. His total yearly bill was £6 5s., the units consumed being 400. He thus burnt each lamp on an average 350 hours per annum, and paid 3s. 9d. per lamp per year, equivalent to 3s. 2d. per 30-watt lamp. He would certainly object to 12s. per 30-watt lamp per annum.

Mr. A. G. Cooper (Borough Electrical Engineer, Colne) said that in some cases they had taken in one service to a block of houses and had run the cables through the cellars, putting in cut-outs at each house.

Mr. C. L. E. Stewart (Borough Electrical Engineer, Rawtenstall) did not approve of the fixed charge per lamp, as it would reduce the number of lamps installed. He thought it was a big mistake if the consumer did not understand the conditions of supply, and his experience was that Lancashire men did not like the flat rate. Cottages did not use 10s. a year in gas, and were not worth connecting up for electric light. There was no doubt that free wiring brought on the consumer, but it also brought on bad consumers. Further, the next tenant invariably wanted the lights in totally different places, and the wiring had to be altered.

Mr. T. H. M. Swinburne thought that supply authorities, whether municipal or companies, would sooner or later have to undertake wiring directly or indirectly.

Mr. A. S. L. Barnes fully agreed with the fixed charge per lamp system, and thought that the author had considerably overestimated the additional consumption caused by people not being so careful as if they had meters. Central station engineers made too much of the loss of a few additional units. On several occasions in Gibraltar the supply had been shut off for a whole day, though steam pressure was kept up, and the coal used amounted to 25 per cent. of the average daily consumption. A fixed rate per lamp charge had been introduced in Gibraltar (with a maximum of five lamps), and it resulted in a large influx of new consumers, while several meter consumers requested to be charged on the new system.

Mr. S. J. Watson (Chief Electrical Engineer, Bury Corporation) said that the great diversity of practice in the methods of charging did the industry harm, and he hoped that soon all undertakings would adopt the same principle, even if not the same scale. The method suggested by the authors did not solve the difficulty of charging for light and heat or power without two meters and special wiring. The only satisfactory system he knew of was that in which a standing charge of from 10 to 15 per cent. on the rateable value was made, with an additional 1d. or 1½d. per unit supplied. In the case of a private house rated at, say, £32, and taking 12½ per cent. and 1d. per unit, the standing charge was £4, and with a consumption of 480 units the total account would be £6 per annum. Such a system would encourage consumers to wire for heating and power as well as lighting. With regard to the effect of metal filament lamps, in the majority of towns the units sold for lighting were again gradually on the increase. It was not desirable to frame the tariffs so as to deliberately keep certain classes off the mains. He had always held the opinion that it was no part of the duty of supply undertakings to instal free wiring. The rate of depreciation was very high, as it was impossible to recover anything if the installation went out of use. Further changes of tenancy and ownership caused much trouble. He did not agree with the "dusk to dawn" supply; a twenty-four hours' supply was essential if the use of electric heating and small domestic appliances was to be encouraged.

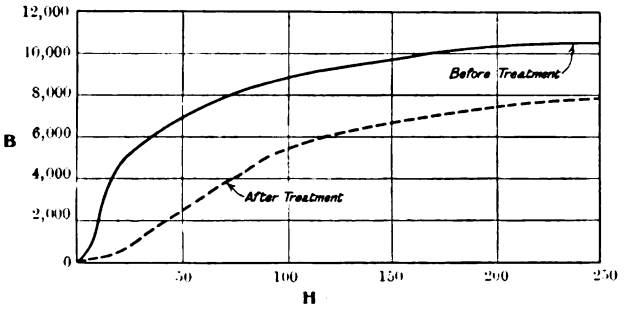
In reply, Mr. Handcock said that the cost of renewals of gas mantles and chimneys for a whole year worked out at exactly the same as the renewal of metal filament lamps. It was difficult to say what was the dividing line between those who should be charged on the contract system and those who

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should be charged on a uniform charge per unit. With regard to house transformers, it was surprising what economies could be effected by their use. A "dusk to dawn" supply was useful when starting a new A.-C. undertaking. The contract system was intended as a weapon to attack the field of small consumers now occupied by gas. He thought very highly of the rateable value basis for charging.

CAST-IRON PERMANENT MAGNETS

An interesting process for the manufacture of permanent magnets for magnetos, instruments, small motors, &c., has been developed by Messrs. F. Burks & Co. (Prospect Works, Manchester), and is in use to the extent of manufacturing some 2,000 magnets per week. The material used is ordinary black cast-iron, and the chief feature of the process is the chemical treatment to which it is subjected. The whole of the machining, &c., on the magnet has to be done prior to its being treated, except, of course, the actual magnetisation. The magnets are raised to a certain temperature in a special furnace and kept at that heat for a specific time, which varies with the shape and size of the magnet. They are then immersed in a chemical bath, after which they are washed for some time to get rid of all superfluous chemicals, which would form crystals on the surface and prevent any



B/H Curves for Burks's Cast-iron Magnets.

paint or enamel adhering properly. After this they are well dried and then magnetised, when they are ready for fitting to the apparatus for which they are intended.

By referring to the curves in the accompanying figure it will at once be seen that the saturation value of this treated iron is about 7,500 C.G.S. units, as compared with about 9,500. Thus it may be taken that these magnets are, roughly speaking, about 20 per cent. less powerful than a corresponding magnet of the best steel, or 10 per cent. less than the average magnet, while they are claimed to be about equal as regards permanence.

An advantage of this magnet is that the poles and the fixing-down lugs can be cast all at once into the shape desired, whereas with a steel magnet separate poles have to be fitted, necessitating the magnet limbs being ground and drilled. Again the fixing down of the steel magnet has always been rather unsatisfactory, and is usually in the form of a clamp. With the cast magnet the designer can choose his method and position of fixing lugs to the best advantage.

That the effect is more than a mere form of case-hardening is shown by the fact that a broken magnet is found to be as hard in the centre as at the outside.

The Kearney Tube Railway System.—A model railway on this system, 200 ft. in length, has been constructed at the Crystal Palace and is open to public inspection. At a Press view on Wednesday of last week, Mr. E. W. Kearney described the system, referring to the Bill it is proposed to deposit for the construction of railways between the Strand and the Crystal Palace, and between Kennington and Cricklewood. It will be remembered that on this system the stations are constructed near the street level, while gradients of 1 in 7 lead to and from the low-level tunnels. There is only one tube, the track being doubled at the stations only. Trains going in opposite directions pass each other at the stations, and automatic switching arrangements are provided to render this safe. The cars run on a single rail, but an overhead guide rail is provided. Grooved guide wheels are pressed up against this. It is proposed to accelerate the cars down the gradients at such a rate that a speed of 50 miles per hour will be attained in 20 seconds. A schedule speed (including 15 sec. stops at the stations) of 30 m.p.h. is said to be possible. The total capital cost is given as £250,000 per mile, as against from £400,000 to £800,000 for the present tube railways. It is asserted that, even with stations five furlongs apart, a 2½ min. service could be given with the single-tube system, and that it is not essential that the stations should be at exactly equal distances apart.

ILLUMINATION

The third and last of the three lectures on this subject by Dr. S. P. Thompson at the Royal Institution, London, was delivered on Thursday last. A magnetite flame arc lamp of the pattern manufactured by the General Electric Co. of America was on view. In this lamp the electrodes are vertically one above the other; the upper electrode is of copper, with special cooling arrangements, and the lower electrode is formed of a compressed mixture of the oxides of chromium and titanium with magnetite, an oxide of iron. The lamp is especially adapted to street lighting, as the light is thrown sideways. (Some photometric results obtained with these lamps for the street-lighting of Boston, U.S.A., were given in Electrical Engineering, November 11th, 1909, Vol. V., p. 972.) The lecturer then called attention to some calculations made by Dr. Drysdale, according to which the maximum efficiency possible for any light source giving out light to which our eyes were most sensitive (58 m.m.) was 27 candles per watt. This figure could only be obtained by the direct conversion of any other form of energy into light energy without any production of heat. According to this standard, the flame arc lamp had an efficiency of only 1 per cent. Dr. Thompson then showed a number of curves of comparative costs of lighting with various illuminants. Of the electrical sources, the quartz lamp was the cheapest, the flame arc lamp coming second with a figure of from 0·5d. to 1d. per 1,000 candle-hours for running costs only. The carbon filament lamp was the most expensive illuminant of all. After comparing the distribution curves of a number of different light sources, Dr. Thompson passed on to consider illumination at a surface. This was not a measure of the brightness of the surface, but of the light received per unit area at the surface. For reading or writing the illumination should never be less than one and a half candle-foot. In factories in Holland, the legal minimum was 0·9 candle-foot. The illumination from a bright sky was from 3 to 6 candle-feet. The lecturer then emphasised the importance of adequate lighting in schools. In Breslau (Germany) it had been found that the percentage of myopia cases (short-sightedness) increased from 6 per cent. in the lower standards to 26 per cent. in the upper standards, and to 59 per cent. in the universities. This was attributed chiefly to bad illumination. In Birmingham the percentage had been found to increase from 5 per cent. in the lower schools to 20 per cent. in the training colleges. The subject was not a new one, as a photometer was in use in schools in Russia over twenty years ago. Another important but different matter was the prevention of glare, or the direct exposure of the eyes to sources of high intrinsic brilliancy. The eye could not look with comfort at a surface having a brilliancy of more than one candle-power per sq. in. By frosting a lamp globe the light could be scattered, so that whereas a tungsten filament had an intrinsic brilliancy of 1,000 c.p. per sq. in., a frosted lamp had only about 5, and did not offend the eye so much. An even better way was to use only the light reflected from a rough white surface, as in indirect lighting by hidden lamps throwing light on to a white ceiling. These were inefficient methods of scattering the light, however, and recently much headway had been made with the so-called holophane globes and shades. These were a development of a "dioptric" globe designed by Mr. A. P. Trotter (Electrical Adviser to the Board of Trade) some twenty-five years ago. This had vertical ribs inside to spread the image of the source sideways, and horizontal ribs outside to spread it lengthways. Further, Mr. Trotter had applied the principle of graduating the slope of the facets in order to obtain a definite distribution. By adjusting the facets the maximum light could be thrown in any desired direction. Finally, Dr. Thompson referred to the necessity for further investigation into the absorption of light by surfaces of different nature and colour, in order that the brightness of a room for any given illumination could be estimated.

Royal Institution.—Among the lecture arrangements after Easter are two "Tyndall" lectures by Prof. J. A. Fleming on "Electrical Heating and Pyrometry.

Arc Lamp Firms in Germany.—The Deutsche Beck-Bogenlampen Gesellschaft, of Frankfurt (German Beck Arc Lamp Co.), have taken over the business and works of the Carbone-Licht-Gesellschaft, of Berlin. The Berlin works of the latter company will continue the manufacture of the Carbone arc lamps under the control of the Beck Co., who manufacture the well-known lamps with supported carbons and no clockwork at Frankfurt. The Carbone-Licht Gesellschaft has gone into liquidation.

Electrical Exhibition at St. Petersburg.—The proposed exhibition at St. Petersburg for demonstrating the application of electricity to railways will be opened on August 27th, and will remain open for two or three months. It will be divided into sections dealing with the application of electricity to steam railways, main lines, local lines, and tramways. A Commission will report to the Russian Government as to the class of exhibits most desired in view of the nature of the exhibition. Full information may be had from the President of the Organising Committee, Mr. N. A. Sitenko, 24 Sadovaia, St. Petersburg.

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COMPANY v. LOCAL AUTHORITY FOR TRAMWAY SUPPLY

THE first inquiry under the Kitson clause in an electric power company's Act of Parliament was recently held, and it is now public property that the Board of Trade decision, adverse to the local authority, has been given. The inquiry concerns the Cleveland & Durham County Electric Power Co., the West Hartlepool Corporation, and the Hartlepool Electric Tramways Co. The Kitson clause first made its appearance in connection with the electric power Bills of 1901, and was so called owing to Sir James Kitson (now Lord Airedale) being chairman of the House of Commons Committee which was considering the Bills in question; it subsequently became standardised, and was inserted in all electric power Acts. The clause provides for the case of a power company wishing to supply a consumer in an area in which the local authority is the supply undertaker. The company has to obtain the consent of the Corporation before it may supply; but this consent must not be "unreasonably" withheld, and the company is entitled to appeal to the Board of Trade in any case to say that this refusal is "unreasonable."

In the Cleveland & Durham County Electric Power Co.'s Act of 1901 the Kitson clause is embodied, so that it was necessary for the company to obtain the consent of the West Hartlepool Corporation before it could enter into an agreement to supply energy to the Hartlepool Tramways Co., who wished to buy energy from the power company. The position is as follows :— The tramway company's system is in Hartlepool and West Hartlepool, the power company are authorised distributors in Hartlepool, while the Corporation is the supply authority in West Hartlepool. The tramway company have a power station of their own, but offers were recently made both by the power company and the Corporation to give a supply of electrical energy. The Corporation offered to supply the tramway company on a sliding scale, which worked out, on the company's estimated consumption, to about 1¼d. per unit, which is ¼d. per unit more than the cost at which the company are at present generating for themselves. On the other hand, the power company offered to supply on a basis which would work out to about ¾d. per unit. In both cases the conditions of supply were practically identical, viz., that the tramway company would not be put to the expense of laying any additional feeders.

The offer of the power company being the lower of the two, the tramway company wished to accept it, but the West Hartlepool Corporation refused to give their consent to supply being taken for the West Hartlepool portion of the tramways. The power company thereupon, under the Kitson clause of their Act, appealed to the Board of Trade to decide whether the consent of the Corporation had been unreasonably withheld. An inquiry took place, and under the provisions of the clause the arbitrator had to be guided by the following considerations :—

"The consent shall be deemed to be unreasonably refused or withheld if the authorised distributor is not willing and in a position to give the requisite supply upon reasonable terms and within a reasonable time, and in considering what are reasonable terms and what is a reasonable time, the Board of Trade shall regard all the circumstances of the case, including the capital expenditure incurred in connection with the undertaking of such distributor, and all charges in respect thereof, and the financial position of such distributor and the terms upon which and the time within which the company is willing and in a position to give a supply."

The award of the Board of Trade is very short and to the point, merely stating that after consideration of the arbitrator's report, the decision has been arrived at that the Corporation's consent has been unreasonably withheld.

In the meantime the Corporation have given notice of their intention to purchase two of the company's lines in their area upon the terms of Section 43 of the Tramways Act, 1870, under the tramway company's Provisional Order. The Corporation is entitled to purchase at the expiration of 14 years from the date of the Order, instead of 21 years, as under the Tramways Act of 1870, but upon purchase the company may demand a lease of the lines for seven years. In addition, the Corporation have given notice of their intention to promote a Bill in Parliament to purchase and extend the company's undertaking in West Hartlepool, the purchase to be compulsory where possible, or otherwise by agreement.

Although this is the first time that the Board of Trade have been called upon to interpret the Kitson clause, no moral can be drawn from the result in regard to the future, as each case will undoubtedly present different local features calling for special consideration. Indeed, the circumstances of each particular consumer—in respect of which there has to be a separate inquiry—will probably vary so much that previous decisions under the clause will not apply as conclusive precedents.

THE "Z" METAL FILAMENT LAMP PATENT

MR. JUSTICE PARKER delivered judgment yesterday morning in the action brought by the "Z" Electric Lamp Manufacturing Co., Ltd., against Messrs. Marples, Leach & Co. (now Adnil Electric Co., Ltd.) for infringement of their patent No. 21,654 of 1906. His lordship held that all the objections brought against the patent failed, and that the defendants had infringed.

In delivering judgment, Mr. Justice Parker said that it was agreed that the presence of carbon in metal filaments conduced to blackening, though it was now known that the actual deposit on the globe sometimes consisted of metal particles from the filament only. Removing the carbon tended to prevent blackening, and he thought the patentees meant to prevent blackening by the use of phospham. It was quite clear that the essential idea in the patent was the removal of carbon by combination with gases evolved by heating chemical substances, in order to obtain a stronger filament. With regard to the three objections offered, the patent was not misleading, as it was addressed to manufacturers and not to chemists, and therefore slight errors in chemistry were unimportant. The specification might be taken to imply that free nitrogen was given off on heating the chemicals mentioned, whereas this could not happen except at exceedingly high temperatures. Nitrogen was given off in the form of ammonia by all the substances mentioned, with the exception of pure phospham, and it was possible that the patentees used the word nitrogen meaning nitrogen in the form of ammonia. It would not matter to the manufacturers so long as the carbon was extracted. It had been argued that pure phospham would not give off ammonia when heated, but he was satisfied that pure phospham (PN_2H) could only be obtained with much difficulty, and that the phospham made at the date of the patent, as well as the present commercial phospham, contained a proportion of phosphoramide which was a result of the decomposition of phospham in the presence of moisture. This substance did give off ammonia at a low temperature. This reconciled the apparently contradictory evidence of the experts. Phospham had a high affinity for moisture, and all the commercial samples tested therefore gave off ammonia on being heated. Chemically pure phospham was found at first not to give off ammonia, whereas later tests (after it had had time to absorb moisture) showed an evolution of ammonia. Again, although lamps treated with pure phospham were perfectly satisfactory, alcohol was used in making it into a paste, and it was more than probable that the alcohol contained water. The objection of insufficiency failed because the experts had had no difficulty in carrying out the process described under manufacturing conditions. The suggestion as to inutility had been based on the idea that chemically pure phospham was intended to be used, but it had been proved that the commercial phospham operated to remove the carbon, whether used in the paste or in the bulb. It was remarkable that the known presence of carbon in a filament had been proved not to lead to blackening when phospham was present, whereas without the phospham blackening had taken place. What actually went on in the bulb was not quite clear. He considered, therefore, that the attack on the patent failed.

With regard to infringement, the defendants claimed that they did not use phospham to remove carbon from the filaments, but to prevent blackening. They asserted that their filaments contained only 0·04 per cent. of carbon before sealing the bulbs, but they had not proved this. Further, they had not proved that the phospham did not remove the carbon still in the filament, and thus prevent blackening. The phospham normally operated to remove carbon, and they had used it with a filament containing carbon. He considered, therefore, that they had infringed the patent.

Telephone Facilities in Glasgow.—An official statement has been issued concerning the working of the Post Office and National telephone systems in Glasgow. As stated in our issue for February 24th, the two systems will be worked more or less in co-operation until the purchase by the Government in 1911, and in the meantime arrangements are to be made for the erection of a new Post Office Exchange for 10,000 lines in the Central district, and a new one in the Exchange district. The National Telephone Co. will also commence the construction of a new exchange.

An Emergency Electric Power Installation.—Messrs. Marshall, Kaye, & Marshall, Ltd., fancy tweed and coating manufacturers, who had the misfortune to have a serious breakdown of the main driving engine at one of their Ravensthorpe Mills, bringing the whole of the machinery to a standstill, consisting of nearly 400 i.h.p., have in less than ten days been able to restart practically the whole of their various departments by the aid of the Yorkshire Electric Power Co., who commenced the work of fixing electric motors and putting into operation of the machinery immediately after the breakdown. It is probable that a stoppage of perhaps five or six months would have been occasioned for the necessary repairs to be effected to the engine.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published March 3rd, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

6,477/09. **Short-circuiting Device for Induction Motors.** The Lancashire Dynamo & Motor Co., and A. R. Stelling. A short-circuiting plate rotating with the rotor is pushed axially to engage with contacts on a fixed plate attached to the slip-rings in the usual manner, but the same movement causes the brush gear to move axially and shift the brushes off the slip-rings on to stationary segments adjacent to the rings. Five claims, seven figures.

6,936/09. **Manufacture of Metal Filaments.** The Westinghouse Metal Filament Lamp Co., Ltd. (*A. Lederer, Vienna*). Raw tungsten filaments containing 2·5 per cent. of carbon are decarbonised by raising them to a temperature of from 1,200° to 1,300° C. in the presence of dry hydrogen, when the proportion of carbon is reduced to about 0·04 per cent. The hydrogen combines with the carbon forming methane. The absence of oxygen prevents oxidation of the tungsten with the resultant bright places in the filament. Two claims.

8,351/09. **Lamp Manufacture.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). This patent covers an ingenious machine, in which the various steps of blowing off the neck of a bulb to the proper length, placing the bulb in proper relation to the stem and filament-carrier, and sealing the stem into the bulb are all carried out automatically. Ten claims, eleven figures.

10,663/09. **Protective Devices.** H. Brazil and H. Cooch. When several spark-gaps are used in series for the protection of A.-C. systems against the effects of excess pressure, difficulties sometimes arise owing to the unequal distribution of the potential across the gaps under different conditions. In order to equalise distribution, connections are made from the junctions between the gaps to a transformer or choking coil at points symmetrically arranged, having regard to the arrangement of the gaps with respect to the system. Four claims, four figures.

17,353/09. **Heating Apparatus.** A. F. Berry. An apparatus for heating the air in rooms comprises a transformer, the secondary of which is connected direct to a metal coil or spiral which is raised to a high temperature by the passage of the secondary current. Fan-like arrangements of metal strips are placed round the connections between the coil and winding to take away the heat by conduction and prevent the winding from getting too hot. Four claims, three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Bowden, Anderson, Atchley and Bull [Supports for overhead cables] 843/09; Witzenmann [Armouring cables] 3,917/09; Franz Clouth Rheinische Gummiwarenfabrik [H.-T. insulators] 1,009/10.

Dynamos, Motors, and Transformers: Buchanan [D.-C. machines] 4,374/09; Siemens Bros. Dynamo Works (*Siemens Schuckertwerke-Ges.*) [Adjustable polyphase transformers] 20,003/09.

Electric Ignition: Unterberg & Helmle [Contact-breaker for magnetos] 4,030/09; Gray, 21,858/09.

Electrometallurgy and Electrochemistry: Thwaites & Ralph [Separating copper] 4,167/09; Johnson (*Badische Anilin & Soda Fabrik*) [Manufacture of nitrates] 10,465/09; Levi [Manufacture of phosphatic fertilisers] 18,433/09.

Heating and Cooking: Kolemine [Heating] 3,709/09; Grob [Heating vehicles] 3,848/09; Hosgood [Cooking] 7,029/09.

Instruments and Meters: Justice (*Kunsch & Jaeger*) [Photographic recording apparatus for oscillographs, &c.] 20,922/09.

Switchgear, Fuses, and Fittings: Dick Kerr & Co. (*Thury*) [Regulators] 24,634/08; Crookell [Lamp-shades] 3,195/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Switches] 4,250/09; Allgemeine Elektricitäts-Ges. [Motor-controller] 4,472/09; Hope [Fuse-boards] 6,049/09; Moffett and Rosher [Slow-motion switch lever] 7,053/09; Baker [Switches] 8,025/09; Cottier [Locking lampholder] 9,194/09.

Telephony and Telegraphy: Adams-Randall [Telephones] 3,717/09; Roubanowitsch [Call-signal devices] 3,933/09; Marconi and Marconi's Wireless Telegraph Co. [Transmitters] 8,582/09; Kingsbury (*Western Electric Co., U.S.A.*) [Automatic selective telephone switches] 20,842/09; Skinner [Iron telegraph poles] 21,222/09; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Telephone exchanges 25,883/09; Siemens & Halske A.-G. [Telephone exchanges] 28,363/09.

Traction: Elinson [Station indicator] 3,512/09; Siemens Bros. Dynamo Works, Ltd., Broadhead and Hawkins [Train-lighting apparatus] 3,906/09; Roubanowitsch [Signalling apparatus] 3,933/09; Chambers [Rails] 10,559/09; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Braking semaphore arms] 26,103/09.

Miscellaneous: James [Protecting ships' bottoms from barnacles] 279/09; Burks [Cast-iron magnets] 5,360/09; Prior [Electric clocks] 5,687/09; Ireland [Automatic depth recorder] 6,574/09; Geller [Illuminating frame for pictures, &c.] 6,601/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Pumping system] 6,984/09; Prestwich [Miners' lamps] 12,751/09; Electric Boat Co. [Torpedoes] 20,852/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution, &c.: Herbing [Cable-boxes] 2,311/10.

Dynamos, &c.: Siemens Shuckertwerke-Ges. [Commutators] 1,292/10.

Electric Ignition: Etablissements de Dion Bouton Soc. Anon. [Magnetos] 2,883/10, and 3,310/10.

Instruments, &c.: Foster [Pyrometer] 30,478/09.

Storage Batteries: Accumulatoren-Fabrik A.-G. [Plates] 27,221/09.

Telephony, &c.: Fessenden [Wireless signalling] 29,481/09: Siemens & Halske A.-G. [Telephone system] 999/10, and [Telephone exchanges] 2,608/10.

Traction: Compagnie de Signaux Electriques pour Chemins de Fer [Signalling apparatus] 3,199/10.

Opposition to Grant of Patents

6,138/09. **Aluminium Solder.** C. E. Steinweg. Opposition has been entered to the grant of this patent. The specification, abstracted in Electrical Engineering, January 20th, 1910, page 50, describes tubular sticks of a cadmium alloy of aluminium.

12,289/09. **Fan.** J. Keith. Opposition has been entered to the grant of this patent. The specification describes an ornamental standard fitted with electric lamps and a ventilating fan arranged vertically in the interior. It is intended for placing in the centre of a table for circulating the air over the surface.

19,098/09. **Magnetic Track Brakes.** Dick Kerr & Co., Ltd. (*R. Braun*). The grant of this patent, abstracted in Electrical Engineering, January 20th, 1910, page 50, is opposed. A number of separately excited electromagnets are linked together to form a chain which can adjust itself to irregularities in the rail.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

5,673 of March 13th, 1896. **Electrolytic Apparatus.** A. S. Elmore (*J. O. S. Elmore, India*). Apparatus for refining copper and other metals, consists of a number of sheets of lead, copper, and rubber respectively, placed one above the other in succession, with wooden separating frames and clamped together between two boards. The electrolyte is pumped through the whole, and the top plate forms the anode, while the bottom plate is the cathode. Pure copper is deposited upon the undersides of the lead plates, the impurities passing away with the electrolyte.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: C. P. Steinmetz [Quartz vapour lamp] 24,909/03.

Distribution Systems, &c.: E. W. Hill [Junction boxes] 23,756/05.

Dynamos, &c.: A. P. Zani [Transformers] 23,720/05; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Frequency-changer] 23,838/05, and [A.-C. commutator motor winding] 28,839/05.

Electrometallurgy, &c.: T. Parker [Electrolytic preparation of sodium or potassium chlorate] 25,631/96; C. C. Connor [Carbon-lead electrodes] 26,059/96; H. S. Blackmore [Manufacture of aluminium] 24,781/04; I. Ickringill [Sterilising by electrolysis] 23,345/05; J. Asbeck [Electrolytic production of lead and silver from sulphur ores] 23,408/05; B. Platschick [Furnace] 23,526/05.

Incandescent Lamps: Siemens & Halske A.-G. [Manufacture of filaments of alloys of tantalum and tungsten] 23,097-8/05.

Instruments, &c.: Nalder Bros. & Thompson, F. H. Nalder, and O. Cox [Commutators for meters] 24,769/04.

Storage Batteries: H. Beckmann [Manufacture of lead peroxide] 22,807/99; L. N. Roselle [Plates] 24,689/04.

Switchgear, &c.: E. Greenfield [Flexible insulated metal conduit] 26,752/97; British Thomson-Houston Co. [H.-T. oil switch] 20,522/00; H. C. Smith [Pendant support] 23,379/05; W. McGeoch & Co. and W. L. Barber [Switch] 23,582/05; C. H. Robinson [Terminal] 23,662/05; H. Simmonds [Lamp-shade holder] 23,728/05.

Telephony, &c.: C. D. Abel (*Siemens & Halske A.-G.*) [Microphone] 23,619/05.

Traction: H. C. Heide (*G. M. Seeley*) [Signalling system] 23,278/05; A. E. Ostrander [Tube car construction] 23,305/05 and 23,381-6/05.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

[*Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."*]

THE MANUFACTURE OF ELECTRICAL PLANT.—We have received a handsome bound volume containing an interesting account of the development of the business of the General Electric Manufacturing Co., of Sweden, whose representative, Mr. S. H. Busch, is now to be seen in London at Norfolk House, Laurence Poultney Hill, Cannon Street, E.C. The firm was founded in 1883, and in 1890 established its headquarters at Westeras, Sweden, where they possess very extensive works, many excellent points in the arrangement of which, as well as of the manufacturing methods in use, are made clear in the numerous illustrations which accompany the description. A brief historical sketch of the development of the dynamo is given, and it is mentioned that continuous-current engineering in Sweden practically dates from the first machine of Wenström in 1880. From those early machines there has been continuous progress, leading up to the designs of the large generators which the company are making to-day. It is impossible to particularise all the directions in which the activities of so large a firm lie, but turning over the pages we find illustrations and descriptions of a large variety of central station generating plant, converting plant, and motors applied to every class of work, an interesting example of which is for ship propulsion in conjunction with Diesel engines. The company have done a great deal in connection with large water-power equipments and transmission schemes, including the Trollhattan Falls and other well-known plants. A particularly fine machine illustrated is a 10,500-kw. alternator for Svaeglos (part of a 40,000-h.p. installation for the Notodden Nitrate Works), but five machines are on order of 17,000 k.v.a. at 10,000 volts for the Norwegian Nitrogen Co., of Christiania, for their plant near Rjukanfos. Large installations have also been carried out at the Domnarfvets Iron Works, the Gullspang-Munkfos Power Supply Co. Interesting details are also given of switchgear, including special rolling mill equipments, and an electric winding system for mines is described. Mention must also be made of the extensive electric tramway and railway work carried out by the company, including examples of the single-phase system. Electric cranes, transporting machinery, and lifts are also well represented.

BLASTING MACHINES.—The Sterling Telephone & Electrical Co., Ltd. (200 Upper Thames Street, London, E.C.) have sent us a booklet describing the various patterns of electric blasting machines manufactured by them. The latest of these was described on p. xxx of the Mining Supplement of our last issue. Machines of the magneto low- and high-tension type and others of the dynamo pattern are described and illustrated. Accessories and spare parts are also listed in this booklet, which contains much information with regard to electric shot-firing generally.

WIRING ACCESSORIES.—A new leaflet from the Sun Electrical Co., Ltd. (118 Charing Cross Road, London), contains a description of some of the uses of the neat little buckle clips and dowel pins for fixing conduit and lead-covered and other cables. Some new sizes are now listed.

METAL FILAMENT LAMPS.—A new list of Osram lamps is being issued by the General Electric Co. (71 Queen Victoria Street), containing particulars of the revised wattages and candle-powers, which we announced in Electrical Engineering, February 10th, p. 85. The lamps listed range from 10 watts 25 volts to the 1,000-c.p. lamp, which is made up to 260 volts.

PROTECTIVE DEVICES FOR TELEPHONE INSTALLATIONS.—Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster), are issuing a new list of protective devices for telephone circuits, both for exchanges and subscribers' lines. These include various combinations of carbon block lightning arresters, line and safety fuses, and heat coils, both made up in strips and arranged singly. Cast-iron junction boxes are listed for these units, and among the accessories are various convenient tools for extracting fuses, &c. The list also deals with vacuum arresters, which can be used for protection both from lightning and from traction currents. Various arrangements of combined spark-gap and vacuum arresters mounted on porcelain bases with heat coils are standardised. Another feature is the series of non-interchangeable tubular fuses.

METRIC TABLES.—A useful card is being issued by the Newall Engineering Co. (Blackhorse Lane, Walthamstow), giving standard tables of tolerances and limits for force, driving, push and running fits in millimetres for diameters up to 150 mm. A copy of the card will be sent to any applicant.

ALTERNATORS.—A very complete list of standard alternating-current generators is included in a new pamphlet issued by Messrs. Bruce Peebles & Co., Ltd. (Edinburgh). These machines are manufactured in the usual types and for voltages of 200–6,600 volts, outputs being given, over a total of nine pages, for standard sizes suitable for three ranges of voltages both in 50- and 25-cycle machines. A general specification of the machines is given, with illustrations of actual sets with various forms of driving.

ELECTRIC DRIVING OF COTTON MILLS.—The Allgemeine Elektricitäts-Ges., whose agents in this country are the A.E.G. Electrical Co., Ltd. (121 Charing Cross Road, London, W.C.), have issued a booklet containing a series of photographs illustrating their system of individual drive for cotton and other textile machinery. Examples of belt, gear, and direct driving of blowing and carding machines with squirrel-cage motors are followed by photographs of gear-driven lapping machines. For doubling frames a special form of squirrel-cage motor, which starts gently without jerk is employed, with a gear-drive, and ring-spinning machines are gear-driven by squirrel-cage motors with a special arrangement of the stator windings to give two speeds by varying the number of effective poles. The latter motors are totally enclosed, and some are water-cooled. A list of fifty-five installations in textile mills by the company, aggregating over 17,000 h.p. is included in the booklet.

CABLES.—A striking pamphlet from Messrs. W. T. Henley's Telegraph Works Co., Ltd. (Blomfield Street, London Wall, E.C.), contains particulars of a paper-insulated cable supplied to Marconi Wireless Telegraph Co., Ltd., for use at Clifden and Glace Bay. This cable is worked normally at 40,000 volts continuous current, but has been tested up to 130,000 for ten minutes. Another new pamphlet also got up in attractive style gives prices and particulars of "London" and "Henley" tapes.

WIRELESS CLUSTERS.—We have received a copy of the export catalogue of Benjamin wireless cluster fittings and electric lighting specialities from the Benjamin Electric, Ltd. (1A Rosebery Avenue, E.C.). Some of the newest of these fittings were described and illustrated in Electrical Engineering, February 10th, p. 90. A copy of the list will be sent to inquirers abroad upon request.

ACCUMULATORS.—Messrs. Richard Pape, Ltd. (Albion House, New Oxford Street), have sent us a copy of their latest catalogue of "Fors" accumulators, of which they are the manufacturers. Owing to the special arrangement of the plates, which are concentric cylinders separated by a porous diaphragm, exceptional durability as well as small size for the output is claimed The patterns listed range from small ignition and lighting cells for motor-cars to larger cells for yacht lighting, medical, and experimental work. Several forms of accumulator hand lamps are listed, including a substantial safety lamp for mines.

METAL FILAMENT LAMPS.—The Foster Arc Lamp & Engineering Co. are issuing an effective poster depicting the disgust of a meter reader on finding that the meter has hardly registered since the last quarter owing to the introduction of Foster metal filament lamps.

CANDLE LAMPS.—A new catalogue from the Lux Candle Co., Ltd., describes and illustrates the latest forms of the Lux patent candle, which consists of a long tubular lamp, over which is clipped the opal tube. The lamp only requires renewing, and another advantage is that the tube can be cleaned inside. Both carbon and metal filament lamps are made, the latter, however, only up to 80 volts.

CORRESPONDENCE

THE ELECTRICAL INDUSTRY.

To the Editor of Electrical Engineering.

Sir,—The undermentioned have decided to constitute themselves into a Provisional Committee to take such steps as may be found advisable in furtherance of the legislative, industrial, and commercial interests of electrical industries. Every effort will be made to work in co-operation with all existing electrical societies. Any member of the industry in sympathy with this movement is asked to communicate with the Hon. Secretary or with any member of the Committee. A further announcement on the subject will be made at an early date.

G. L. Addenbrooke.	E. Garcke.
A. Bruce Anderson.	J. Barber Glenn.
A. K. Baylor.	F. E. Gripper.
Lt.-Col. H. R. Beddoes.	H. Hirst.
E. Bergtheil.	J. G. Lorrain.
J. Cecil Bull.	J. A. Lycett.
E. Charrington.	W. C. Mountain.
A. N. Connett.	R. K. Morcom.
A. Dickinson.	W. M. Murphy.
H. Justus Eck.	H. B. Renwick.
W. B. Esson.	A. A. Campbell Swinton.
E. H. Freeman.	A. P. Wood.

R. Borlase Matthews, *Hon. Sec.*

Bank Buildings, Kingsway, London, W.C.,
March 7th, 1910.

FACTORY FIRES.

To the Editor of Electrical Engineering.

Sir,—Your issue of 3rd inst., reporting the fire at Messrs. Johnson & Phillips's works, mentions that water at sufficient pressure to reach the upper floor of a building only two storeys high was not available, and raises astonishment that this engineering firm should not have previously provided private fire-extinguishing measures of a more efficient character.

Yours faithfully,
J. H. Heathman.

Parson's Green, S.W., March 3, 1910.

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LOCAL NOTES

ABERDEEN: *Supply to Tramways.*—The directors of the Aberdeen Suburban Tramways Co. have agreed to accept an offer of the Town Council for the supply of electrical energy to the tramways at 1¾d. per unit. This represents a reduction of about £400 per annum on the present bill of the company.

ACTON: *Street Lighting.*—The Acton U.D.C. is now experimenting with metal filament lamps for street lighting. Several experimental posts have been erected, and each lantern is provided with three 100-c.p. Osram lamps backed with a suitable reflector.

BERLIN: *Trolley Omnibuses.*—The *Westminster Gazette* states that it is proposed to run trolley omnibuses in the western suburbs of Berlin to join up with the lines of the Berlin tramway companies. The latter have refused to extend the tramways to the west.

BRIGHTON: *"Free" Wiring.*—In our last issue we mentioned that the Electricity Committee recommended the adoption of a proposal that local wiring contractors should wire premises, the Council charging the consumer an extra 1d. per unit, and paying this over to the wiring contractor. A long discussion took place upon this recommendation at the last meeting of the Council, but eventually it was rejected.

DUNDEE: *Electricity Works' Insurance.*—The Electricity Committee recommend that the new electricity works be insured to the extent of £40,000, and that a policy to the extent of £10,000 be taken out upon the sub-stations.

FARNHAM: *Provisional Order Revoked.*—The Board of Trade have revoked the Farnham Electric Lighting Order, 1905.

GATESHEAD: *Trailer Cars.*—The Gateshead & District Tramways Co. have applied to the Board of Trade for permission to use trailer cars on their system.

KENDAL: *Electricity Deficit.*—The electricity accounts for last year show a total deficit of £671.

LIVERPOOL: *Street Electric Lighting.*—An extension of the street electric lighting is to be carried out in Hardman Street at a cost of £250. The annual cost for maintenance is put at £4,983. At present, with gas, there is 2,460 c.p., but with the new lighting there will be 10,000 c.p.

MONMOUTH: *Electricity Supply.*—A London firm has inquired from the Corporation terms for a supply of electric power to the extent of 500 kw. for a calcium-carbide factory. As, however, the Monmouth Corporation works have not at present a maximum output of the quantity of electricity required by the proposed company, the suggestion has been made locally that the present works should be taken over by the company.

NEWPORT (Mon.): *Electricity Works.*—Although the report of Mr. C. P. Sparks upon the working of the Corporation electricity undertaking has been regarded as private, certain details of it are being publicly discussed by the Electricity Committee. For instance, Mr. Sparks does not approve of the policy of maintaining two generating stations, having regard to the area of supply. He recommends the concentration of all the plant at the Corporation Road power-house, with two 300-kw. sets in reserve at the Llanarth Street works. He also recommends the concentration of the whole of the staff at Corporation Road. Mr. Sparks also recommends the laying of mains for public lighting before there is any demand from private consumers. Mr. Sparks further suggests various increases in the charges, and a reduction of discounts to 2½ per cent. The Committee have at present come to a decision only on one point, viz., with regard to discounts, and they have decided to retain the present rate of 5 per cent. for accounts paid within one month.

PARTICK: *New Plant.*—A new 1,000-kw. reciprocating engine generating set was put into service last week. The total cost of the extension scheme was £21,328.

SALFORD: *Electric Supply.*—On and after April 1st users of electricity for power will only be allowed to use current for lighting purposes at the power rate up to 10 per cent. per quarter of their power consumption, instead of 15 per cent., as at present.

SOUTH AFRICA: *Bulawayo Electric Supply.*—After a long period of disagreement and litigation between the Council and the Bulawayo Waterworks Co. with regard to the supply of electrical energy by the latter, an agreement has at last been come to. The average price will work out at about 2s. per unit in the absence of any special contract. Osram lamps are being installed for street lighting.

WATFORD: *Railless Electric Traction.*—Inquiries have recently been made on behalf of the Urban District Council, on the Continent and elsewhere, in regard to railless electric traction. The Highways Committee, having considered the matter, reported at the last meeting that they were not prepared to recommend that railless electric traction be substituted for electric tramways at Watford. The report was adopted.

WOOLWICH: *New System of Charging.*—It has been decided to offer terms to long-hour consumers based upon their normal maximum demands to be ascertained by the Borough Electrical Engineer as distinct from the present maximum demand system now in force.

YORK: *Cost of Tramways.*—The Tramways Committee report that the loans authorised in respect of the tramways which are now approaching completion amount to £130,700. The contracts already entered into for the construction of the tramways, cars, widening works, &c., inclusive of the purchase of the old tramways company, amount to £115,605.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BELFAST.—The White Abbey Sanatorium recommend the installation of an electrical plant at an estimated cost of £4,143.

BLACKBURN.—The Electrical Engineer has presented a report on improvements and additions at the electricity works.

BURNLEY.—The Electricity Committee propose to borrow £5,000 to cover expenditure on mains for the next three years.

CANADA.—H.M. Trade Commissioner for Canada reports that the four principal electric supply undertakings in Quebec have amalgamated, and that an expenditure of about £205,000 is contemplated upon extensions of plant. The names of the General Manager and Electrical Engineer of the new organisation may be obtained by British firms interested from the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

FINCHLEY.—Application is to be made to the Local Government Board for sanction to borrow £10,000 for mains extensions, &c., to March 31st, 1912.

GORING AND STREATLEY.—The Goring and Streatley Electric Light & Power Co. propose to increase their generating plant and extend their mains.

IRELAND.—At the meeting of the Monaghan Council last week, it was decided to proceed with an electric lighting scheme.

NETHERLANDS.—Tenders are invited by March 21st by the Dutch Ministry of Finance for the installation of an electric light and power plant in the new building of the Royal Mint at Utrecht. Particulars from the Ministerie van Financien, Rijks Munt, Oude Gracht, Utrecht.

SCOTLAND.—A scheme for working the Ballachulish Estate Quarries by electricity is under consideration. The proposal includes the whole of the haulage and pumping works.

SOUTH AFRICA.—According to the *British and South African Export Gazette*, the New Modderfontein Gold Mining Co., Ltd., require a complete electrical plant.

SOUTH WALES.—The directors of North's Navigation Co. have decided to erect large electric power stations in connection with some new sinkings at Cwmdu.

STRETFORD.—The Resident Engineer is to report with reference to extensions of the generating plant.

SWANSEA.—Subscriptions are being invited for an issue of £1,011,800 3½ per cent. redeemable stock at 97½. The money is required for various municipal purposes, including extensions of the tramways and electricity undertakings.

WEDNESBURY.—The Council propose to borrow £2,095 for electrical extensions.

WEST HAM.—Application is to be made to the Local Government Board for sanction to borrow £55,000 to meet the additional capital expenditure in connection with the electricity undertaking for the next two years.

Miscellaneous

BOLTON.—The Electricity Committee require motors, meters, switches, transformers, and other accessories for the year to March 31st, 1911. (See an advertisement on another page.)

BRAY.—The Council require general stores for the Electric Light Works. Particulars from the Clerk to the Council, and tenders by April 5th. (See an advertisement on another page.)

BURNLEY.—Extensions of the tramways are contemplated, and the manager is to report.

EDINBURGH.—The Tramways Committee recommend that in lieu of the extension of the cable tramways, an electric tramway should be constructed along Slateford Road to the new markets at Gorgie. The recommendation has been adopted.

JAPAN.—H.M. Commercial Attaché at Yokohama reports the intention to equip Yokohama-Tokio Railway with electric traction, and also a proposal to construct an electric tramway alongside the present railway. It is also proposed to convert the Usui section to electric traction.

SOUTH AFRICA.—The *British and South African Export Gazette* states that the Cape Government is in the market for a number of electric motors.

SOUTHAMPTON.—Tenders are invited for a twelve months' supply of stores, fittings, &c., by the Tramways and Electricity Departments. Particulars from Mr. H. F. Street, General Manager, and tenders by March 14th.

The estimated cost of extending the tramways to Northam is £15,248, including overhead equipment, track, extension of car-sheds, &c. Application is to be made for the necessary loan.

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Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

W.—Church, Harcourt Street, W. Niven & Wigglesworth, architects, 104 High Holborn, W.C.

Shops and show-rooms, Bond Street, W. Paul Hoffman, architect, Capel House, New Broad Street, E.C.

S.E.—Rink, Lower Woolwich Road, S.E. W. H. Cornell, architect.

S.W.—Theatre, Garratt Lane, Earlsfield. Architects, Emden, Egan & Co., Lancaster Place, W.C.

PROVINCES.

AUCKLAND (Northumberland).—The Guardians have decided to install electric lighting at the workhouse infirmary.

AYR.—Premises, York Street (£1,700). Architects, W. Cowie, Ayr.

Restaurant and offices, Cattle Market (£1,500). J. Young, Borough Surveyor.

BELFAST.—Public abattoir (£32,000). Builders, H. & J. Martin, Ormeau Road, Belfast. City Surveyor, Belfast.

Theatre. Architects, Swanston & Syme, Redburn Wynd, Kirkcaldy.

BRISTOL.—Extensions to University (£5,300). Architects, Lingen, Barker & Sons, Leadenhall Street, E.C.

CHESTER.—Turkish baths (£2,500). Architect, W. T. Lockwood, Foregate Street, Chester.

Fire station (£3,000). Architect, J. Strong, Chester.

COVENTRY.—Additions, Leigh Mills. Architect, R. J. Meakin, Queen Victoria Road, Coventry.

DUNDEE.—Engineering laboratory at University (£11,000). Sir Rowand Anderson & Paul, architects, 16 Rutland Square, Edinburgh.

EDINBURGH.—Additions, George Heriot College (£5,000). J. Anderson, superintendent of works at College.

ELLAND.—School. Architect, W. S. Braithwaite, South Parade, Leeds.

GLOUCESTER.—The Gloucestershire County Council invite tenders for the wiring of the Shire Hall, Gloucester. Tenders to the Clerk to the Council, Shire Hall, by April 2nd.

HALIFAX.—Billiard saloon (£2,000). Architect, C. Williams, Halifax.

HUDDERSFIELD.—Works for W. Brown & Co., Crossland Avenue. Architect, J. Berry, Huddersfield.

ILFORD.—Secondary school, Heath Park (300 places). J. H. Nicholas, Secretary, Essex Education Committee, Chelmsford.

KEIGHLEY.—Dye works for Stockbridge Furnishing Co. (£1,500). Architect, Bradford Dyers' Association Offices, Bradford.

KILMARNOCK.—Dick Institute (£20,000). Architects, Ingram & Brown, King Street, Kilmarnock.

KIRKCALDY.—Buildings for Co-operative Society (£4,000). Architect, D. F. Smith, High Street, Kirkcaldy.

LINCOLN.—School, Spring Hill (£4,110). Architect, W. G. Watkins, Bank Street, Lincoln.

NORTHAMPTON.—Engineering works for Smith, Major, Stevens & Co. Ltd., Queen's Road, Battersea, S.W.

PONTYPRIDD.—Cottage hospital (£3,950). Architects, Evans, Williams & Evans, Pontypridd.

SHEFFIELD.—University college hall (£10,000). H. Frackingham, builder, Hoyle Street, Sheffield.

TORQUAY.—School. Architect, Education Committee, Torquay Town Council.

WEST HAM.—Bank and offices for Sir J. H. Bethell, M.P., Park House, Wanstead.

Prices of Metal Filament Lamps in Germany.—The list prices of the "Sirius" lamps manufactured by Messrs. Julius Pintsch, of Berlin, are reduced from to-day as follows:—25-50 c.p. 100-135 volt, from 3s. to 2s., and 50 c.p. 170-250 volt, from 3s. 6d. to 3s. each.

Edison Battery Tramcars.—According to our American contemporaries, a test is being made of a tramcar with Edison batteries in actual service on the 28th and 29th Street cross town lines in New York. If the tests are satisfactory, it is said that nineteen more cars will be ordered and the present horse cars discontinued.

The G.B. Surface Contact Stud System.—Mr. William Griffiths, who owns the patents of the "G.B." surface contact system of electric traction, with Mr. B. H. Bedell, the inventor of the system, are taking action against the *Daily Chronicle* and *Star* newspapers in relation to the publication of articles, alleged to be of a defamatory nature, at the time of the experiment with the system in the Mile End Road. A short time ago, in chambers, Mr. Justice Jelf decided that certain paragraphs in the pleadings for the defence should be struck out, mainly for the reason that they were contrary to the rules of pleading, and tended to delay the trial. Mr. Justice Jelf also ordered the defendants to deliver further and better particulars. An appeal against this decision was heard in the High Courts last week, and was eventually allowed.

TENDERS RECEIVED AND ACCEPTED

BELFAST.—The tender of Messrs. Willans & Robinson, Ltd., has been accepted for a 1,500-kw. turbo-alternator and condensing plant.

COLCHESTER.—Messrs. Crompton & Co. are supplying a 275-kw. dynamo to the Corporation.

INDIA.—The Globe Electric Co., Ltd., recently received an order for 36 arc lamps for the Bengal Nagpur Railway Co. After inspection and tests, a repeat order covering a further 28 lamps has been placed with the same firm.

LONDON: *Battersea.*—The Council have accepted the tender of Kortings, Ltd., for the supply of an ejector condenser, valves, gauges, &c., for a turbo-generating set at £110.

Islington.—The Council have accepted the following tenders for annual supplies for the electricity department:—Motors and prepayment meters: British Westinghouse Co.; Bat Meter Co., Ltd. Cables: British Insulated and Helsby Cables, Ltd. Electrical sundries, lamps, arc lamp parts, &c.: Bristish Tungsten Lamp Co.; Bryant Trading Syndicate; General Electric Co.; Heap and Johnson; Johnson and Phillips, Ltd.; Falk, Stadelman and Co. Cable, terminal service, network boxes and tapes: Johnson and Phillips, Ltd.; W. Lucy and Co., Ltd.; British Insulated and Helsby Cables, Ltd.; Calender's Cable and Construction Co., Ltd.; British Bitumen Co.; General Electric Co., Ltd. Transformers and accessories: British Electric Transformer Co.; Ferranti, Ltd.; Sykes & Sugden, Ltd. Arc lamp carbons and globes: Sloan Electrical Co.; Geipel Co.

METROPOLITAN RAILWAY CO.—Messrs. Siemens Bros. Dynamo Works, Ltd., have secured the contract for "tantalum" lamps for station and sign lighting on the Metropolitan Railway.

SHEFFIELD.—The Council have accepted the following tenders:—British Electric Transformer Co., Ltd., five boosting transformers of 1,000-kw. capacity each, £2,195; J. P. Hall & Sons, Ltd., boiler feed pump (10,000 gallons per hour), £190; Tramway Supplies, Ltd., M. Bonser & Co., Brecknell, Munro & Rogers, Ltd., British Insulated & Helsby Cables, Ltd., and W. Wood & Co., annual supply to the tramways department of overhead-line material; India Rubber & Gutta Percha Telegraph Works Co., Ltd., Tasker, Sons & Co., Ltd., Sheffield Corporation Electric Supply Department, and T. A. Ashton, Ltd., electrical fittings for the Health Department

WEST HAM.—The Council have extended the contract with the British Insulated & Helsby Cables, Ltd., for the supply of cables from March 31st for twelve months.

WIGAN.—The Council has placed an order with Chamberlain & Hookham for 20 meters for the tramway cars at £65.

APPOINTMENTS AND PERSONAL NOTES

Mr. R. W. Weekes asks us to state that his connection with *The Electrical Engineer* as editor terminated in July last, and he has now no interest, editorially or financially, in that journal. Mr. Weekes is now devoting his time to his consulting engineering practice at Maxwell House, Arundel Street, Strand. He specialises in the equipment of factories with steam or electric plant.

Sir William Mather has placed £10,000 in trust, the income from which is to be distributed annually among the employees of Messrs. Mather & Platt.

Mr. J. E. Kingsbury, General Manager of the Western Electric Co., Ltd., has been presented with a solid silver rose-bowl by the employees on the occasion of his retirement from the company.

Mr. A. S. Black, Borough Electrical Engineer at Southport, will in future have full charge of both electricity and tramways undertakings, with Mr. T. J. Kendrew, the present tramways manager, as his deputy.

Alderman Sir Joseph Baxter Ellis has been presented with a silver cigar-box on the occasion of his retirement from the chairmanship of the Newcastle Tramways Committee. Lady Ellis has been presented with a rose-bowl on an oak stand.

Mr. James Swinburne has retired from the firm of Swinburne, O'Gorman & Baillie. He and the firm continue their respective practices at 82 Victoria Street, Westminster.

Reduction in the Price of Simplex Metal Filament Lamps.—As announced in our advertisement columns, substantial reductions have been made in the price of Simplex metal filament lamps. The most important alteration is that the list-price of the 50-c.p. 200- to 260-volt lamp has been reduced from 4s. to 3s. 6d. The smaller candle-powers at this voltage remain at 4s. as hitherto, so that in buying these lamps the consumer obtains an advantage by using the 50-c.p., which may be of some assistance to the central station man. The 16-c.p. 60- to 130-volt lamp has been reduced from 2s. 9d. to 2s. 6d., and the 25-, 32-, and 50-c.p. at this voltage from 3s. to 2s. 6d. There has also been a reduction of 9d. in the price of round bulb lamps: the 200-volt sizes are now obtainable at 3s. 9d., and the 100-volt at 2s. 9d. Readers of Electrical Engineering can obtain copies of the new list on application to Simplex Conduits, Ltd., 113–117 Charing Cross Road, W.C.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £62 5s. to £62 15s. per ton (last week, £61 15s. to £62 5s.).

TRANSFERENCE OF BUSINESS.—The business of the New Ignition Syndicate, Ltd., has been purchased by the Float Electric Co., Ltd., Britannia Works, 49A Adam Street, New Kent Road, London.

CANADIAN CUSTOMS.—An Order in Council has been approved by the Dominion Government, providing that the surtax hitherto imposed upon German imports is to be suspended in future, and that such imports will only be subject to the duties of the general tariff.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Llandudno & Colwyn Bay Electric Tramways Co., 3 per cent. on the ordinary shares for 1909; Liverpool District Electric Lighting Co., 4 per cent. for the December half-year.

Western Telegraph Co. second quarterly dividend of 3s. per share, free of tax, for year ending June 30th.

Brompton & Kensington Electricity Supply Co., 11 per cent. per annum on the ordinary shares for the December half-year, transferring £6,000 to reserve, £3,592 to depreciation, and carrying forward £8,533.

Stewarts & Lloyds, 10 per cent. on the preferred ordinary shares, and 1s. per share on the deferred shares for December half-year. Hove Electric Lighting Co., final dividend at the rate of 9 per cent. per annum, making 8½ per cent. for the year. Globe Telegraph & Trust Co., interim dividend of 2s. Direct Spanish Telegraph Co., 4 per cent. per annum on the ordinary shares for the December half-year.

British Insulated & Helsby Cables, Ltd., 6s. per share for December half-year, transferring £33,500 to reserve and depreciation; Vickers, Sons & Maxim, final dividend of 1s. per share, making 10 per cent. for the year, carrying forward £33,927; Gateshead & District Tramways Co., 6 per cent. for 1909; W. T. Glover & Co., 5 per cent. for 1909.

BUENOS AIRES LACROZE TRAMWAYS CO.—Subscriptions are being invited for an issue of £350,000 5 per cent. extension mortgage debentures at 90 per cent. The Anglo-American Debenture Corporation has guaranteed the issue.

GORING & STREATLEY ELECTRIC LIGHT & POWER CO.—Messrs. Brain & Brain, of 156 Friargate Street, Reading, are inviting offers for the purpose of £900 five per cent. mortgage debentures at 92 per cent. The money is required for mains and generating plant extensions.

WEST AFRICA.—An issue is announced of 94,993 £1 shares at par, and £80,000 six per cent. first mortgage convertible debenture stock, of the Lobito, Benguella & Catumbella Electric Light & Power Co., Ltd.

COMPANIES' MEETINGS AND REPORTS

MATHER & PLATT.—The net profit for 1909, after providing for depreciation, amounts to £106,367, in addition to £30,512 brought forward. Dividends of 10 per cent. are recommended upon both the old and new ordinary shares, in addition to a bonus of 2 per cent. The carry forward is £19,879, after placing £25,000 to reserve.

KENSINGTON & KNIGHTSBRIDGE ELECTRIC LIGHTING CO.—A balance of £1,756 is carried forward for 1909, after meeting the full dividends on the 6 per cent. and 5 per cent. preference shares, and 8 per cent. on the ordinary shares.

NOTTING HILL ELECTRIC LIGHTING CO.—There was a net profit of £20,859 for 1909. After meeting depreciation (£3,000), debenture and other interest (£2,440), and interest and sinking fund charges on Kensington and Notting Hill joint debenture stock, there is a balance of £11,609. A balance dividend of 4½ per cent. is recommended on the ordinary shares, an interim dividend of 3 per cent. having been paid in July. In addition to the full dividend on the 6 per cent. preference shares, a bonus of 1½ per cent. will be given.

CHARING CROSS, WEST END & CITY ELECTRICITY SUPPLY CO.—A dividend of 5 per cent. per annum is recommended on the West End undertaking for 1909, carrying forward £5,162. On the City undertaking there is a balance of £13,288, after meeting the preference dividend, which it is proposed to carry forward.

At the meeting last week a shareholder complained that the company was giving the preference to foreign firms for the supply of their machinery. He thought it rather suggested that there was an arrangement between the company and a foreign bank. In reply, the Chairman said that there was no financial arrangements which tied the company to any bank, either English or foreign. The position was that in the past the directors had found foreign machinery to be better and cheaper. The question, however, was one to which further consideration would be given.

METROPOLITAN ELECTRIC SUPPLY CO.—The net profit for 1909 was £49,377. A 5 per cent. dividend on the ordinary shares is recommended, carrying forward £877. The depreciation account has been credited with £15,000, bringing this to £258,855. The Company have acquired the Hanwell and Southall-Norwood Provisional Orders. At the meeting on Tuesday reference was made to the diminution in the revenue for 1909 of nearly £6,000. The chairman said this was principally due to the use of metal filament lamps. The company, however, looked for a large expansion of business in the use of electric heating apparatus.

CHELSEA ELECTRICITY SUPPLY CO.—A final dividend, making 4½ per cent. for 1909, is recommended. The sum of £12,530 is transferred to renewals and depreciation fund.

W. T. HENLEY'S TELEGRAPH WORKS CO.—A dividend of 15 per cent. is recommended on the ordinary shares for 1909, after transferring £10,000 to reserve. A balance of £32,395 is carried forward. At the annual meeting on Tuesday a portrait of Mr. George Sutton, Managing Director, together with a service of silver plate, was presented to him.

At the meeting last week, Mr. George Sutton, the managing director, said that the feature of 1909 was the extension of the company's foreign and colonial trade. China, Japan, South America, India, and the British Colonies had all contributed to the company's excellent balance-sheet, whilst in Africa they had had the best year since the war, and in Australia they had created a record. The one fly in the ointment was Canada, where they found it impossible to accept the conditions which were creeping into municipal contracts. The particular objection they had was to the condition that these contracts provided for no arbitration, and the contract money was placed entirely at the disposal of the engineer supervising the work. Such contracts they would never tender for. A portrait of Mr. Sutton and a service of plate was presented to Mr. and Mrs. Sutton at the close of the meeting, in recognition of the very valuable services he had rendered to the company. Mr. Sutton, it may be mentioned, is not leaving the service of the company.

ROSARIO ELECTRIC CO.—At meetings of the preference and ordinary shareholders on Monday it was decided to accept the offer made by the Société Financière de Transports et d'Entreprises Industrielles to purchase the company's business on the terms of paying £6 10s. for each £5 first preference share, and £9 each for each second preference and each £5 ordinary share. The total cash payment will be £518,000.

SOUTH LONDON ELECTRIC SUPPLY CO.—The report for 1909 shows a net profit of £14,125, and a dividend of 5 per cent. is recommended on the ordinary shares, carrying forward £1,125. The sum of £8,475 is set aside for depreciation. In spite of the effect of metal filament lamps, the revenue for the year exceeds that of 1908 by £2,061.

BRITISH ENGINE, BOILER & ELECTRICAL INSURANCE CO.—At the annual meeting last week, the Chairman stated that it was in connection with the insurance of electrical machines that the advantage of the company's system of periodical inspection was most noticeable. The ratio in breakdowns was higher for motors than for dynamos, and taking the two together for the past year it was 1 in 9 of the total number of machines insured. The use of alternating current in place of continuous current had been gradually extending, but while it might have been expected that breakdowns would have been diminished, according to the company's experience this was not the case.

COUNTY OF LONDON ELECTRIC SUPPLY CO.—A dividend at the rate of 6 per cent. per annum is recommended on the ordinary shares, carrying forward £3,163. The sum of £16,000 is transferred to depreciation. Reference is made in the report to the fact that steps are being taken to connect up the company's northern and southern districts under the powers under the London Electric Supply Act, 1908. It will be remembered that a short time ago the company placed proposals before the City Corporation for carrying the necessary mains across London Bridge, and through the City, but objection was taken to the route, and we understand that the matter was referred to the Board of Trade for arbitration.

CITY OF LONDON ELECTRIC LIGHTING CO.—A final dividend at the rate of 7 per cent. per annum is declared on the ordinary shares, carrying forward £25,668, after transferring £10,000 to a dividend equalisation fund. The sum of £45,000 is transferred to reserve.

Tramways and Light Railways Association.—At the recent annual general meeting, the following officers and council were elected:—Chairman, Hon. Arthur Stanley, M.P.; Vice-Chairman, James Devonshire; Members of Council, Wm. Anderson, George Balfour, W. Worby Beaumont, A. A. Blackburn, A. N. Connett, R. W. Cramp, Harry England, E. Hatton, Thos. B. Holliday, R. J. Howley, W. E. Ireland, C. W. Mallins, P. J. Pringle, J. R. Salter, H. M. Sayers, D. Sinclair, P. D. Tuckett; Hon. Solicitor, W. Morris, Jun.; Hon. Auditor, A. W. Chambers; Accountants, Messrs. Wright and Wake; Secretary, A. de Turckheim.

It is announced that a tramway congress, under the auspices of the Tramways and Light Railways Association, will be held in Dublin on Thursday and Friday, May 12th and 13th next.

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ELECTRICAL ENGINEERING

No. 168 [Vol. VI., No. 11] THURSDAY, MARCH 17, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

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United Kingdom. 6s. 6d. per Annum.

Canada. 8s. 8d. per Annum.

Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Letters for Insertion, *Tuesday first post.*

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Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

At the annual general meeting of the National Electrical Manufacturers' Association it was decided that an electrical exhibition be held at Olympia in October, 1911. (Page 178.)

By the courtesy of Major O'Meara, Engineer-in-Chief of the Post Office, we are enabled to publish a detailed description of the first submarine telephone cable with Pupin or "loading" coils. Our article includes illustrations of the method of inserting the coils in the cable, which is a 4-core 160 lb./300 lb. gutta-percha-covered cable. The coils are packed in position with gutta-percha cones, and covered in with gutta-percha sheet, and an ingenious method of extending the armouring over the joint is employed. The coils have an inductance of 0·1 henry, and are inserted 1 naut (1·15 miles) apart. (Page 179.)

The report that the fire at Messrs. W. Whiteley's, Ltd., was caused by the electrical installation, appears to have been quite unfounded. (Page 180.)

An important article on Central Battery Omnibus Telegraph Circuits, by Mr. H. H. Harrison, appears on page 181.

A Paper by Mr. A. Scott Younger, read recently before the Institution of Engineers and Shipbuilders in Scotland, describes arrangements for carrying out ship repairs by electric welding, and compares this system with autogenous welding, greatly to the advantage of the former. (Page 182.)

An arc lamp lowering arrangement is illustrated on page 182.

On Thursday last, a paper was read before the Institution of Electrical Engineers by Mr. Miles Walker, in which he described the effects of short-circuiting large alternators. As the armature current takes time to demagnetise the field, the former may on sudden short-circuit amount to from 20 to 30 times the full-load value. The author describes several different methods of holding the windings down against the mechanical forces resulting from this current rush, and gives some interesting oscillograph records. A second paper by the same author dealt with the question of salient pole *versus* cylindrical slotted rotors. The latter type is preferred by Mr. Walker, who describes a new method of making the end connections. In the discussion, interesting particulars of some remarkable forged steel rotors of American design were given. (Page 183.)

A series of experiments has been made by Mr. L. W. Wild on the effects of differences in A.-C. wave forms. The hysteresis loss in transformer iron was found to be directly proportional to the mean ordinate factor of the wave form, but apparently independent of the amplitude factor. The author considers that differences of the order of 7 per cent. in the total losses are likely to occur if attention is not paid to wave form. The breakdown strength of air was found to depend on the maximum value of the wave, but other results were obtained with transformer oils.

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Meters of the induction-motor type were only very slightly affected by change of wave form. (Page 185.)

SOME particulars with regard to street lighting by metal filament lamps at Croydon are given on page 186.

THE Belfast Corporation are recommended to place an order with Messrs. Willans and Robinson, Ltd., for a 1500-kw. D.-C. turbo-generator for traction purposes. (Page 187.)

WE describe a new dry cell with a specially ventilated carbon and expanded zinc sheet, and a rice and salammoniac electrolyte. Some test results are given. (Page 187.)

A NEW set of rules for the arrangement and construction of lightning conductors has been drawn up by the Phœnix Fire Office. A new specification for earth plates has also been issued by the London County Council. (Page 187.)

AN experiment with a contract system of charging at Dundee has been unsuccessful.—A proposal on behalf of the Lancashire United Tramways Co. to purchase the Wigan Corporation Tramways has been rejected by the Council.—An electric supply scheme at an estimated cost of £215,000 is recommended by the City Electrical Engineer at Auckland (New Zealand).—The first section of the Bahia Blanca tramways has been opened.—The hire-purchase system of wiring is to be discontinued at Accrington. (Page 188.)

PLANT for a complete power-house is required at Aberdare; a 1,000 kw. turbo-alternator, and a 750 kw. rotary convertor, with switchgear, at Warrington; and a 500 kw. mixed pressure alternator and a 2,000 kw. turbo-alternator at Wolverhampton. Walsall Corporation propose to borrow £8,345, and the Wigan Corporation £36,000. Three electric cranes are required at Ghent (Belgium); carbon filament traction lamps, cables, meters, &c., at Glasgow; and lamp-posts and fittings at Grimsby. Tenders are invited for tramway construction at Southampton. (Page 189.)

A DIVIDEND of 10 per cent. is announced by the British Insulated & Helsby Cables, Ltd., 4 per cent. by the Newcastle-on-Tyne Electric Supply Co., and 10 per cent. by Messrs. Vickers, Sons & Maxim. (Page 191.)

AN ingenious lock nut, in which a few threads are replaced by a steel wire helix, is described. The helix is fixed at one end and tightens round the bolt when the nut turns in the left-handed direction. (Page 190.)

AMONG the specifications published by the Patent Office on Thursday last was one by Harland, Bowden and Co. for a line insulator with bolts through it for clamping on the cable.—W. Buchanan covers a commutating pole with a winding in the pole face to compensate for the armature field.—A process for hardening cast-iron for making permanent magnets is described by F. Burks.—Earthenware cooking appliances, with the heating element embedded in the walls of the vessels, are covered by N. Hosgood.—Application has been made for the revocation of a patent by E. Boddam for an electro-hydraulic lift system on the ground of inadequate manufacture in this country; and also of a patent by H. Aron for a multiple tariff meter with maximum demand attachments.—A patent for an electric primer for guns, and another by E. Preston and A. Gill covering details in the slipping belt train-lighting system, expire during the current week. (Page 194.)

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—*Member:* R. M. Wilson. *Associate Members:* A. C. Adams, H. M. Campbell, P. S. Fernandez, R. H. Handcock, C. G. Roach, B. Scheuer, F. E. Spencer, E. Turner, G. V. Twiss, E. A. Ullmann, A. V. Vowles, H. G. Weaver. *Associate:* J. H. Advani.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MARCH 17TH.

Institution of Naval Architects.

7.30 p.m. At Royal Society of Arts. "The Substitution of the Electric Motor for Marine Propulsion," by W. P. Durtnall.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. Adjourned discussion on Mr. Miles Walker's Papers read last week.

SATURDAY, MARCH 19TH.

Royal Institution.

3 p.m. Afternoon Lecture VI., by Sir J. J. Thomson, F.R.S., on "Electric Waves and the Electromagnetic Theory of Light."

Junior Institution of Engineers.

3 p.m. Visit to the new engineering laboratory at Finsbury Technical College, London.

Institution of Mining Electrical Engineers.

3.30 p.m. Meeting of Nottingham Branch at University College, Nottingham.

4.0 p.m. Meeting of Cumberland Branch at Grand Hotel, Whitehaven.

Birmingham and District Electric Club.

7 p.m. Special Ladies' Night and Concert at the Colonnade Hotel, New Street.

TUESDAY, MARCH 22ND.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. Annual General Meeting at the University. "Some Properties of Switch and Transformer Oils," by W. Pollard Digby and D. B. Mellis.

WEDNESDAY, MARCH 23RD.

Institution of Mining Electrical Engineers: Newcastle Branch.

7.30 p.m. At Armstrong College. "Relative Merits of Alternating and Direct Current for Mines," by C. R. M. Young.

ANNUAL MEETING OF THE NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION

THE fifth annual general meeting of this Association was held recently at Balfour House, Finsbury Pavement, E.C., Mr. H. H. Berry in the chair. Before the report was considered, the Insurance Expert attached to the Association read his report, and explained the benefits to be secured in utilising this department of the Association. Many of the members had been able to obtain considerable reductions in premiums besides valuable aid in the adjustment and settlement of claims, &c. The committee's report was taken as read, and commented on by the Chairman.

Various suggestions as to increasing the utility of the Association were made. There was a consensus of opinion that the work done by the Association was insufficiently appreciated by manufacturers, and attention was drawn to the fact that much more could be done if the membership were increased. The report and accounts were approved and passed, and the following committee was elected for the current year:—H. H. Berry (Berry, Skinner & Co.), H. Bevis (Pirelli, Ltd.), H. W. Butler (Electrical Power Storage Co..), E. J. Clark (Hart Accumulator Co.), D. N. Dunlop (British Westinghouse Co.), T. J. Grainger (Sunbeam Lamp Co.), B. Longbottom (Electromotors, Ltd.), A. P. Lundberg (A. P. Lundberg & Sons), F. H. Nalder (Nalder Bros. & Thompson), H. Oppenheimer (International Electric Co.) A. P. Pope (Johnson & Phillips), B. Broadhurst (Brush Electrical Engineering Co.), and H. C. Siddeley (Lancashire Dynamo & Motor Co.). Messrs. Beaver and H. Stanley Marsh were elected hon. auditors. After some discussion, it was decided that the Association should hold an electrical exhibition in London at Olympia in October, 1911.

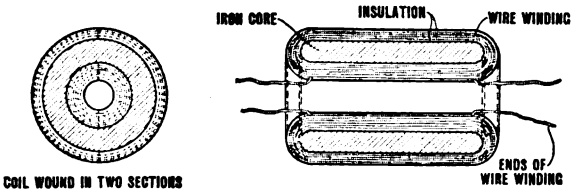
Telegraph Traffic and Movements of Cable Ships.—On the 9th inst. communication between Saigon and Bangkok was restored, while the routes *via* El Arich and Hanekin were down between Adana and Alexandretta and Diarbekin and Alep, as well as between Monssul and Bagdad. Telegraphic communication between Rome and Constantinople was in working order again on the 10th inst., and the Hanekin and El Arich routes were restored to working order on the 13th inst. Telegrams for British Borneo can only be accepted at sender's risk, while the same conditions rule on telegrams for the United States of Colombia, excepting those for Buenaventura. Telegrams for Cartagena and Santa Marta are subject to delay. Sender's risk also applies to telegrams to the Republic of Panama, excepting in the case of Colon and Panama. The cable steamer, *Mackay-Bennett*, arrived at Halifax, N.S., in the early part of the month, and left soon afterwards to repair the Canso Rockfort cable, while the new Newfoundland-Coney Island cable was broken some distance from the latter place. The repairs being completed, the ship again returned to Halifax. The *Contre Amiral Caubet* was busy on the main section of the Compagnie Française des Cables Télégraphique off Newfoundland.

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NEW TELEPHONE CABLE BETWEEN ENGLAND AND FRANCE

The First Submarine Cable with Pupin Coils

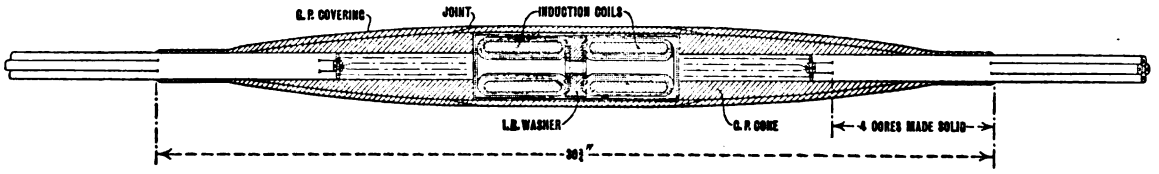
A NEW telephone cable will shortly be laid between England and France to supplement those now employed for the telephone service between London and Paris. As a result of negotiations between the two countries, it was decided that two new cables should be laid, each containing four wires (two circuits). One cable will be laid by each Government; but while the French cable will probably be more or less of the same type as those already in use, the



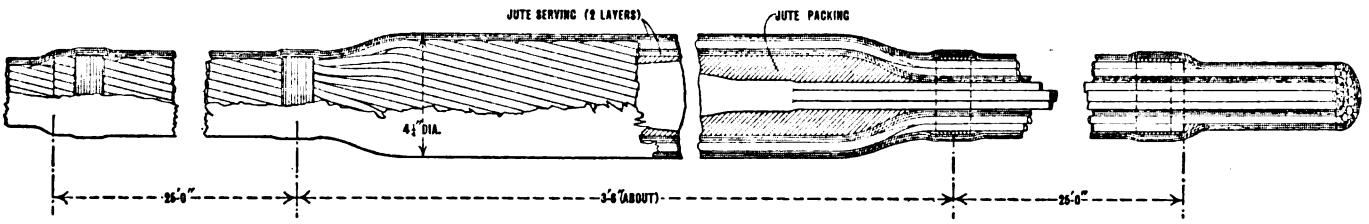
INDUCTION COIL (ABOUT ONE-THIRD SIZE).

British one (which is already manufactured and is waiting at Messrs. Siemens Bros. & Co.'s works at Woolwich for a favourable opportunity for laying it) embodies the most recent improvement in the design of long distance telephone lines, viz., the insertion of "loading" coils at intervals along its length. Instead of its scope being limited to conversations between London and Paris, it has been designed so that it will be possible to converse through it between Paris and all the large towns in the Midlands and North of England, and even to Glasgow, by utilising the existing land-lines. Tests show that the electrical properties of the cable predetermined by the designers have been accurately fulfilled, and it is reasonable to expect that, when once the cable is taken into use between Paris and London the extension of the telephone service to the North will be carried out as soon as the necessary traffic arrangements have been completed by the authorities. The cable will be laid by the makers, Messrs. Siemens Bros. & Co., from Abbots Cliff, halfway between Dover and Folkestone, to Cape Gris Nez.

This cable will be the first submarine cable in which "loading," or inductance, coils are distributed throughout its length on the Heaviside-Pupin principle. It is the outcome of the experimental work of Mr. W. Dieselhorst, the works manager of Messrs. Siemens Bros. & Co.'s cable works at Woolwich. It was Mr. Dieselhorst who laid the lead-covered cable with loading coils in the Lake of Constance in 1906, and he then realised the difficulty that would be experienced in dealing with lead-covered cable in submarine work owing to its great weight and the damage which would be caused to a lead cable in tidal waters. On his return to the Woolwich works he immediately started experiments on the insertion of loading coils in gutta-percha-covered cables, and a method of doing this, which is that in use in a slightly modified form in the new Anglo-French cable, was patented by him, in conjunction with his firm, in November, 1906 (British patent 25,306/06). An experimental cable made in this way at the Woolwich works was left in water for fifteen months, and occasionally subjected to pressures of four tons per square inch, corresponding to a depth of 2,500 fathoms of water. This cable was found to withstand these tests without injury, and was brought to the attention of the Post Office engineering saff. Finally, when tenders were invited for a loaded cable for laying across the English Channel, Messrs. Siemens Bros. & Co. were able to guarantee a standard cable equivalent length of 3·5 miles for the total length of 21 nauts (24·2 miles), and their tender was accepted. The tests of the cable after manufacture have shown that the actual cable has a standard cable equivalent of 3·28 miles, which is still better than the guaranteed figure. Without loading coils, a mile of the same cable has a standard equivalent cable length of 0·435 mile, and therefore the actual gain due to the addition of loading coils is equivalent, in its effect on the speech transmitted, to reducing the length of the cable 3·2 times. The cable is a four-core cable with conductors weighing 160 lbs. to the mile, insulated with 300 lbs. (per mile) gutta-percha, the resistance of the conductors per loop mile is 12·5 ohms, and the wire to wire capacity 0·12 m.f. per mile. The inductance coils, each of slightly less than 6 ohms resistance, with an inductance of 0·1 henry at 750 cycles per second, are placed at one naut (1·153 miles) apart. The actual attenuation constant of the cable is 0·140 per mile, while the cable without its inductance coils has an attenuation constant of 0·045 per mile. As the cable and coils were designed for an attenuation constant of 0·0147 after preliminary experiments had been made, the closeness to this figure is extremely satisfactory.



ARRANGEMENT OF COILS IN CABLE.
(Scale about one-sixth.)



METHOD OF SHEATHING OVER COILS.
(Scale about one-sixth.)

In the insertion of loading coils in a submarine cable, the mechanical problem is even more important than the electrical one, and the makers are to be congratulated on their solution of this. The coils have been

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inserted so compactly that the part of the cable containing them can be paid over a 4 ft. sheave without damage. Our illustrations show the design of the coils, and the method of inserting. They increase the diameter of the gutta-percha core from about 1 in. to 3 ins., a gutta-percha cone is inserted at each end as packing, and gutta-percha sheet is wrapped round them and jointed to the gutta-percha of the core at each end.

Those of our readers who remember the description of Messrs. Siemens' patent in ELECTRICAL ENGINEERING some months ago, will note that an alteration is now made in the arrangements of the loading coils. Instead of four coils inserted one after the other, one for each of the four wires of the cable, two double coils are employed. Each double coil consists of two windings on the same iron core, and one winding is connected in series with each conductor. This has an advantage over four distinct coils, as the iron core experiences an ageing effect which affects its permeability, and may not be precisely the same in two cores. If separate coils on separate iron cores were used for the go and return circuit, the gradual change in permeability might disturb the even balance of the circuit, but by winding them on the same core the variations are automatically compensated. Between the silk-covered wire of the coils and the gutta-percha sheet there is a sheet of metal foil, not shown in the drawing; this was found to be a necessary precaution in the construction of the cable, and has been patented. An annular rubber distance-piece is inserted between the two sets of coils to give greater flexibility.

The method of armouring is extremely ingenious. At about 10 yards before the position of the coils is reached, the stranding-machine is stopped, and a second armouring is started on the top of the other one. When the bulge in the cable is reached the wires of the second armouring, which, of course, is given the same lay as the first, automatically place themselves between the other wires, so that the part of the cable with the increased diameter is covered with a single layer of the armouring wires, and at about 10 yards on the other side of the coils the additional wires are cut and bound up as before.

Major O'Meara, the Engineer-in-Chief to the Post Office, is to be congratulated in having adopted this type of cable in the face of much criticism by Continental experts. It has been stated freely that the high specific inductive capacity of gutta-percha would render a cable insulated with this material unsuitable for loading with coils, and that the calculations employed in the design would therefore be falsified. The tests already alluded to have shown, however, that this is far from being the case, and some tests made by the Post Office engineers last October and November on some of the Danish Government "continuously loaded" cables show that the coil method of loading is far more effective. The "continuous loading" consists of covering the copper conductor with a close spiral winding of thin iron wire throughout its length. Obviously this cannot increase the inductance to the same extent as the insertion of coils at intervals, and at the same time it materially increases the capacity of the cable. Actual measurements against standard cable compared with the values calculated for the same cables as those under test, but without the continuous iron winding, showed that the improvement due to the "continuous loading" was about 60 per cent., whereas with coil loading an improvement of from 250 to 370 per cent. has been shown to be practicable in the Post Office cables in this country—the former by experiments with gutta-percha cables, and the latter with paper-insulated cables.

At the Physical Society of London, on February 25th, Prof. Perry read a mathematical Paper in which he endeavoured to show that a general method of calculation of the attenuation on telephone lines, applicable to any "contrivance" consisting of a combination of resistances, inductances, capacities, and leakances, could be deduced, which could ultimately be taught to quite unmathematical people. Major O'Meara, who opened the discussion, in the course of his remarks quoted the test results for the new Anglo-French submarine telephone cable, which in the above article we have, by his courtesy in placing information at our disposal, been able to amplify by giving details of the actual construction of the cable. He also mentioned that the question of leakance was certainly of very great importance. It was owing to the very large part that leakance played that their first experiments were not successful. In America they had commenced to load aerial wires, and so large a part does this leakance play that in that country telephone engineers had been obliged to abandon the use of glass insulators, and to substitute the highest grade of porcelain insulators to meet the difficulties which had been met with owing to an insufficient allowance for the part this factor played. Mr. A. W. Martin, of the Post Office Engineering Staff, who made the tests on the Danish cables mentioned above, and has done extremely valuable work in connection with this subject, contributed both to the theoretical and practical side of the discussion, and was followed by Messrs. B. S. Cohen and G. M. Shepherd, who are engaged in similar experimental and research work with the National Telephone Co. Mr. Cohen stated that Prof. Kennelly's formulæ and methods, published in his Paper at the St. Louis Congress, and in other Papers since that date, were now adopted by many telephone engineers, and were rapidly becoming standardised. Dr. Alexander Russell (Faraday House), and Dr. J. A. Fleming (University College), also spoke.

THE FIRE AT WHITELEY'S

AN outbreak of fire occurred about mid-day on Monday in the basement of the turnery department of Messrs. William Whiteley's, Ltd., at No. 151 Queen's Road. A report was immediately published by the evening papers stating that the fire was due to "the fusing of an electric wire," but it appears that this supposition was entirely unfounded. The first thing that our representative saw on visiting the scene of the fire early in the afternoon was that the room which had been burnt out had already been fitted with temporary electric lighting, to assist the work of the salvage men. Mr. William Whiteley, one of the directors, expressed the opinion, in conversation with our representative, that there was nothing to point to the fire having been caused electrically. It was much more likely, he said, that the outbreak occurred in some other way, and a probable cause was the dropping of a lighted match or cigarette-end down one of the gratings in the street pavement, which admitted air and light to the room in question. The engineering staff of Messrs. Whiteley's are also of this opinion.

The room in which the fire broke out is about 30 ft. square and contained baskets, wicker chairs, and brooms. Smoke was seen issuing from the room, and immediately the fireproof doors in the party walls on either side were closed. The Grinnell sprinklers did their work well, as although the stock in the room was almost completely destroyed, the heat was sufficient to start the sprinklers in the neighbourhood, and this prevented the fire from spreading. Fortunately the ceiling was fireproof. The whole of the basement is lit by electric light, as is indeed the whole of the premises, there being a private generating plant. The room in question contained four pendants in the centre. The wiring is, of course, destroyed, but outside the room the cables are practically intact, in spite of the great heat. There were no fuses in the room, the fuses for the circuit in question being placed with others some distance from the room. As has already been mentioned, within a very short time of the extinction of the fire the room was temporarily lighted by flexible extensions from adjacent points in order to assist the work of the salvage men.

Mr. H. W. Cox.—In the House of Commons this week, the Prime Minister stated that he would give most sympathetic attention to any representations which may be made in favour of granting Mr. H. W. Cox a Civil List pension. It will be remembered that Mr. Cox has suffered, and is still suffering, severely from X-ray dermatitis as a result of his early work with X-rays.

Royal Institution.—Among the Friday evening discourses after Easter are the following:—April 22nd, "The Telegraphy of Photographs, Wireless and by Wire," by T. Thorne Baker; May 13th, "Radioactivity as a Kinetic Theory of a Fourth State of Matter," by Prof. W. H. Bragg. Among the afternoon lectures are two by Prof. J. A. Fleming, F.R.S., on Saturdays, June 4th and 11th, at 3 p.m., on "Electric Heating and Pyrometry."

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CENTRAL BATTERY OMNIBUS TELEGRAPH CIRCUITS

By H. H. Harrison.

THE type of circuit illustrated in Fig. 1 is now well known and doing good service in various parts of the world. It is perhaps not too much to say that the arrangement is an extremely ingenious

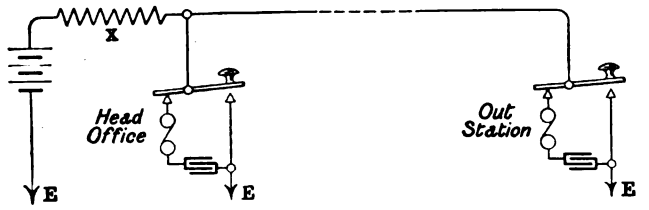


Fig. 1.

modification of the ordinary closed circuit system, as, while retaining all the advantages of this, there is no permanent current on the line except that due to leakage.

In common with all closed circuit systems, it is adversely affected by leakage, the strength of the signals varying to a greater extent when signalling inwards (*i.e.*, towards the central battery) than when signalling in the outward direction. Some complaints having been received from abroad as to its intermittent failure when applied to lines with variable insulation, the writer was instructed by the British Insulated & Helsby Cables, Ltd., to look into the matter, and the result is, by their permission, given below.

From theoretical reasons it was evident that the adoption of a fixed resistance of 3,000 ohms, either for a given line subject to widely varying insulation resistances or for lines of differing lengths and

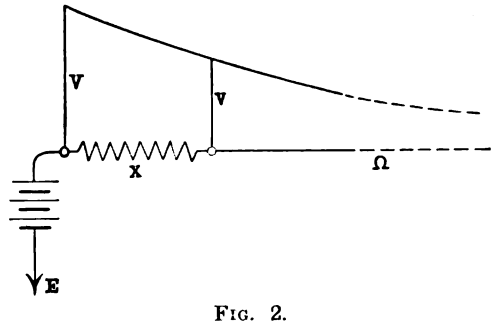


Fig. 2.

constants, is not suitable, and the following result shows that there is a theoretical best value to give this resistance in terms of the line constants.

Referring to Fig. 2, x = the fixed resistance and $\Omega = r$, the measured conductor resistance of the line, with the terminal out-station key depressed (*i.e.*, the far end of the line to earth). Also, $\Omega = R$, the measured insulation resistance of the line with the out-station key released, insulating the far end of the line, the normal condition.

In the latter case,

$$\frac{v}{V} = \frac{R}{x+R} \text{ or } v = V\frac{R}{x+R} \quad . \quad . \quad . \quad (1)$$

If the terminal out-station key is depressed, the potential v changes to v_1, and

$$\frac{v_1}{V} = \frac{r}{x+r} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

The difference (1) − (2) is the fall of potential, producing a signal at the head office, and, putting v equal to unity, is

$$\frac{R}{x+R} - \frac{r}{x+r} \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Multiplying across and rearranging, this becomes

$$\frac{Rx - rx}{x^2 + Rx + rx + Rr} \quad . \quad . \quad . \quad . \quad (4)$$

which is a maximum when $Rr = x^2$.

or, $x = \sqrt{Rr}$

That is, the best value for the fixed resistance is equal to the geometric mean of the measured conductor and insulation resistances of the whole line.

Fig. 3 is plotted for a fifty-mile line of 100 lb. copper wire, having a conductor resistance of 8·782 ohms per mile and an insulation resistance of 200,000 ohms per mile. The full-line curve gives v for varying

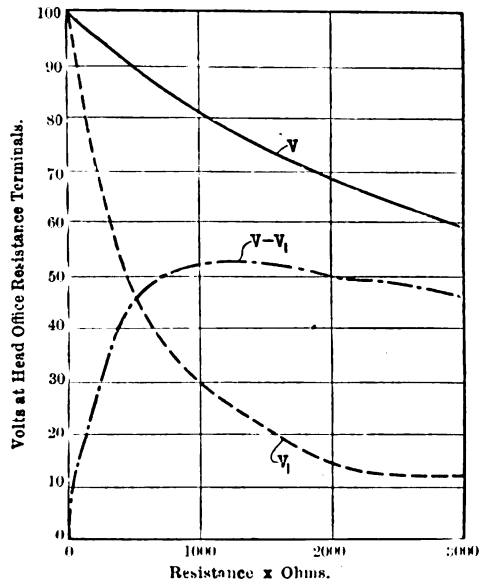


Fig. 3.

values of x; the dotted curve the corresponding values of v_1; and their differences (to which the strength of the signals at the head office is proportional) are given by the chain-dotted curve. The maximum difference is attained with $x = 1{,}340$ ohms, which is equal to $\sqrt{423 + 4{,}200}$, the geometric mean of the measured conductor and insulation resistances.

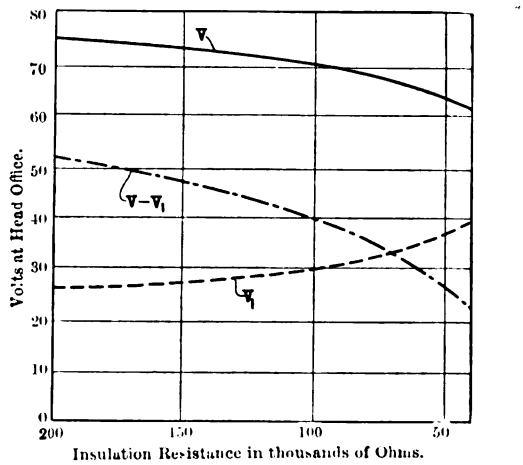


Fig. 4.

Fig. 4 is plotted for the same line with varying values of insulation resistance, x being given its appropriate value as indicated above. The strength of signals at the head office is thus the maximum obtain-

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able for any insulation within the limits for which the curves are drawn, and is, as before, given by the ordinates of the curve $v - v_1$. It is seen to decrease with the fall in the insulation resistance, which is what is to be expected.

The foregoing shows conclusively that the important consideration is the strength of the incoming signals at the head office, and the most favourable conditions are only assured by the adoption of an adjustable in place of the fixed resistance x.

The strength of the outgoing signals can always be doubled by adopting a reversing key in place of the

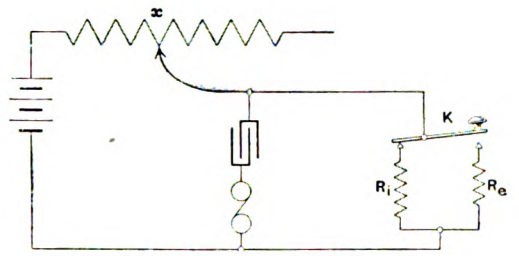


FIG. 5.

simple Morse key, and making slight modifications in the circuit at the battery end.

In order to try a number of variations of the circuit rapidly and conveniently, and to study the influence of line variation on them, the writer used the arrangement shown in Fig. 5, which explains itself.

ELECTRIC WELDING IN SHIP REPAIRS

A PAPER entitled "Steamship Repairs by Electric and Autogenous Welding" was read by Mr. A. Scott Younger on Tuesday, Feb. 22nd, before the Institution of Engineers and Shipbuilders in Scotland. The carrying out of ship repairs by welding, he said, was not practised in this country to anything like the same extent as on the Continent, and he proceeded to a description of the arc-welding process developed for this purpose by Mr. O. Kjellberg, of Gothenburg, as in use by three separate welding companies in different districts in Sweden.

The apparatus in use at Gothenburg was installed on board an old barge which could be towed alongside any steamer requiring repairs. It contained a complete welding outfit, with sufficient cable to pass on board the steamer and long enough to reach inside of the boilers if necessary. The cables were in duplicate, so that repairs could proceed at two places at the same time. The barge, or floating workshop, was about 80 ft. in length × 20 ft. in breadth, fitted with a small marine type of boiler which supplies steam to a de Laval turbine driving two D.C. dynamos and exciter. The voltage could be varied from 50 to 120. At the fore end of the barge there was a workshop having an anvil and vice benches, and generally suitable for carrying out small repairs. There was also a steam-driven air compressor for supplying compressed air to pneumatic tools which were used for preparing the surfaces for welding, or dressing off after the operation. The anvil block is a slab of steel 10½ in. wide by 2½ in. deep, laid across two wooden trestles, and the negative terminal from the dynamo is clamped to it. The positive pole is the holder, and is held in the hand of the operator. The handle, of course, is insulated, and the current passes through the tongs in the jaws of which the steel rod used for welding is held. This rod is about $\frac{3}{16}$ of an inch in diameter, and is specially prepared, being coated with a substance, the composition of which is secret, but which appears to be of the nature of a flux. This coating would also appear to get over the usual difficulty of welding with carbon electrodes that the resulting material becomes too hard by absorbing carbon from the electrode. The parts to be worked on are first welded at one spot to the anvil as one would use sealing-wax with paper. The welding heat is said to penetrate only $\frac{3}{4}$ mm. into the material, and the temperature of the arc can be regulated to suit the work from 2,000° F. to 4,500° F., partly by apparatus connected with the dynamo and partly by the coating on the rod. Of course, the heat is gradually conducted away, but it is generated so rapidly that while a portion is at welding heat, it is possible to touch the plate 3 to 4 in. away.

The Paper gives results of a number of tests of sample bars, showing the excellence of the welds produced, and passes on to a description of methods adopted in making repairs to boilers, &c., in place. In making good a leak between the lap of two plates, as in boiler work, it is usual to add a fillet of iron. This was done at the rate of 11 in. in 2½ minutes. In butt welding the edges of the plates to be joined are chamfered, and the work consists in filling up the right-angled grove thus formed. A practical rate of working for a plate of ⅜ of an inch thick was found to be about 10 ft. per hour. The current required was 13·5 kilowatts at 90 volts, and 150 amperes. The method can be applied to almost all other boiler repairs, cracks can be filled up in furnaces, manholes can be restored where wasted, and leaky rivets and pitted holes made good. The method is equally applicable to machinery and general ship repairs, such as repairing cracks in crank shafts and adding metal on worn parts of rudder, pintles, &c., and mending stern posts.

The second part of the Paper dealt with autogenous welding, but, in comparing the two methods, the author points out that the test results from the electric welding are more favourable, and considers that the electric process could be used in cases where the oxy-acetylene method would be inadmissible.

ARC LAMP LOWERING GEAR

THE accompanying illustration represents a street arc lamp standard at Ealing, which has been fitted with the centre carrier form of lowering gear, specially designed by the London Electric Firm (George Street, Croydon) for this class of work. In this particular case the posts were converted by altering the



ARC LAMP STANDARD WITH LOWERING GEAR AT EALING.

existing carriers to take lowering gear. The range of the firm's designs includes arrangements whereby practically every class of fitting can be converted. Other examples of the centre carrier type of lowering gear are to be seen in Westminster, Oxford Street, Upper Regent Street, as well as at Croydon, Cardiff, Eastbourne, Grimsby, Rawtenstall, and at Melbourne (Australia).

Regent Street Polytechnic.—The annual conversazione of this Institution was held on Friday last. The medals, prizes, and certificates gained by the students during the past year were distributed by Albert Dykes Spicer, Esq., a member of the governing body.

Parliamentary.—In the House of Commons on Thursday, the Board of Trade introduced a Bill constituting the London County Council the purchasing authority of the following London electric supply companies:—Kensington & Knightsbridge Electric Co.; Westminster Electric Supply Corporation; St. James & Pall Mall Electric Lighting Co.; Central Electric Supply Co.; Notting Hill Electric Lighting Co. These companies were not included in the London Electric Supply Act, 1908, which constitutes the London County Council the purchasing authority of the remaining electric supply companies in London

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SHORT-CIRCUIT EFFECTS AND TURBO-ALTERNATOR CONSTRUCTION

ON Thursday last, Mr. Miles Walker (British Westinghouse Electric & Manufacturing Co.) read two Papers on these subjects before the Institution of Electrical Engineers in London. The first Paper was entitled "Short-circuiting of Large Electric Generators, and the Resulting Forces on Armature Windings." If an alternator while running at full speed and fully excited is suddenly short-circuited, the current may rise to more than 20 times its full-load value, for there is no time in the first 1/100 part of a second for the field to be demagnetised by the increased armature current. The rate at which the current rises is chiefly determined by the self-induction of the armature winding, or rather by that part which is due to the flux leaking between armature and field windings; but as the eddy currents in the pole-face produced by the rapid rise in current maintain the flux almost at its full value, they must first die down. The leakage flux is often in turbo-generators only 5 per cent. of the total flux, so that the rate of rise of the current in one of the phases which happens to be near its maximum E.M.F. at the instant of short circuit would, if the pole-flux were constant, be 20 or 30 times as great as the rate of rise from zero at full load.

In a 5,500-kw. 3-phase generator with four solid salient poles revolving at 1,000 r.p.m., the total flux per pole amounts to 78,000 kilolines, and the maximum instantaneous value of the E.M.F. generated in one phase at the moment when the pole

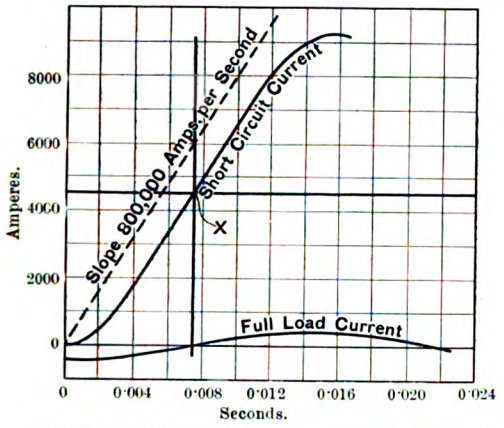
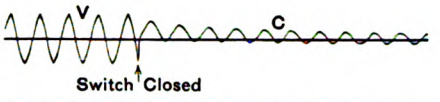


FIG. 1.—CURVE OF ARMATURE CURRENT AT INSTANT OF SHORT-CIRCUIT AS COMPARED WITH FULL LOAD CURRENT LAGGING 90°.

is opposite it is 9,000 volts. The resistance per phase is 0·056 ohm. The leakage flux amounts to 2,500 kilolines per pole for the full load current of 288 amps., or 3·2 per cent. of the total flux per pole. The factors determining the rate of rise of the current on short circuit are the leakage flux already considered, and the reaction due to the eddy currents in the pole-face. The self-induction of the eddy-current paths can be transferred for the purposes of calculation to the armature winding, and, when multiplied by the ratio of transformation, has a value about 2·4 times that of the armature winding opposite the pole. The total leakage may, therefore, be taken as 21·2 kilolines per ampere in the present case, and the rate at which the current would begin to rise works out at 800,000 amperes per second. Fig. 1 shows the way one would expect the short-circuit current to rise in this machine, leaving out of account the effect of the distributed capacity. The zero line of the curve depends upon the instant at which short-circuit occurs, *e.g.*, if the machine is short-circuited when the pole is opposite the phase, the zero line must be drawn through X. As stated above, the current will then rise at the rate of 800,000 amps. per sec., but the maximum current will be only 4,700 amps., and the curve will be more symmetrical about the zero line than that shown in Fig. 2, where short-circuit occurred when the phase voltage was about zero.

Fig. 2 is an oscillograph record of the short-circuit current of a large machine. Curve V shows the voltage before the short circuit. At the instant of short circuit the voltage falls to zero and the current curve springs into being; the highest current recorded was 3,100 amperes. As indicated in Fig. 1, the current rises to such a high value during the first half of a cycle that the pole which passes during the next half cycle is hardly sufficient to bring it to zero. It then rises and falls in waves of gradually diminishing amplitude, until after a lapse of several seconds it assumes the normal short-circuit value. The value of the current at the first peak is in this case about 32 times full-load current. The value of the eddy current in the pole-face can be readily calculated, and in



V = Terminal volts across phases : 1 cm. = 16,500 volts.
C = Current : 1 cm. = 15,000 amperes.
Time Scale : 1 cm. = 0·075 second.

FIG. 2.—OSCILLOGRAPH RECORD OF ARMATURE CURRENT ON SHORT-CIRCUIT.

the above case appears to have been about 150,000 amperes. With laminated field poles, the exciting current increases at short-circuit as the diminution of the pole flux produces a forward E.M.F. With solid poles, however, the exciting current is decreased as the eddy currents induced in the body of the pole momentarily assist the field current, causing it to sink in value.

The author then considers the magnitude of the forces acting on armature coils, and due to these very heavy current rushes. He shows by calculation that, with an early form of winding

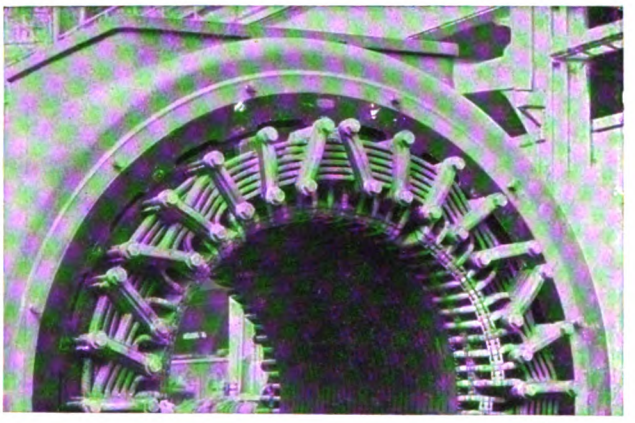
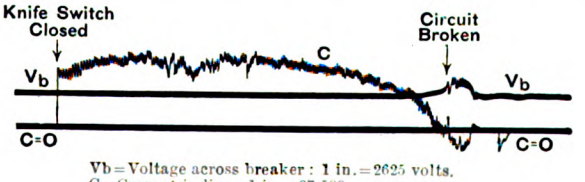


FIG. 3.—WINDING OF 6,000-K.V.A. THREE-PHASE GENERATOR (BRITISH WESTINGHOUSE CO.)

which was completely wrecked by throwing the generator on to the bus-bars when it was out of step, the actual force on short-circuit would be 1,100 lbs. per foot run for the worst coil. He then illustrates several different arrangements for clamping down the end-connections. In a method employed by the B.T.-H. Co., a substantial ring, supported on brackets, and cast with them, is provided immediately behind the winding. This ring is well insulated, and the formed winding is braced to it by means of circular metal bands placed over



Vb = Voltage across breaker : 1 in. = 2625 volts.
C = Current in line : 1 in. = 37,500 amperes.
Time Scale : 1 in. = 0·06 second.

FIG. 4.—OSCILLOGRAPH RECORD OF CURRENT AND VOLTAGE WHEN AN 800-KW. ROTARY IS SHORT-CIRCUITED THROUGH A SHORT LENGTH OF FEEDER.

wooden clamps which are shaped to hold the coils. In another method employed by the same firm for securing a barrel-wound armature, there are two rings wound with a considerable thickness of insulating material and held by brackets cast with the frame. The winding is braced to the insulated rings. Fig. 3 shows the winding of the 6,000 K.V.A. three-phase generators

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built by the British Westinghouse Co. for the London County Council.

Finally, the author turned to continuous current machines, dealing briefly with such effects as the twisting off of shafts and the leaping of cables; and in connection with the effects of opening suddenly a circuit carrying a heavy current, described the results of tests made on an 800 kw. 600-volt rotary converter. Fig. 4 shows an oscillograph record of what happened when the rotary was short circuited through a short length of feeder cable consisting of 270 feet of 61/12 s.w.g. The maximum current reached was 14,000 amperes.

The second Paper dealt with the design of field magnets for turbo-alternators. The author points out that the ideal arrangement for a rotating field is to have the copper on the outside of a nearly cylindrical iron rotor. With the salient pole-type, there is a space between the poles which is not utilised at all, and that is the very space where the copper should be. This span can be utilised for ventilation, but it is frequently occupied by bronze coil supports. This arrangement also reduces the cross-section of the pole, and with it the output of the machine. The advantage of the cylindrical type is that by placing the winding in slots a greater part of the periphery can be used both for flux and ampere-turns. To get good regulation it is necessary that the ampere-turns

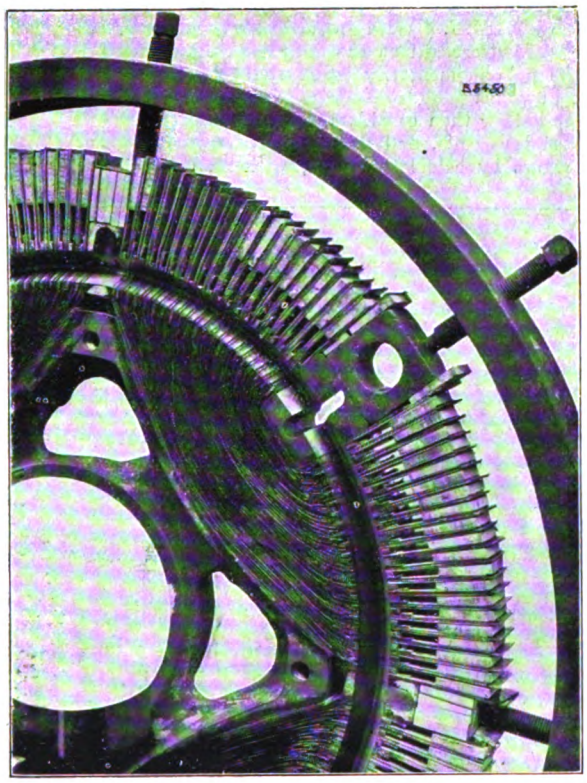


Fig. 5.—Method of Assembling End Connectors.

on the rotor at no load should be greater than the ampere-turn of the armature, and consequently, the interference with the magnetic circuit caused by the slots is beneficial, and takes the place of an increased air gap. It is found that copper placed in slots can carry twice as many amperes per square inch as copper in a wound coil 2½ in. in thickness. Further, the iron below the slots offers such a large cross-section that there is space for a number of large holes from one end to the other for supplying air to the radial ducts.

The main difficulty, continues the author, with the early cylindrical field magnets was the supporting and cooling of the end connections. Where the exciting current is small, say, 50 to 100 amperes, at a high pressure, the best method is to use a number of concentric coils with a metal ring over the ends at each end of the rotor. In the latest method of the British Westinghouse Co., illustrated in Figs. 5 and 6, the rotor is wound with bars, and the end connections consist of copper straps, insulated from one another, and assembled so as to form a solid fan-shaped block. Four of these blocks are mounted on a saddle and V-shaped grooves are cut, as shown in Fig. 5. The whole is then assembled between steel cheeks having V-shaped projections, mica V-rings being placed in the grooves, just as in the construction of a direct-current commutator.

Mr. Walker then deals with the effect of slots on the field form, pointing out that, as ripples in the E.M.F. wave may, by resonance, give rise to dangerous pressure rises on capacity loads, it is best to employ semi-enclosed slots. With regard to regulation, comparative curves for salient pole and cylindrical field machines are given, showing that on account of the high saturation in the body of the pole in the former type, the curve bends over much sharper, whereas in the cylindrical field type the highly saturated teeth act like a long air-gap,

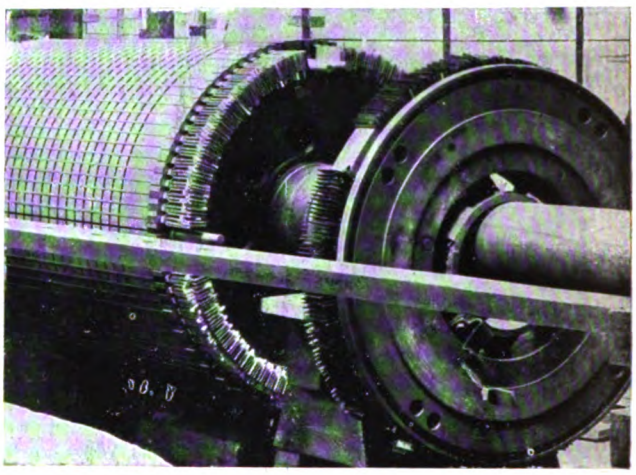


Fig. 6.—Fixing End-connectors to Field Bars.

the curve ascending at a steeper angle. Another important advantage of the cylindrical type is that it is easy to arrange it so as to embody the author's compensating principle, and make the armature reaction strengthen the field. With this arrangement it is possible to get good regulation (2 per cent. at unity power factor and 12 per cent. at 0·8 power factor) with the ampere-wires per inch of periphery as high as 1,000. It is also possible to employ a flux density in the air-gap as high as 11 Kapp lines per square inch.

Discussion in London.

Mr. W. A. Chamen (South Wales Electrical Power Distribution Co.), said he had a two-pole 3,000 kw. alternator running at 1,500 r.p.m., and designed by Mr. Miles Walker. Although there had been one or two short circuits, the machine had never broken down. One-inch studs, holding the clamps, had been bent in various directions, however, and the coils had been pushed slightly out of place. After Mr. Miles Walker's investigations, he looked forward to even this being made impossible. The leaping of cables referred to reminded him of what happened in the days of copper-strip mains. He had a bad short circuit on mains of this class in Glasgow, due to this leaping. He had replaced them with lead-covered concentric cables, and there had, of course, not been any movement since.

Dr. Silvanus P. Thompson, F.R.S., said that many years ago, in connection with the breakdown of some Mordey alternators, he had expressed the opinion that the current at the time of a short circuit was 20 to 30 times the ordinary full load current. That opinion, which was based on the mechanical results of short-circuiting, was greatly disputed at the time by Mr. Raworth, who stoutly maintained that the short-circuit current was only two or three times the full-load current, an opinion based on actual experiments in running up with the armature short-circuited. He had not been able to satisfactorily explain the discrepancy until he saw this Paper. Mr. Miles Walker's idealised construction, in which the copper was on the outside of the rotor, reminded him of what was said years ago, that as the use of field-magnet windings was really to drive the magnetic flux across the air gap the exciting coils ought to be wound round the air gap and not round the magnet poles. Eikemeyer tried to do this. He was right theoretically, but purely mechanical considerations proved that it was not possible. The area of iron was proportional to the diameter and length of the rotor, and the cross-section of copper was proportional to the square of the diameter, and independent of the length. These two factors should be multiplied to get the duty of the rotor, which was proportional to the cube of the diameter, and to the first power of the length. This showed that it was much more important to increase the diameter than to increase the length. An increase of length of five per cent. increased the duty of the rotor five per cent., but an increase of diameter of five per cent. increased the duty by 15 per cent. He did not think that Mr. Miles Walker's compensated winding had yet been really appreciated. It was no small gain to be able to increase the specific loading of the armature to 1,000 ampere wires per inch of periphery, and it was shown that it might go even higher without the demagnetisation

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becoming sufficient to make the machine a bad one from the point of view of regulation. With regard to ripples in the E.M.F. wave-form, they could be eliminated if the slots in the armature were not made exactly parallel to those in the rotor.

Mr. H. M. HOBART, on the question of short-circuit current, said he tested some 5,000-kw. machines in a Continental works about six years ago. These had laminated pole shoes, but the magnet cores were solid, and the current in the field circuit increased to about three times the normal short-circuit value at the moment of short circuit. This was an opposite result to that obtained by Mr. Walker, but the machines were very different. They were 5,000 kw., 500 r.p.m., 20 pole. The circumstance, however, showed that this phenomenon was known several years ago. A feature of the tests which were made was that it took 20 to 40 seconds for the current to fall from the initial short-circuit value as detected by an ordinary rough switchboard instrument—eight to ten times the rated current—down to the normal short-circuit value—about three times the rated current.

Mr. J. S. COOPER (British Westinghouse Co.) said the question of holding the armature winding against short-circuit forces was closely connected with the question of open *v.* closed slots, and it might further be said to have only arisen in connection with turbo-generators with small numbers of poles. An advantage of Mr. Walker's field construction was that there were no joints in the magnetic circuit. This advantage was also shared by the forged steel method of construction, but not by those designs in which either the poles or the teeth were keyed on to the rotor body. The speaker then described some remarkable American designs of forged steel rotors. In the first of these, the shaft was forged in two pieces, with half the rotor on each, the two halves being fixed together by bolts through the pole pieces. With this construction the shaft was integral with the poles, and the weakness caused by cutting out V-pieces which penetrated too near the shaft in other designs, was avoided. In another design the rotor was in three pieces—a central piece, and the shaft in two halves, each with a flange which bolted on to the centre-piece. In a two-pole rotor of this construction it was possible to carry the field windings right across the rotor from one pole face to the other, as there was no shaft in the way. In this machine, the bronze flanges were fixed to the body of the rotor by short, heavy screws. The two ends of the shafts were machined so as to end in a bevel-wheel form, with dovetail teeth, and the flanges were cast on to these. This, he said, looked a little bold at first sight, but it had proved very satisfactory in practice. In some cases, instead of having a cast on construction, the flange was bored out and the shaft was either pressed in or the flange shrunk on to it. This construction had had the important effect of raising the critical speed of the rotor. In ordinary designs, with the shaft running right through, the critical speed was met with at about two-thirds or three-quarters the normal speed. The above solid construction had proved so rigid, however, that in machines of between 2,000 kw. and 3,000 kw., running at 3,600 r.p.m., the critical speed was not passed through in running up. On the other hand, there was the disadvantage that a machine of this character was larger for the same output than a machine with cylindrical field construction. Mr. Walker's compensating device was exceptionally well suited for machines with cylindrical field construction, and a number of them were running satisfactorily in parallel with machines of ordinary construction.

The discussion will be continued to-night (Thursday).

DISCUSSION AT MANCHESTER.

The first of the above Papers was read on Tuesday, March 8th, at Manchester, where the discussion was opened by Mr. M. B. FIELD (Ferranti, Ltd.), who said it was gratifying to know the confidence with which the designers and owners of the alternators used made such drastic tests. He had carefully measured up some of the oscillograph records, and had discovered considerable speed variation within the very short period of short-circuit.

Mr. W. CRAMP (Manchester University) said that if an E.M.F. were applied suddenly to an inductive circuit of constant permeability, the maximum current that could flow was about twice the normal. In the case of a generator, however, the great initial current rush was due to the varying permeability accounted for by eddy-currents and the moving poles. In order to decrease this rush, he would suggest making the permeability more constant by using a cylindrical rotor, lower saturation, and a smaller flux per pole. Further, the higher the frequency, the higher, according to theory, should be the initial rush. In practice, however, it was thought to be smaller.

Prof. E. W. MARCHANT (Liverpool University) first referred to some experiments on a 2,000-kw. turbo-alternator at Liverpool. From the self-induction of the armature winding, he had estimated the instantaneous short-circuit current to be approximately fifteen times the full-load current, which agreed fairly closely with Mr. Walker's figures. Mr. Walker had mentioned that it took about a second for the exciting current to fall from its normal value to the lowest value due to the effect of armature reaction. This reminded him of an experiment made by the late Dr. Hopkinson on an 11-in diameter core with ballistic coils embedded in the iron. The coil in the centre was not affected until 20 seconds after energising the external exciting coil.

Mr. G. W. WORRALL (Liverpool University) pointed out that the experiments consisted in short-circuits following open-circuit. He thought that short-circuiting a loaded generator would give different results, as the rate of rise of the short-circuit current would be influenced by the rate of change of the load current at the instant of short-circuit. Secondly, the phase relation between the load current and the position of the poles would also have an effect. He had seen sheets of mica sewn up in canvas bags, used for the purpose of clamping down the windings.

Mr. G. D. SEATON (Willans & Robinson, Ltd.) complained that turbo-generators still suffered from three defects, namely, going out of balance, not running concentrically, and short-circuit troubles.

Dr. E. ROSENBERG (British Westinghouse Co.) said that turbo-generators suffered less on short-circuit than reciprocating engine machines, on account of the comparatively small diameter, stiff yoke, and large air-gap. In any case, the damage was limited to the windings and couplings. The damage done on short-circuit was sometimes due to a generation of high voltage in the winding at the moment of high current. In the case of a shunt-wound D.C. machine, the exciting current was maintained several seconds when the armature was short-circuited, as the field resisted the demagnetising effect of the armature. There might even be an increase in field current, although there was no voltage impressed from outside. Further, a high voltage was induced between points on the commutator, and there was little doubt that the arc round the commutator on bad short-circuits was started mainly in this way.

Mr. A. H. EVEREST (British Thomson-Houston Co.) pointed out that the decrease in armature inductance due to saturation on short-circuit would increase the short-circuit current to above that calculated. Referring to surges in the rotor, he described the case of a salient pole machine with field windings of edge-wound copper strip, which flashed across one coil when the machine was accidently thrown upon a short-circuited feeder. It was important that the reactance of machines should be fairly large to reduce the short-circuit current rush, and to improve the regulation, a Tirrell regulator might be used.

EFFECTS OF DIFFERENCES IN A.C. WAVE-FORM.

AN interesting Paper by Mr. L. W. Wild, of the Westminster Electrical Testing Laboratories, on the production, measurement, and effect of variable wave form has been accepted by the Institution of Electrical Engineers for publication in the *Journal* as an original communication. The author first describes the method he adopted for obtaining a series of wave forms with widely different characteristics from a single alternator by combining three waves from three different windings in various proportions. The methods of determining the amplitude and mean ordinate factors of the various wave-forms are then described. The amplitude factor is obtained by dividing the maximum ordinate of the wave by the R.M.S. voltage, and the former was determined with the aid of a rotating contact maker, and an electrostatic voltmeter shunted by condensers; the condensers were charged once in every revolution, and the voltmeter registered the voltage at the instant at which contact was broken. To obtain the mean ordinate of the wave-form, a direct-current moving-coil voltmeter was used in series with a rectifying commutator, so that the voltmeter registered the mean ordinate of the half wave. The R.M.S. value was taken simultaneously with an electrostatic voltmeter, the ratio of the two giving the mean ordinate factor.

The relative effects of the different waves on transformer iron losses was first investigated, and the author concludes that the statement that the loss is less for a peaked than for a flat-topped wave is not always true. The loss depends not upon the amplitude factor, but upon the mean ordinate factor to which it is directly proportional. Thus for "Stalloy" transformer stampings, worked at a nominal maximum density of 10,000 lines per sq. cm. at a frequency of 50 cycles, the total loss was 0·682 watts per lb. for a mean ordinate factor of 0·87, increasing proportionately to 0·745 watts per lb. for a mean ordinate factor of 0·915. The total loss per lb. for Sankey "armature" iron increased from 1·215 watts to 1·312 watts within the same limits of mean ordinate factor. The values seemed to be quite unaffected by the amplitude factors. Tests were made at different frequencies, and the curves connecting the total loss per lb. per cycle with the frequency were pure straight line curves even up to 100 cycles, showing that the loss per cycle can be divided into two parts, a constant one, the hysteresis loss, dependent upon wave form, and a loss proportional to the frequency, the eddy-current loss, which is independent of the wave-form. These experiments also showed that Lohys iron has a smaller hysteresis loss than armature iron, but a greater eddy-current loss; below 60 cycles, Lohys iron has the lesser loss, above 60 cycles, armature iron. The low eddy-current loss claimed for

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Stalloy is confirmed, and it is shown to have a lower hysteresis loss also. The percentage of eddy-current loss varies from 9 per cent. for Stalloy at 25 cycles, up to 50 per cent. for Lohys at 100 cycles. The hysteresis loss was increased by about 10 per cent. in the case of all three kinds of iron by increasing the mean ordinate factor from 0·872 (a peaked wave) to 0·914 (a flat-topped wave), a difference of 4·8 per cent. The percentage difference in the total loss effected by this change in the mean ordinate factor is reduced as the frequency is increased, owing to the predominance of eddy-current losses. At 100 cycles, armature iron is affected only 5·9 per cent., Lohys 5 per cent., and Stalloy 7·2 per cent. Concluding this section, the author states that differences of the order of 7 per cent. are likely to be found by different authorities in the total losses if due attention is not paid to wave-form.

Turning to the effect of wave-form on dielectric strength, Mr. Wild points out that the breakdown of an insulating material is not always directly related to the maximum value of the E.M.F. wave. If the insulation resistance is low, there may be a sufficient leakage current passing to heat up the material to a serious extent, and this leakage would depend more upon the R.M.S. voltage. The presence of dielectric hysteresis and capacity also complicates matters. Experiments made by the author showed that for air the breakdown depends entirely upon the maximum value, the results also confirming the dielectric strengths given by Mr. E. A. Watson in his recent Papers. The results of experiments on transformer oils were most erratic, but it seemed that high viscosity is generally accompanied by high dielectric strength. Wilcox light dynamo oil appeared to depend upon the maximum value of the wave for its breakdown, resin oil upon the R.M.S. value, and Duckham transformer oil upon something half-way between the two. In order to test whether leakage had any effect upon the results, a sensitive wattmeter was inserted in circuit, but no deflection was observed up to the point of breakdown, and consequently it does not appear that the breakdown was accelerated by local heating in any case. Further, it was found that the resin oil had the highest, and the Wilcox the lowest insulation resistance, which is exactly in the reverse order to that required to account for the results.

Finally, the effect of wave-form on the readings of six modern induction-motor meters was tried. These were B.T.H., Aron, Westinghouse, Ferranti, Siemens, and Alva meters, and were all rated at 10 amp. 110 volts, 50 cycles. The effect was found to be so small as to be of little or no consequence. The percentage effect on changing over from a peaked to a flat-topped wave was in some cases an acceleration and in others a retardation, but never greater than 0·8 per cent. for unity power factor, and generally only about 0·3 per cent. No explanation is offered, but the effect is thought to have something to do with the iron losses.

Manchester Municipal School of Technology.—The award of the James Prescott Joule Commemorative Silver Medal (presented by Sir W. H. Bailey) will be made in September next by the Manchester Education Committee. The medal (in silver) will be awarded for the best essay dealing with physical science or engineering, preference being given to subjects concerned with the transformation of energy. The competition is confined, for the present year, to past and present students of the Manchester Municipal School of Technology whose ages are not less than sixteen years nor more than twenty-six years. Essays should be sent in to the principal not later than July 1st.

Fire at a Paris Generating Station.—The statements in some of our contemporaries last week to the effect that a generating station belonging to the French Thomson-Houston Co. at Port à l'Anglais, near Vitry, had been damaged by fire to the extent of some £32,000, were not quite correct, in that the station in question is not the property of the French Thomson-Houston Co. (although they were the main contractors for its equipment), but belongs to the Cie. Générale de Distribution d'Energie Electrique. We are in a position to state that the cause of the fire was in no way electrical. The fire caused an interruption of the tramway service on the Eastern & Bastille and Montparnasse lines.

Prices of Metal Filament Lamps in Germany.—We have already announced the reductions in prices by Julius Pintsch, and by Siemens & Halske, following the original reductions by the Allgemeine Elektricitäts-Gesellschaft. The Deutsche Gasglühlicht Aktien-Gesellschaft (Auergesellschaft) have now reduced the German list prices of Osram lamps as follows:—The 16, 25, 32, and 50-c.p. 90–139-volt lamps are now 2s. each, and the 50-c.p. 170–260-volt lamps are 3s. each. The Bergmann Elektricitäts-Werke have made similar alterations in their list prices; the 25, 32, and 50-c.p. 100–130-volt lamps are reduced to 2s., and the 50-c.p. 200–250-volt lamp to 3s. For the other sizes the prices are as before. It will be noticed that the Osram is the only 16-c.p. 90–139-volt lamp at 2s. In this country reductions have been made by the Electrical Co., Ltd., and by Simplex Conduits, Ltd., as already notified in our columns.

OSRAM STREET LAMPS AT CROYDON

A LARGE proportion of the main and side streets in and around Croydon are now being lighted by means of Osram lamps. High candle power lanterns have been fixed on all the tramway routes apart from the main road, in most cases on alternate trolley poles, but in some instances on small arc poles. The average distance apart is 65 yards, and the height of the reflector 20 ft. 3 ins. Each lantern is provided with three 110-watt Osram lamps, in spring suspended lamp-holders. Rather less than half of the lamps are extinguished at midnight.

For the side street lighting lamp posts are placed at an average distance of 75 yards apart, and a single 88-watt Osram lamp is fixed with a conical vitreous enamelled reflector at 12 ft. from the ground.

Mr. A. C. Cramb, the Borough Electrical Engineer, reports that the average life of these lamps since their installation has been highly satisfactory.

Tramway Assessment in London.—The Islington Borough Council, supported by a number of other Metropolitan Borough Councils, has asked the London County Council to convene a conference to discuss the basis upon which the tramways in London should be rated.

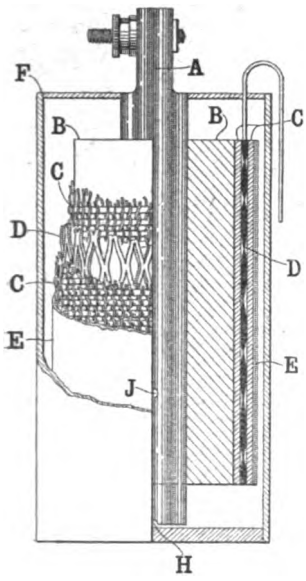
Tantalum Lamps on Board Ship.—The electric lighting of many of the large floating palaces which are being constructed for passenger traffic is as complete as that of many hotels and restaurants on land, and Messrs. Siemens Brothers Dynamo Works, Ltd., have recently carried out a striking example of marine electrical illumination which, as regards the saloon of the steamer, resembles in every way that of the dining-room of a first-class hotel. Everything is, of course, rigidly fixed, so that there may be no disorder caused by the "roll" of the ship. In this instance "tantalum" lamps are installed for illumination in small fittings fixed to the ceiling at equal distances apart. For ventilation several electric fans are installed, and the best possible lighting effect is obtained, whilst the temperature can be regulated exactly as required. The tantalum lamp, by reason of the strength of its wire-drawn filament, is particularly suited to ship lighting, and Messrs. Siemens Brothers have designed numerous fittings for this class of work, of which they will be glad to send particulars to all who apply.

Photometry.—Tuesday's meeting of the Illuminating Engineering Society at the Royal Society of Arts, London, was devoted to the subject of lamp photometry. Dr. S. P. Thompson, who was in the chair, opened the discussion with a brief lecture on photometers, illustrated with experiments, and concluding with a lucid exposition of the "flicker" method for the comparison of lights of different colours. Prof. Vernon Harcourt, to whom the pentane standard is due, described some experiments made many years ago at South Foreland for the purpose of comparing gas, oil, and electric lamps in lighthouses. The difficulties due to the differences in colour were then overcome by the use of a star disc and a white background illuminated alternately by the two sources to be compared. Prof. J. A. Fleming (University College) emphasised the disadvantages of flame standards, and suggested that the National Physical Laboratory should set up a molten-platinum standard, as proposed by Violle, but heated by an electric induction furnace. He mentioned that artificially aged incandescent filament lamps prepared for secondary standards fifteen years ago had never shown any variation over 0·5 per cent. Mr. A. P. Trotter said that he had had occasion to inspect the photometer rooms in colleges and manufacturers' works, and he had been amazed at the antiquated apparatus used in the former. Further, every text-book described the Bunsen grease-spot inaccurately. He showed a series of models made by himself for educational purposes to illustrate the various photometers. Mr. J. Patterson (National Physical Laboratory) said, in reply to Dr. Fleming, that it was possible to reproduce the pentane standard with an accuracy of ±0·1 per cent., and it could be used commercially. The colour of the platinum standard was redder than the pentane and the Hefner units, and this would rule it out. At the N.P.L., to lessen the colour difficulty in testing metal filament lamps, they had made comparisons in steps by first testing 4-watt against 3½-watt carbon lamps, then 3½-watt with 3-watt, then 3-watt carbon lamps with 2½-watt metal filament lamps, and so on up to metal filament lamps taking 1½ watts per c.p. Dr. Sumpner (Birmingham Municipal Technical School) thought that the candle-power of filament lamps was best expressed as the candle-power at right angles to the filament. Prof. Morris (East London Technical College) said that he had obtained as good results from a carefully prepared Bunsen grease-spot screen as from the most modern apparatus.

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IMPROVED DRY CELL

MR. J. T. SZEK has called our attention to the results which have been obtained with a new form of zinc-carbon dry cell, covered by British patents Nos. 8,660/07 and 18,082/07.



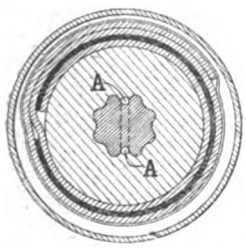


FIG. 1.—ELEVATION AND SECTIONS OF "SZEK" DRY CELL.

The carbon electrode is corrugated and a depolarising mass of manganese peroxide, graphite, and other substances is pressed round it. As shown in Fig. 1, two vertical air passages, *A*, are left between the carbon and the depolariser, *B*, and these are connected together by a hole in the carbon at *J*, and at the bottom by a horizontal passage, *H*. The object of these is to enable the air to reach the depolariser and revive its activity. The electrolyte consists of a paste of sal-ammoniac and flaked rice. This is spread over a loose-woven fabric, *C*, which is then wound round the depolariser, and on both sides by a sheet of expanded zinc, *D*, which is bent round in the form of a cylinder. We are informed that zinc of exceptional purity is employed, so that no amalgamation is necessary. Finally, the whole is covered with treated paper, *E*, and inserted in a *papier-mâché* case, *F*.

Fig. 2 illustrates tests made by the Electrical Standardising and Testing Institution, Faraday House, on two Szek dry cells weighing 4 lbs. each. Curve I. represents the results for a new cell, and Curve II. for a cell which had been stored for fourteen months previous to the discharge. The cells were discharged continuously through a resistance of 10 ohms, and the terminal volts read every day. Other life curves which we have seen show equally good results.

Fig. 3 shows an interesting curve plotted from the results of

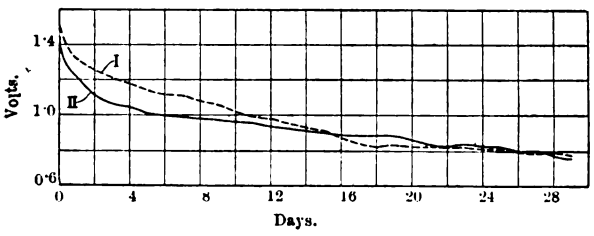
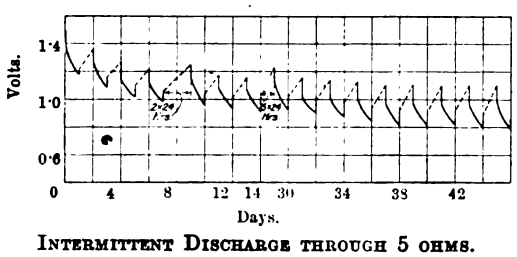


FIG. 2.—CONTINUOUS DISCHARGE THROUGH 10 OHMS.
(I. New Cell. II. Cell stored fourteen months previous to discharge.)

an intermittent discharge test on a 4-lb. Szek cell. The cell was discharged for 24 hours continuously through 5 ohms, then



INTERMITTENT DISCHARGE THROUGH 5 OHMS.
(Twenty-four hours continuous discharge after twenty-four hours' rest.)

allowed 24 hours' rest, then run again for 24 hours, and so on. The cell was made in December, 1908, and the test started May 30th, 1909.

Cells of this type can be obtained in small quantities from Mr. J. Szek (53/54 Chancery Lane, London, W.C.), who is already preparing to manufacture them on a larger scale.

WILLANS' IMPULSE D.C. TRACTION TURBO-GENERATORS

PARTICULAR interest is attached to the decision of the Belfast Corporation, as announced in our last issue, to extend their tramway generating plant by the addition of a 1,500-kw. Willans' Impulse "Disc and Drum" type turbine, coupled to a direct-current dynamo, in view of the strong opposition to the adoption of direct-current turbines when the previous contracts were settled during February, 1907. On that occasion two 1,000-kw. units were required, and the feeling expressed in many quarters at that time was in the direction that direct-current turbo-dynamos were not sufficiently reliable for tramway purposes. After the matter had twice been referred back from the Council to the Tramway and Electric Lighting Committee, it was finally decided to place an order with Messrs. Willans & Robinson for the supply of the two 1,000-kw. direct-current sets. These units have now been in daily operation for two years, and the performance of the dynamos (which were considered the doubtful factor) compares favourably with the best results obtainable with dynamos running at more moderate speeds.

In the light of this experience, Mr. Bloxam, the Belfast City Electrical Engineer has recommended his Council to install a further unit of 1,500-kw. capacity, and as it is intended to obtain this output from one dynamo (and not by installing tandem dynamos, as has previously been the case when dealing with this output) the present unit will be the largest single direct-current turbine set installed in this country, the largest sets at present being the two 1,200-kw. units which Messrs. Willans & Robinson, Ltd., have in hand for the Admiralty for the Devonport Dockyard.

LIGHTNING CONDUCTORS

A NEW series of rules for the erection of lightning conductors has been drawn up by the Phœnix Fire Office, and embody the results of consultations between Mr. S. G. Castle Russell (Electrical Adviser to the Phœnix Assurance Co., Ltd.), with Sir Oliver Lodge and Mr. Killingworth Hedges (Hon. Sec. to the Lightning Research Committee, 1901-1905).

The rules are prefaced by a short discussion of the general principles of lightning protection, distinguishing between the "A" flash (as defined by the Lightning Research Committee), which strikes pointed conductors in preference to others, and the "B" discharge of much greater suddenness, against which complete security can only be attained by a "birdcage" system of conductors. For an ordinary building, however, a sufficient approach to ideal conditions can be arrived at of taking advantage of the extent of metalwork outside it, and adding a few other conductors. It is also pointed out that a building with trees adjacent to it, or dominated by a steeple or other lofty building, must not be considered as immune.

The material of conductors is required to be either copper tape at least 1 in. by ¼ in., or stranded copper or galvanised or sherardised iron rope of equivalent area. Copper is recommended as less subject to deterioration, but it is admitted that iron is electrically more efficient, as it carries off the discharge with less disruptive effect. Conductors should be kept away from the wall to avoid accumulation of dirt, and sharp bends and joints should be avoided. It is recommended that conductors should be protected at earth level by galvanised iron tubing or casing carried 5 ft. above the surface, and that those running underground to the earth plate should be embedded in a wooden trough filled in solid with bitumen. Vertical conductors should be connected to all elevated and exposed masses of metal, but church clocks may be protected by a screen of outside conductors.

Elevation rods of copper or galvanised iron should be fixed at least 2 ft. above that portion of the building to which they are attached, or in the case of chimney stacks the rod must be at least 1 ft. above the highest chimney, and should be provided with three or more points.

The number of conductors and area of protection depends on the size of the building and the comparative heights of its structural parts. There is no special area below an elevation rod which can be considered as actually protected; so that "area of protection" really cannot be defined, and no definite rule can be laid down as to the number of rods necessary to protect a building. The consideration of the extent of protection afforded must bear some relation to the value and importance of the building concerned. It should be the practice to provide at least two or more rods on any building. It should be noted that any chimney stack is liable to be struck; each, therefore, should have its own elevation rod connected to the nearest conductor leading to earth. Special attention should be paid to kitchen chimneys, as a column of hot air will often be selected as a path for the flash.

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Full instructions are given as to the preparation of each connections, either by means of a copper plate buried in damp earth, by the tubular earth system, or by connection to the water mains. If a copper plate is used, it should not be of less than 3 sq. ft. in area, and not less than ¼ in. thick, and rectangular in shape, with saw edges, and surrounded with broken coke or graphite. The use of copper plate is not recommended unless it can be sunk into the earth at such a depth as to ensure it always being in water or in moist earth.

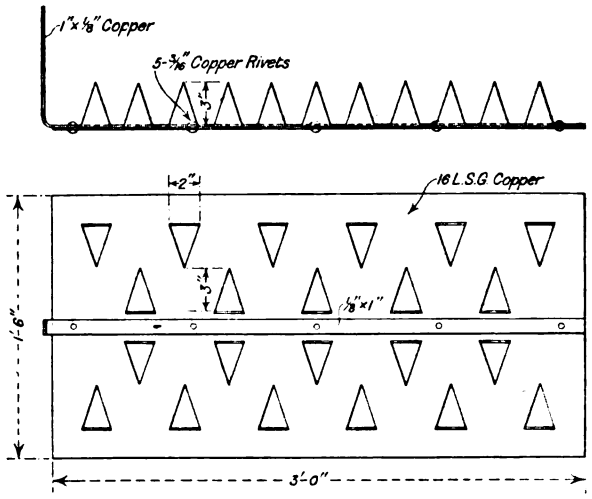
The tubular earth system is as follows: A perforated pipe furnished with a steel spike is driven into the ground until it reaches moisture, and is then lengthened up to the surface to a casting which marks the position of the earth. The copper conductor is enclosed in the pipe, and carried to the bottom of the tube which is packed with granulated carbon. A connection is made by means of an iron or lead pipe to the nearest rain-water pipe, so that a small quantity of rain is diverted to insure moisture, or a similar pipe may be opened up into a funnel shape at the surface of the ground, so that rain will enter, or water can be poured down. The earth resistance of each of the earth connections should not exceed 5 ohms. For the purpose of testing, a special disconnection joint should be made in the conductor near the ground level, so that the earth can be tested separately from the system of the conductors on the building by disconnecting the joint. A test and examination should be made annually.

Some special notes are given as to the requirements of churches and factory chimneys. In the case of the latter, the elevation rod should take the form of a circular band of metal round the top of the shaft, preferably below the actual outlet, and furnished with long spikes. The points should be fixed at an angle of about 45°, pointing outwards; or an arch of metal, provided with points, may be fixed across the mouth of the chimney.

It is recommended that after a church or other uninhabited building has been struck by a flash, or whenever there has been a flash in the near neighbourhood, an examination should be made to see that no ignition of gas has occurred, owing to the puncture of a compo pipe by a residual spark causing and igniting an accidental leak.

A new specification for earth plates has been issued by the London County Council. The new plate, which is a double plate with a branching tape, is shown in the accompanying figure. It possesses the characteristics of that recently proposed by Sir Oliver Lodge in connection with the Elan Valley works protection from lightning scheme. The new specification reads as follows:—

"The earth plate to be of copper No. 16 gauge; the conductor to be riveted and soldered the full length of the plate; the joints to be thoroughly washed free of acid, and protected by a thick coat of tar; each plate



LONDON COUNTY COUNCIL EARTH PLATE.

to have four rows of triangular tongues formed out of the plate itself—two outer rows of six and two inner rows of five—so that the tips of tongues in adjacent rows point in opposite directions, each tongue 3 inches long, and tapering from 2 inches to a point; the tongues to be bent at right angles, and point upwards when the earth plates are laid in position."

LOCAL NOTES

ACCRINGTON: *Hire Purchase Wiring.*—It was announced at the Council meeting last week that the practice of wiring premises on the hire purchase system was not working satisfactorily. The Chairman of the Electricity Committee suggested its discontinuance and the substitution of a deferred payment system. Under this, 10 per cent. of the cost of installation will be charged each quarter.

ARGENTINE: *Tramways.*—The first section of electric tramways in Bahia Blanca has just been opened.

BURSLEM: *Mixed-pressure Turbine.*—The new 600-kw. mixed-pressure turbine, which has been installed at the Council's electricity works, was formally started up last week. Exhaust steam from the three reciprocating sets is made use of as far as possible, the deficiency being made up with live steam direct from the main steam range. The turbine was constructed by Messrs. Belliss & Morcom, and the generator by Messrs. Siemens Bros. & Co. An additional B. & W. boiler, with an evaporative capacity of 10,000 lbs. of steam per hour, has also been installed.

DUNDEE: *Electricity Works Assessment.*—Mr. H. Richardson, the City Electrical Engineer, has raised the question of the assessment of the electricity undertaking. Mr. Richardson complains that whereas the Gas Department receives 75 per cent. reduction on their mains, the Electricity Department in a a few cases only were allowed a reduction of 25 per cent. Bearing in mind that the underground work of the electricity undertaking now amounted to a cost of nearly £100,000, it is pointed out what a serious matter this is. The Convener of the Electricity Committee states that the only thing to be done is to instruct the Town Clerk to insert a clause in the next Provisional Order promoted by the Council to deal with the question.

Contract System of Charging.—Mr. Richardson has reported that an experiment in charging for the lighting of tenements at a fixed price per lamp according to the rental has not proved satisfactory, and he recommends its discontinuance.

New Loans.—Negotiations are being carried on between the officials of the Scottish Office and the Electricity Committee concerning an application for additional borrowing powers in connection with the electricity departments.

Underground Telegraph Wires.—A deputation from the Dundee and Aberdeen Corporations waited upon the Postmaster-General on Monday to urge the extension of the underground telegraph system to the North of Scotland. Whilst admitting the strong claims which Dundee and Aberdeen have for the extension required, the Postmaster-General said that so far as this year was concerned, the Post Office had been unable to include any provision in the Estimates for this purpose.

FROME: *Proposed Transfer of Electricity Works.*—It is proposed to transfer the Electricity Works from the Council to Messrs. Edmundson's Electricity Corporation, Ltd., who at present run the works on behalf of the Council. Last year the undertaking involved a loss of £2,000.

HARROW: *Fire at Electricity Co.'s Works.*—A fire occurred on Sunday morning at the works of the Harrow Electric Light & Power Co. Fortunately, it was confined to the offices and showrooms, which are separated from the generating plant, and thus the supply of electricity was not interfered with. The whole of the offices and showrooms, with the exception of the Board room, were destroyed.

HORNSEY: *Electric Lighting Profits.*—Although the electricity undertaking last year made a profit, the accumulated loss on past years, which has been met out of rates, amounts to £7,189. A long discussion took place at the last meeting of the Council upon a proposal to transfer £1,000 to the relief of rates in part liquidation of the sum outstanding. The present accumulated balance is only £1,075, and this was used as an argument against making any contribution to the rates at present, as, obviously practically the whole of the working capital would be absorbed. Eventually the Electricity Committee were authorised to transfer a sum not exceeding £1,000 to rates.

LINTHWAITE: *Tramway Track Repair.*—Under the agreement with the Huddersfield Corporation, who run cars in this district, the Council have to maintain the track, and under a recent arbitration they were ordered to relay the track by the end of May. It is now stated that the cost of this will be about £11,000, and, deducting the rent received from the Huddersfield Corporation, there will be a sum of £1,500 per annum for twelve years to raise for sinking fund, interest, and repairs. It is estimated that this will amount to an extra rate of 1s. in the £. Five years ago the Huddersfield Corporation offered to take over the track for a payment of £5,000, but this offer was refused.

NEWPORT (Mon.): *Electricity Works.*—Mr. C. P. Sparks's report on the working of the Corporation electricity under-

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taking has been passed and adopted by the Council. He made twenty recommendations, the gist of which was briefly given in our last issue, and they have all been adopted except that an amendment has been made on an unimportant point with regard to discounts on accounts.

NEW ZEALAND: *New Power-house.*—Mr. A. Wyllie, the Auckland City Electrical Engineer, has presented a report in which he recommends the erection of a new power station at an estimated cost of £215,000.

REDRUTH: *Defective Lighting.*—Owing to the unsatisfactory nature of the public electric lighting, the Town Council have decided to enforce the penalty clause in their agreement with the Urban Electric Supply Co.

TURKEY: *Electric Lighting and Traction.*—It is stated that the Turkish Minister of Public Works has drawn up a general memorandum relating to electric lighting and traction, and with a view to granting concessions for electric tramways and electric lighting and power plants, a circular has been sent to the principal towns in Turkey requesting the local authorities to state their views on the matter.

WIGAN: *Proposed Purchase of Tramways.*—A proposal has been placed before the Corporation to purchase the Corporation's tramway system. The Lancashire United Tramways Co. were interested in the proposal, and Mr. J. R. Salter, the General Manager of the company, made the offer under instructions from the Hon. R. Stanley, who is Chairman of the Lancashire Co. The local papers state, however, that at a private meeting of the Corporation the offer was refused.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ABERDARE.—Tenders are invited for a complete power house, including two direct-current generating sets (200-kw. and 100-kw.), balancer, booster, switchboard, 500-ampere hour-cables, &c. Particulars from Mr. Stephen Sellon, 36 Victoria Street, London, and tenders to the Clerk by April 9th.

GLASGOW.—Tenders are invited for the supply of cables, meters, and arc-lamp carbons for the year to May 31st, 1911. Particulars from the City Electrical Engineer, and tenders to the Town Clerk by March 29th.

HEREFORD.—The Electricity Committee have been authorised to spend £1,000 on cable extensions.

WALSALL.—In order to meet the demands upon the electricity undertaking during the coming winter an application is to be made to the Local Government Board for sanction to borrow £8,345.

WARRINGTON.—A 1000 kw. turbo-alternator, a 750 kw. rotary converter and switchgear are required by the Corporation. Particulars from the Borough Electrical Engineer, and tenders by March 22nd.

WIGAN.—A Local Government Board inquiry was held last week to inquire into an application by the Corporation for sanction to borrow £36,000. The money is required for extensions at the Wigan power house, and alterations at Pemberton.

WOLVERHAMPTON.—The Electricity Committee require a 2,000-kw. turbo-alternator, and a 500-kw. mixed pressure alternator. (See an advertisement on another page.)

Miscellaneous

BELGIUM.—The Ghent Municipal Authorities invite tenders by April 2nd for three electric cranes. Particulars from Monsieur le Maire, l'Hôtel de Ville, Ghent.

DUNFERMLINE.—The Dunfermline & District Tramway Co. propose to proceed this summer with the extension of their tramways from Kelty to Lochore, and to Rumblingwell from the present terminus in Dunfermline.

EDINBURGH.—Tenders are invited for the supply of bitumen, arc-lamp globes, conduits, &c., for the Electricity Department for one year. Particulars from the City Electrical Engineer, and tenders to the Town Clerk by March 28th.

GLASGOW.—Tenders are invited by the Tramways Department for 20,000 85-volt 16 c.p. carbon filament traction lamps. Particulars from the General Manager, and tenders to the Town Clerk by March 22nd.

GRIMSBY.—The Electricity Committee require 300 cast-iron lamp posts, 285 swan necks and fittings, and 300 double pole fuse boxes. Particulars from the Borough Electrical Engineer, and tenders by March 21st.

SOUTHAMPTON.—Electric light is to be substituted for gas in the whole of the schools at an estimated cost for wiring of £804. The Works Committee has passed a scheme for the conversion of 596 additional gas lamps to electric light.

The Corporation invite tenders for the construction of tramways. (See an advertisement on another page.)

YARMOUTH.—The Sub-Committee which have gone into the question of street electric lighting recommend that the whole of the gas lamps be converted into 80 c.p. electric lamps, and they estimate that the total saving by the conversion will be £295 per annum. The work will take two years to carry out.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

W.—Rebuildings, 19 Berkeley Street, Piccadilly, W. (£18,500). Architects, Richardson & Gill, 46 Great Russell Street, W.C.

N.W.—Electric theatre, Cricklewood Broadway, N.W. Builder, A. Bretzfelder, 180 Cricklewood Broadway, N.W.

PROVINCES.

AYR.—House, Dunure Road (£5,000). Architect, J. K. Hunter, Ayr.

CARLISLE.—Theatre. Sidney Bacon, architect, Carlisle.

CHELMSFORD.—School (£13,000). Builders, H. Potter & Son, Chelmsford.

EDINBURGH.—School (£20,000). Architect, A. D. Robinson, School Board Offices, Edinburgh.

EXETER.—Additions and alterations, St. Luke's College (£5,200). Architect, J. Jerman, 1 Bedford Circus, Exeter.

EXMOUTH.—Additions to hospital (£2,000). Architect, E. E. Ellis, Imperial Road, Exmouth.

HALIFAX.—Arcade and shops (£4,000). Architect, C. Williams, Halifax.

ILFORD.—Church and school, Kildowan Road. Architects, Smee & Houchin, Byron House, Fleet Street, E.C.

KETTERING.—School. Education Sec., County Hall, Northampton.

PORTSMOUTH.—Two blocks, hospital. G. E. Smith, 145 Victoria Road, Southsea.

ROCHDALE.—Extensions, Town Hall (£17,000). Architect, P. W. Hathaway.

ROTHERHAM.—Smallpox hospital, Kimberworth (£5,000). Borough Engineer, Rotherham Town Council.

SALFORD.—Tenders are invited for the wiring of the Wellington Street Boys' School, Pendleton. Particulars from the Borough Electrical Engineer, and tenders to the Town Clerk by March 31st.

YARMOUTH.—New pier pavilion for the Britannia Pier Co., Ltd.

WEST HAM.—Enlargement of Fyfield Industrial and Truant School. F. E. Hilleary, Sec. West Ham Education Committee.

TENDERS RECEIVED AND ACCEPTED

BUCKINGHAM PALACE.—A further order has, we understand, been placed with the General Electric Co., Ltd., for the supply of 100 and 210-volt 32-c.p., half-obscured Osram Lamps for use in Buckingham Palace to the order of his Majesty's Office of Works.

CARLISLE.—The tenders of the British Insulated & Helsby Cables, Ltd., for cables at £1,128, and of the Albion Clay Co., Ltd., for ducts at £428 have been accepted.

EDINBURGH.—The Tramways Committee recommend the acceptance of a tender by Messrs. Dick, Kerr & Co., Ltd., at £12,265, for the construction of an electric tramway connecting the present cable tramways with the new markets at Gorgie. The line is to be completed by May 14th.

GENERAL POST OFFICE.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a large contract from the G.P.O. for tantalum lamps for all voltages from 25 to 250 volts.

An order has also been placed with the General Electric Co., Ltd., for the supply of filament lamps of 16, 25, 32, 50, 100, 200, 300, and 400 c.p. for the ensuing six months. It may be mentioned that the General Electric Co. has held this contract for the past year.

INDIA.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained another very large contract for street lighting fittings for a municipality in an Indian State.

LONDON: *London County Council.*—The Highways Committee recommend the acceptance of the tender of Messrs. Hurst, Nelson & Co., Ltd., for 79 sets of window operating gear for bogie cars at £7 12s. 6d. per set, and 11 sets for single truck cars at £6 per set.

The tender of the Edison & Swan United Electric Light Co. for the supply of insulating materials to December 31st, 1910, is recommended for acceptance.

Hammersmith.—The Council received the following tenders for six 100 kw., one 200 kw., and one 250 kw. transformers:—Johnson & Phillips, £553 15s.; Lahmeyer Electrical Co., £819 2s.; General Electric Co., £892; British Westinghouse Co., £892; Spagnoletti, Ltd., £907; British Electric Transformer Co. (accepted), £919; British Thomson-Houston Co.,

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£942; General Electric Co., £942 10s.; Siemens Bros. (100 kw. transformers only), £898 5s.; Ferranti, Ltd. (100 kw. transformer only), £439. The Committee, in reporting on the matter, said it was most important to have regard not only to the prices, but also to the comparative circuit losses, regulation, and weight. On these tests the most favourable tenders received were those of the General Electric Co., the British Westinghouse Co. (who quote for the same machine), and the British Electric Transformer Co. The Engineer reported that in his opinion the higher price quoted by the last-mentioned company was more than counterbalanced by the reduction in circuit losses, and the better regulation obtained.

For a 30-h.p. motor the tender of the Electric Construction Co., at £60, was accepted. For annual supplies the following tenders were accepted:—City Glass Co., arc lamp globes and lamp shades, £22 17s. 9d.; Liverpool Electric Cable Co., insulated wire (for cables only), £104 0s. 10d.; General Electric. Co., items other than cable, £18 16s. 1d.; Pryke & Palmer, packing and jointing materials, £4 9s. 6d.; Lucy & Co., Ltd., joint boxes, disconnecting boxes, &c., £374; British Thomson-Houston Company, meters.

Marylebone.—The Council have accepted the tenders of Messrs. Aubert, Grenier & Co., and the Standard Cable Manufacturing Co., Ltd., for the supply of cable, and of Messrs. Lucy & Co., Consolidated Electric Works & Appliances, Ltd., Callender's Cable & Construction Co., Ltd., Messrs. Sykes & Sugden, Ltd., and the British Insulated & Helsby Cables, Ltd., for cut-outs, house service boxes, and fittings and disconnecting boxes.

PLYMOUTH.—The Council have accepted the following tenders for annual supplies for the electricity undertaking:—British Insulated and Helsby Cables, Ltd., cables, £93 8s. 5d.; Crompton & Co., Ltd., Conradty carbons, £3 16s. 6d. per 1,000 ft.; Ferranti, Ltd., house meters, average price, £1 12s. 4d.; British Electric Transformer Co., transformers, average per kw., £1 14s. 5½d.; Adams British Oil Co., cylinder oil, 1lb., 1s.; C. & C. Wakefield, grease, No. 3, 2½d. The tender has also been accepted of Walter Scott, Ltd., for 100 tons of tram rails, joint and anchor, plates, at £8 per ton, and fish plates, £10 per ton.

ROSARIO.—It is stated that the municipality have sent an order to Germany for 300 arc lamps for street lighting.

SOUTHEND.—The Corporation have placed an order with the Brush Electrical Engineering Co., Ltd., for six single truck tramcars at £504 5s. each. The cars are guaranteed for three years.

SOUTH AMERICA.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a very large contract for street lighting fittings of special design for a district in South America.

SOUTH MANCHURIA RAILWAY CO.—Mr. N. Yoshino, Chief Mechanical Engineer to the South Manchuria Railway Co., who is now in England, has placed an order with the British Vacuum Cleaner Co., Ltd., for a large vacuum cleaning equipment driven by an 8-h.p. electric motor.

STALYBRIDGE.—The Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board have placed a repeat order with Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton, for four stokers and compressed-air furnaces (Lancashire boilers), for their generating station, Tame Valley.

As is now generally known, Messrs. Willans & Robinson, Ltd., of Rugby, have recently placed on the market a turbine of the plain impulse type, and also a turbine of the impulse "disc and drum" type; these two types of turbine, in conjunction with their well-known Willans-Parsons turbine, being intended to meet the varying requirements with which turbine manufacturers are daily confronted. Orders for turbines of the plain impulse type are at present under construction for the Ashton-under-Lyne Corporation, Messrs. Charles Moore & Co., and others; whilst turbines of the impulse "disc and drum" type are in hand for the Belfast Corporation, Calcutta Electric Supply Corporation, Bridlington Corporation, and others.

Wireless Telegraphy.—It is stated in a daily contemporary that Mr. G. Marconi has invented an apparatus called the telephonotypographe, the object of which is that a wireless telephone message may be written at the receiving station without the aid of an operator.

A Reuter telegram from Berlin states that as the result of five weeks' experiment on the Tegel flying ground, the feasibility of the use of wireless telegraphy on all three types of airship employed in the German army, viz., the Zeppelin, the Gross, and the Parseval, has been successfully demonstrated.

Mr. Marconi is at present at Glace Bay, superintending the installation of the new Transatlantic wireless station, and it is expected to be in working order shortly.

The Bill introduced in the Canadian Parliament requiring wireless apparatus to be installed on all vessels of 400 tons and over, was rejected in Committee, on the ground that it was premature.

It is stated that H.M.S. *Dreadnought* is being fitted with a new wireless telegraph equipment, which will enable communication to be carried on between Whitehall, Portsmouth, and Malta.

APPOINTMENTS AND PERSONAL NOTES

Mr. F. M. Denton has been appointed to the post, rendered vacant by the resignation of Dr. C. V. Drysdale, of Associate-Head of the Electrical Engineering and Applied Physics Department of the Northampton Polytechnic Institute, London, E.C. Mr. Denton received his technical training at the Central Technical College, London, obtaining the diploma in 1901. On leaving the College, he spent a year and a half in the works of Messrs. Elliott Bros., London, and subsequently was for two and a half years at the Oerlikon Works in Switzerland, where he was engaged in design and other work. From the Oerlikon Works Mr. Denton was brought back to the Central Technical College to a position on the staff of the Electrical Engineering Department, which he occupied for one year, and at the expiration of this engagement he went to the United States to join the staff of the General Electric Co. at Pittsfield, Mass., and at Schenectady. After occupying these positions for one year, he was two and a half years ago appointed lecturer in electrical engineering at the new Carnegie Technical Schools at Pittsburg, a position which he still occupies, and is resigning to take up his London appointment.

Mr. H. Richardson, the Dundee City Electrical Engineer, has been presented with a silver match box, which was subscribed for by his staff, to mark the occasion of the opening of the Carolina Port power station.

Councillor A. Arbuthnot Murray has resigned his membership of the Edinburgh Town Council. Mr. Murray was convener of the Electric Lighting Committee for three years.

MISCELLANEOUS CITY NOTES

COMPANIES STRUCK OFF REGISTER.—The names of the following companies have been struck off the register of Joint Stock Companies:—Electric Laundry Co., Electric Royalties Co., Hampstead Electric Supply Co., Midland Electrical & General Engineering Co., Pioneer Electric Light & Power Co. of China, and S.M. Van Hinden Electrical Co.

VICTORIA FALLS & TRANSVAAL POWER CO.—A Reuter telegram from Berlin states that 5 per cent. debentures amounting to £900,000 have been issued by the leading Berlin banks at 101.

DIVIDENDS ANNOUNCED.—Sao Paulo Tramway, Light & Power Co., quarterly dividend of 2½ per cent. Winnipeg Electric Railway Co., 2½ per cent. for the March quarter. Scarborough Electric Light Co., 3 per cent. for 1909. Richmond (Surrey) Electric Light & Power Co., 6 per cent. for 1909.

Canadian General Electric Co., 1¾ per cent. for March quarter. Davis & Timmins, 8 per cent. for 1909.

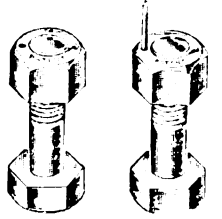
MORTGAGES AND CHARGES.—Particulars have been filed of the following:—Electric Vehicle Co., £2,000 debentures of an issue of £20,000 debentures created in November, 1909; no trustees. "Electrician" Printing and Publishing Co., £1,000 debenture, charged on the company's undertaking and property, including uncalled capital; holders—Messrs. Coutts & Co. Western Telegraph Co., supplemental trust deed, dated January, 1910; to secure £239,650 four per cent. debenture stock; trustees—Right Hon. Viscount Midleton and Sir John Wolfe Barry.

NEW YORK TELEPHONE CO.—An issue is being made in London of £2,500,000 4½ per cent. bonds at 97½

VERA CRUZ ELECTRIC LIGHT, POWER & TRACTION CO.—This company are offering £250,000 5 per cent. first mortgage debentures at 91½.

NEW AUTOMATIC LOCK NUT

A MOST ingenious lock nut is being introduced by the Automatic Lock Nut Co., Ltd. (Carlton House, High Street, Birmingham). It is entirely automatic in its action, and locks in all positions when on the bolt. The accompanying illustrations show a nut in position and one being removed. The nut has a few of the threads removed at the top, and to replace these a steel wire is coiled around in the interior, the grooves between the turns coinciding with the thread of the bolt. One end of the wire is fixed outside the nut at the top as shown, and the other end is free. It will be readily seen that when screwing on the nut, the steel wire helix is pushed round from the fixed end and is kept loose on the bolt, but that directly any attempt is made to screw the nut in the reverse direction, the helix is pulled round from the fixed end, and grips the bolt. Any vibration tending to unscrew the nut also effects a tightening of the helix, so that it should be useful on A.-C. apparatus. To unlock the nut, all that is necessary is to push an ordinary nail, cotter-pin, or piece of wire, down the small hole on top of the nut, and the latter will screw off. The nail or pin fixes the free end of the helix, and makes it move round when the nut is unscrewed, thus preventing it from tightening on the bolt. The nut is quite self-contained, and the locking arrangement cannot injure the thread of either nut or bolt.



Automatic Lock Nut.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire-bars, net c.i.f. port of arrival, quoted on Tuesday night, was £61 10s. to £62 per ton (last week, £62 5s. to £62 15s.).

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—W. S. Jenkinson, electrical engineer, Rodborough Street, Stroud, Glos., has been adjudicated bankrupt.

A meeting of the Geneva Tramways Co. will be held at Salisbury House, London Wall, London, E.C., on March 30th, at 3 p.m., to hear the liquidator's account of the winding-up.

A meeting of the Adams-Randall Telephone Patents Co., Ltd., will be held at 194 Dashwood House, London, E.C., on Tuesday, March 22nd, at 3 p.m., to receive the liquidator's account of the winding up.

Allan McAlpin, trading as MacAlpin & Co., electrical engineers, 44 Cank Street, Leicester, and Cumbergate, Peterborough, has been adjudicated bankrupt.

The Electric Ignition Co. is to be wound up voluntarily.

Mr. B. P. Alnatt, chartered accountant, 2 Forbury, Reading, has been appointed trustee in the bankruptcy of Messrs. Felgate & Storey, electrical engineers, 10 Queen Victoria Street, Reading.

A supplemental dividend of 1s. 11¾d. in the £1 will be paid at the Official Receiver's Office, 13 Winckley Street, Preston, on March 18th, in the bankruptcy of R. Foster and W. Baker, trading as the Nelson Electrical Engineering Co., Stott Street, Nelson.

HIGH-TENSION INSULATORS.—The Locke Insulator Manufacturing Co., of Victor, N.Y., have purchased the plant and business of the Lima Insulator Co. In future the insulators turned out by these two works will be sold under the name of "Victor." Messrs. Wm. Geipel & Co., of 72a, St. Thomas Street, London, S.E., continue to act as European agents.

A NEW METAL FILAMENT LAMP.—Messrs. Siemens Brothers Dynamo Works Lamp Department at Dalston, inform us that they are about to place upon the market a range of high- and low-voltage high candle-power metal filament lamps of an efficiency of approximately 1 watt per c.p. 100 c.p. lamps will very shortly be on sale, and we learn that lamps of 200, 300, 400, and 600 c.p. are to be expected at a somewhat later date. We understand that full details will be forthcoming in the course of a week or two, as regards price, size, &c. Their new lamp is to be styled the "Onewatt" Lamp.

CANADIAN AGENCIES WANTED.—A London firm manufacturing a new patent porcelain insulator for telegraph, telephone, light and power purposes wish to enter the Canadian market.

A firm in the English Midlands wish to appoint Canadian agents for the sale of lightning conductors.

A commercial traveller with Colonial experience is desirous of representing in British Columbia some United Kingdom electrical and engineering firms.

Particulars of the above may be obtained at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W.

NEW WORKS.—Messrs. D. H. Bonnella & Son, Ltd., 58 and 60 Mortimer Street, London, W., inform us that owing to increase of business their works will be removed on and after March 25th, to larger and more convenient premises situated at Newton Works, Whitfield Place, Tottenham Court Road, W.

PEEBLES' STAFF BALL.—The staff of Messrs. Bruce Peebles & Co., Ltd., held their annual ball at the North British Station Hotel, Edinburgh, on Friday evening last. Amongst those present were several of the directors, as well as branch managers, outside representatives, and agents of the company. About 150 ladies and gentlemen were present, and a most enjoyable evening was spent.

COMPANIES' MEETINGS AND REPORTS

BUENOS AYRES TRAMWAYS (1904).—The available balance for 1909 was £65,842, and a dividend of 5 per cent. for the year is recommended. A large portion of the company's income is the annuity from the Anglo-Argentine Tramway Co., as a result of the amalgamation of tramway companies in Buenos Ayres.

WASTE HEAT & GAS ELECTRICAL GENERATING STATIONS.—The net profit for 1909, after providing £4,000 for depreciation, was £12,523. A dividend of 7 per cent. is recommended, carrying forward £3,603.

ELECTRICAL DISTRIBUTION OF YORKSHIRE.—There was a net profit for 1909 of £184, which is carried forward. During the year the company acquired the Sowerby Bridge Electric Lighting Order from the Council.

ASCOT DISTRICT GAS & ELECTRICITY CO.—There was a profit of £374 on electricity account for 1909.

NORTHAMPTON ELECTRIC LIGHT & POWER CO.—There was a net profit of £4,701 13s. for 1909. After meeting the full dividend on the 5 per cent. preference shares and 5½ per cent. on the ordinary shares, a balance of £1,053 is carried forward. A change-over was made during the year from non-condensing to partial-condensing, and a considerable reduction of working costs has been effected.

ABERDEEN SUBURBAN TRAMWAYS CO.—The report for 1909 recommends that the net profit of £1,270 be carried forward. Reference is made to the dispute with the Aberdeen Corporation regarding the price to be paid for electricity for working the trams. The present position is that the Corporation have offered 1·75d. per unit with a minimum supply of 140,000 units, and this offer is now under consideration by the Board. The company took exception to the award of Mr. W. H. Patchell, who sat as arbitrator to settle the price, and ordered them to pay a standing charge of £900 per annum, irrespective of the quantity of electricity used. Counsel's opinion is that the award is illegal, having regard to the terms of the reference. An agreement, however, has now been arrived at.

OXFORD ELECTRIC CO.—There is a net profit of £11,952 for 1909, and a dividend of 7 per cent. per annum is recommended on the ordinary shares. Notwithstanding the increased use of metal filament lamps, the revenue exceeded that of the previous year.

TELEGRAPH CONSTRUCTION & MAINTENANCE CO.—The net profit for 1909 was £85,768. The sum brought forward was £104,111. A dividend of 17½ per cent. for the year is declared, carrying forward £111,444.

BOURNEMOUTH & POOLE ELECTRICITY SUPPLY CO.—The report for 1909 recommends a dividend at the rate of 6 per cent. per annum on the ordinary shares, carrying forward £1,076. The sum of £4,000 has been transferred to depreciation, repairs, and renewals.

HASTINGS & DISTRICT ELECTRIC TRAMWAYS CO.—The report for 1909 shows a net profit of £8,642. The directors consider that in previous years an insufficient sum has been set aside for depreciation, and they recommend that £8,000 should be transferred to depreciation account, and the balance of £642 carried forward. At the meeting on Tuesday, the high cost of fuel was referred to. A cheap quality of coal is now being used in conjunction with mechanical stokers. The expenditure per car mile was reduced from 6·11d. to 5·53d.

O. C. HAWKES.—There was a net profit of £4,720 for 1909. After meeting the 5 per cent. preference dividends, a balance of £470 remains, which is to be carried forward.

BRITISH INSULATED & HELSBY CABLES.—After transferring £8,500 to special reserve, and £5,000 to debenture stock redemption, a final dividend at the rate of 10 per cent. for 1909 is recommended, carrying forward £42,263.

MADRAS ELECTRIC TRAMWAYS (1904).—The directors recommend placing £3,000 to depreciation and renewal fund, and the payment of a dividend at the rate of 5¼ per cent. for the year. The sum of £663 is carried forward.

COUNTY OF DURHAM ELECTRICAL POWER DISTRIBUTION CO.—After meeting the 5 per cent. preference dividends, and transferring £6,000 to depreciation and reserve, a sum of £2,620 is carried forward. The connections during the year increased by 5,688 h.p., the total now being 35,024 h.p.

NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO.—The net profit for 1909 was £81,298, and a 4 per cent. dividend is recommended on the ordinary shares, transferring to depreciation £16,500, and carrying forward £2,923. The new power station at Dunston-on-Tyne will be in operation before the end of the current year. The total connections amount to 129,219 h.p., which is an increase of 17,735 h.p. during the year.

WINCHESTER ELECTRIC LIGHT & POWER CO.—The directors recommend a dividend at the rate of 6 per cent. per annum for 1909, transferring £1,000 to depreciation, and £1,200 to reserve. The Winchester Corporation have given 12 months' notice of their intention to purchase the company's undertaking.

CHELSEA ELECTRICITY SUPPLY CO.—At the annual meeting last week, Sir I. Courtenay, the chairman, expressed the opinion that when the disturbance caused by the introduction of metal filament lamps has settled down, he saw no reason why the company should not increase their earnings sufficiently to pay increased dividends.

MELTON MOWBRAY ELECTRIC LIGHTING CO.—At the meeting last week, the small falling off in gross revenue was attributed to the fact that the company lost the street lighting contract from August last. But although there was a decrease of £29 on the gross revenue account, the net revenue account increased by £126. Mr. W. J. New, who presided, said that the moral to which this pointed was there is very little to be got out of street lighting.

BROMPTON & KENSINGTON ELECTRICITY SUPPLY CO.—There was a net balance of £37,103 for 1909, and the directors recommend placing £3,604 to depreciation, £6,000 to reserve, and the payment of a dividend of 10 per cent. for the year. The sum of £8,521 is carried forward.

COUNTY OF LONDON ELECTRIC SUPPLY CO.—At the meeting on Monday, Mr. J. B. Braithwaite, the chairman of the company, said that the total generating costs of the company, including repairs, were 0·706d. per unit. In spite of metal filament lamps, their units sold last year increased by 8·3 per cent., but he warned the shareholders not to expect larger dividends in spite of the sales going up and the expenses going down. The Board did not set aside to depreciation as much as they would like, and the first improvement in profits must go to this fund.

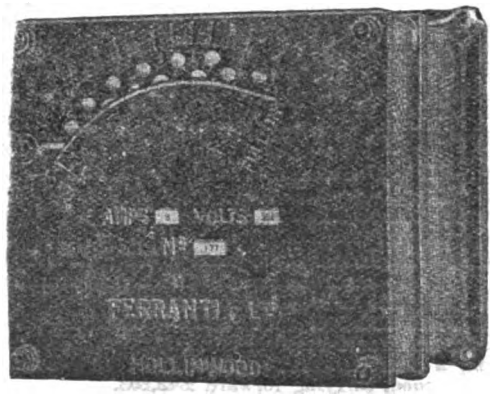
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BRITISH SOUTH AFRICA CO.—The report for 1909 states that the Victoria Falls and Transvaal Power Co. has now completed its first two new power stations on the Witwatersrand. These have ben in commission for several months and are giving excellent results, working at a higher efficiency than was originally calculated. The construction of a third large station of 100,000 h.p. has been commenced and the supply from this station will begin in October next. The Company will then have about 130,000 h.p. of plant available for service. The following mining groups have contracted to take their electrical supplies from the Company:—Consolidated Gold Fields, Eckstein, Rand Mines, Albu, Barnato, Consolidated Mines Selection and Neumann. Minimum contracts for twelve years have been entered into with the different mines, and the latest reports indicate that the installation of electrical power on the Rand will prove a most successful undertaking.

MANSFIELD & DISTRICT TRAMWAYS.—After transferring £1,200 to reserve, the directors recommend a dividend of 2½ per cent. on the ordinary shares for 1909. The extension of the tramways to Crown Farm Colliery is to be put in hand during the current year.

COMPANIES STRUCK OFF REGISTER.—The names of the following companies have been struck off the register of Joint Stock Companies: Adelaide Electric Tramways; Automatic Electric Co.; Bettwsycoed Electric Lighting Co.; Burmah Electric Works Syndicate; Cleminson Electric Lamp Attachment; Diamond Electric Lamp; Electrical & Hardware Co.; Electrical Bleaching Co. (1904); Electromotion Corporation; Manchester & Liverpool Electric Railway Syndicate; Perth Electric Lighting Co.; River Po Electric & Power Syndicate; Tavistock & District Electric Supply Co.; Wynne's Electric Closed Tube Tramways.

NEW COMPANIES

HOLSWORTHY GAS & ELECTRIC SUPPLY CO.—8 Fore Street, Holsworthy, Devon. Capital, £10,000. To acquire Holsworthy Gas Co., and the electric supply business of W. H. Barkell, of Holsworthy.

W. P. THEERMAN & CO.—263 Oxford Road, Manchester. Capital, £5,000. To acquire business of W. P. Theerman, electrical engineer and contractor. Subscribers: W. P. Theerman and J. S. Roylance, electrical engineers.

BRITISH ELECTROMETALLURGICAL PRODUCTS CO., 25 Victoria Street, London. Capital £100,000. To adopt an agreement with the Electrometallurgical Syndicate, Ltd., &c. Subscribers: W. L. Madgen, Falcon Works, Loughborough; J. J. Steinitz, Falcon Works, Loughborough; C. J. Head, W. D. Rock, J. R. Easton, R. O. Ahliss, and W. G. Jarrett.

WEST NAPLES TRAMWAYS & VALPORTORE RAILWAY CO., 57 Gracechurch Stret, London. Capital £50,000. To acquire a concession granted to A. Capuano for the construction of electric tramways between Naples, Soccavo, Pianura, and certain other places.

FLUORUNDUM FLAME CARBONS.—Registered by Jordan & Sons, Ltd., 116 Chancery Lane, London. Capital £5,000. To acquire from T. M. Lewis and H. S. Hatfield licenses to manufacture and use certain inventions relating to enclosed arc lamps and electrodes.

J. B. MARR & CO.—53 Victoria Street, London. Capital, £1,000. Electrical Engineers, &c.

BRITISH SCHOOL OF TELEGRAPHY, 179 Clapham Road, London.—Capital, £1,500. To carry on schools for training persons in wireless telegraphy, telephony, &c.

ELECTRACITES, 37A Duke Street, St. James's, London. Capital, £10,500. Manufacturers of and dealers in electrical and other machinery.

APPLEBY CRANE & TRANSPORTER CO., 57 Victoria Street, London. Capital, £150,000 in 100,000 preferred ordinary and 50,000 ordinary shares. To acquire the business of Messrs. Appleby's, Ltd. (in liquidation), and to carry on the business of dealers in electric cranes, &c.

SLAG POWER, 638 Salisbury House, London Wall, London. Capital, £20,000. Generators of power by electricity or otherwise.

PERCIVAL BROS., 11 Snargate Street, Dover. Capital, £1,000. To take over the business of electrical, mechanical, and illuminating engineers, now carried on by R. G. Walker and H. S. Roberts.

SOUTH BRAZILIAN RAILWAYS CO.—Registered by Gilbert Samuel & Co., 5 and 6 Great Tower Street, London. Capital, £150,000 in £4 shares. To acquire a tramway concession known as the "Empresa Ferro Carril Curytibana," Curytiba, Parana, Brazil.

VACA FALLS CO.—Registered by S. D. Perks, 36 New Broad Street, London, E.C. Capital, £35,000. To construct railways, tramways, electric light, telephony, telegraphic, and similar undertakings.

CECIL HODGES & CO.—Registered by W. T. Hick, 2 Church Court, Clements Lane, London, E.C. Capital, £1,000. To carry on the business of electricians, engineers, suppliers of electricity, &c.

R. J. RODD.—Registered by Foss, Bilbrough, 5 Fenchurch Street, London, E.C. Capital, £1,000. Electrical and mechanical engineers.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."]

DRILLING MACHINES.—An illustrated leaflet describing a new pattern of standard and table for use in conjunction with the standard types of electric hand drilling machines manufactured by the Oerlikon Co. has been issued by Mr. G. Wuthrich (Oswaldestre House, Norfolk Street, London). This is supplementary to the general drilling machine list of the firm.

ELECTRIC DRIVING OF WEAVING MACHINERY.—An illustrated booklet from the Allgemeine Elektricitäts Gesellschaft (agents in this country: The A.E.-G. Electrical Co., Ltd., 121 Charing Cross Road, London, W.C.) describes the individual drive of looms, and gives a list of over 140 weaving establishments of different kinds employing in all some 16,000 motors. The illustrations show a number of examples of looms driven by small three-phase squirrel-cage motors on spring supports with either belt or gear drive. In many cases a clutch of some kind is employed so that the motor may run continuously.

LIGHTNING ARRESTERS.—Another illustrated booklet from the same firm contains a detailed description of the construction and operation of aluminium cell lightning arresters and excess pressure dischargers. Their use in conjunction with the ordinary horn dischargers for protecting various kinds of systems is described, and instructions as to their maintenance are included.

ELECTRIC LOCOMOTIVES.—Two leaflets received from the above firm comprise lists of the full- and narrow-gauge electric locomotives supplied to various railways and works, with illustrations in each case of some of the more important designs. These include shunting, works and mines locomotives, with trolley and accumulator supply.

ELECTRIC POWER IN AGRICULTURE.—Three further leaflets from the A.E.G. give illustrated descriptions of various examples of electric driving in agricultural operations. These include threshing machines, grain cleaning machinery, chaff cutters, oil-cake breakers, &c. Portable motors, complete with starters and leather covered cables, on wood sleighs or carriers, are illustrated. The motors are totally enclosed for protection against dust and rain.

AUTO-TRANSFORMERS.—The Foster Arc Lamp & Engineering Co. have issued a revised list embodying their latest designs of small auto-transformers for metal filament lamps. We are informed that considerable improvements have been made in the apparatus, and the no-load losses have been considerably reduced, while at the same time the regulation and efficiencies have been improved. The standard sizes range from 5 to 100 amperes on the secondary at 25, 50, and 100 volts, and all ordinary supply voltages and frequencies can be met. Standard sizes can be despatched within two days. The company's automatic transformer switch, which works entirely without batteries, is described, as well as the small transformer for bell ringing from alternating supply circuits.

New Generating Station in Copenhagen.—According to *Engineering*, a new generating station ultimately aggregating 180,000 h.p. is to be constructed at the Kallebadstrand watercourse. The initial equipment is to be three 7,500 h.p. turbo-generators. As the site will not be available till 1911, extensions to the existing stations are to be made in the meantime. Our proposal as to taking power from the Trollhättan water power station in Sweden has also been under consideration, but no arrangement has been arrived at.

Railway Electrification in France.—The Midi Railway Co. in France have placed an order with the Société Anonyme Westinghouse, Havre, for the electrical equipment on the single-phase system of the Montrejean-Pau section, about 70 miles, and contemplate the conversion of about 200 miles of line. According to *Engineering*, 30 motor-coaches each with from 125 h.p. motors and one 1,200 h.p. 80-ton locomotive have been ordered. The line pressure is to be 12,000 volts, and a frequency of 15 cycles per second will be employed.

District Railway Rolling Stock.—Some further details are given in the *Railway Gazette* of the new rolling stock which is on order for the Metropolitan District Railway. With the exception of the interior mouldings, which will be of fireproofed mahogany, they will be constructed entirely of steel, and they will thus differ from the present cars, the bodies of which are mainly of non-inflammable timber. The exterior will be quite smooth, no rivets showing. The seating capacity will be the same as in the present trailers, but slightly more room will be given, and there will be no divisions between the seats, which will be a little wider and tilted towards the back. Middle doors will be retained, but glazed screens on each side of them will protect passengers from draught. The bogie-trucks will be of more substantial design, and will have a longer wheel-base, but the electrical equipment will be the same, and the Sprague-Thomson-Houston control equipment will again be employed.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published March 10th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

843/09. **Line Insulator.** G. H. BOWDEN, F. C. ANDERSON, C. A. ATCHLEY, and G. BULL. A porcelain insulator is provided with a semi-circular peripheral groove to receive the cable. Bolts pass through the insulator above and below the groove, and hold the cable by means of grooved clamps. The latter may be provided with terminals for making connections to kicking coils, &c. Two claims, one figure.

3,195/09. **Lamp-shade Retainer.** W. CROOKELL. A device for fixing shades or reflectors to lamp-holders comprises a spiral spring, the lowest and innermost coil of which is provided with embayments to permit it to pass over lugs on the lamp socket. Two claims, two figures.

3,906/09. **Train Lighting.** SIEMENS BROS. DYNAMO WORKS, LTD., F. G. BROADHEAD, and S. HAWKINS. When the direction of travel is reversed, the brushes of the dynamo are shifted 180° by means of friction discs controlled by a governor on the armature spindle. A quick-acting switch worked by this device operates a solenoid multiple switch controlling the dynamo field and armature circuits. A change-over switch for use in a two-battery system is also described. Six claims, eight figures.

3,917/09. **Cable Armouring.** E. WITZENMANN. A flexible metallic tubular armouring consists of a metal band of [illegible] section wound helically so that the edges of adjacent coils interlock. The band is wound on tightly so that the insulation is forced up into the section in the form of a screw thread, thus preventing longitudinal movement of the armouring. One claim, three figures.

4,374/09. **Commutating Poles.** W. BUCHANAN. In order to obtain a uniform commutating field in machines with commutating poles, a number of open or closed slots are made in the latter. These contain a winding which neutralises the M.M.F. of the armature. Two claims, five figures.

5,360/09. **Cast-iron Permanent Magnets.** F. BURKS. This patent covers the process referred to on page 170 of our last issue. The magnet is cast in porous grey iron and is heated to a temperature of 2,000° F., and then immersed in a bath consisting of salt, cyanide of potassium, nitric acid, and prussiate of potash dissolved in water. The cyanide hardens the iron, which is then ready for magnetising. Two claims.

7,029/09. **Cooking Appliances.** N. HOSGOOD. Cooking utensils of earthenware, china, &c., have a heating element consisting of a resistance wire embedded in the vessel during manufacture. To prevent fracture due to expansion of the wire, a soft asbestos cord, which yields when the wire expands, is wound in with the wire. Alternately, the wire may be made hot and allowed to cool while the clay is plastic, thus producing a wide channel in the clay. Five claims, four figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: GEB. SIEMENS & Co. [Electrodes] 21,374/09; CHRISTOPH and KLEIN, 22,768/09.

Distributing Systems: THOMAS [Power transmission] 1,582/09.

Dynamos, Motors, and Transformers: STANSFIELD and HATT [Voltage regulation of variable-speed generators] 4,181/09; SIEMENS BROS. DYNAMO WORKS, LTD., and KLOSS [Starting induction motors] 6,956/09; GRAFTON and JOHNSON & PHILLIPS, LTD. [A.-C. generators] 13,059/09; PRÖTT [Motor] 15,317/09; MILTON [A.-C. generator] 27,033/09; FRIED. KRUPP A.-G. [Regulating D.-C. generators] 27,245/09.

Electric Ignition: VANDERVELL, 534/09; TWIGG, 5,955/09; R. BOSCH, 25,236/09, and 30,049/09.

Electrochemistry: JOHNSON (*Badische Anilin & Soda Fabrik*) [Manufacture of nitrates] 10,867/09.

Incandescent Lamps: MESZAROS, FAWNS, and MCCRACKEN [Metal filament lamps] 22,273/09.

Instruments and Meters: THORPE [Electrolytic meters] 4,258/09; MCCLELLAND and FERRANTI, LTD. [Maximum demand indicator] 5,459/09; JOHNSON [Electrical torsion-meter] 13,010/09.

Storage Batteries: TAYLOR [Charging arrangements] 24,643/08.

Switchgear, Fuses, and Fittings: BROOK and HIRST [Automatic switches for motor-starters] 4,093/09; THORPE [Electrolytic device] 4,258/09; LACEY [Safety device for controllers] 5,223/09; W. T. HENLEY'S TELEGRAPH WORKS Co. and NICHOLS [Fuse carriers] 12,744/09; JENKINS [Hand-lamps] 20,882/09; MYGATT [Glass shades] 21,995/09; SIEMENS BROS'. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*) [Fuse fittings] 25,733/09.

Telephony and Telegraphy: CEREBOTANI [Telegraph type-printing machines] 1,551/09; BURSTYN [Telephone diaphragms] 4,329/09; NIKIFOROFF [Relay for weak A.-C. currents] 4,480/09; SIEMENS & HALSKE A.-G. [Telephone exchanges] 28,825/09, and [Connections of telephone apparatus] 999/10.

Traction: SCHOFIELD, EDWARDS, and TICKELL [Signalling] 4,600/09; ECCLES and HADFIELD [Trolley retrievers] 11,326/09.

Miscellaneous: ROSENBERG [Medical vibrator] 4,133/09; BLUEMEL and SHILL [Dispatch tubes] 16,004/09; WALDEN [Escapement] 24,632/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: SIEMENS-SCHUCKERTWERKE GES. [Polyphase commutator machines] 1,611/10.

Incandescent Lamps: WESTINGHOUSE METALLFADEN GLÜHLAMPENFABRIK GES., 2,983/10 and 3,610/10.

Miscellaneous: STACHOW [Magnetic separators] 3,314/10; LUX [Electrical control of valves] 3,697/10.

Applications for Revocation

19,483/05. **Electric Lifts.** E. M. T. BODDAM. Application has been made under Section 27 of the Patents Act for the revocation of this patent on the ground of inadequate manufacture in this country. The specification describes an electro-hydraulic lift system in which the lifting cylinder is connected by a pipe to the main cylinder, the latter containing a piston operated by an electrically-driven screwed shaft. The valves connecting the two cylinders are controlled by a handrope or electromagnetically. An automatic controller for the motor is described, and this is mechanically connected with the spindle of the controlling valve.

9,289/08. **Meter.** H. ARON. (Application under Section 26.) The patent is for a 2-rate or multiple-rate meter, the counting mechanisms of which operate separate maximum demand indicators.

Applications for Amendment

19,520/03. **Control of A.-C. Motors.** C. F. SCOTT. The British Westinghouse Electric & Manufacturing Co., Ltd., wish to amend this specification to limit its scope.

5,055/08 and 15,105/09. **Aluminium Solder.** A. NIELSEN. The patentee wishes to correct some clerical errors.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

6,053 of March 18th, 1896. **Primer.** THE MORRIS TUBE AMMUNITION & SAFETY RANGE Co., LTD., C. CUTHBERTSON, and W. H. STENTIFORD. A primer for firing guns, consists of an insulated pin fixed in a cup containing the explosive. A platinum wire connecting the pin with the edge of the cup is brought to a red heat, when the striker touches the pin.

6,329 of March 21st, 1896. **Train-lighting.** E. J. PRESTON and A. B. GILL. Details in a system with slipping-belt, dynamo, and automatic switches.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: BRITISH THOMSON-HOUSTON Co. (*O. N. Wiswell, U.S.A.*) [Cover for globe of enclosed lamps] 23,288/99.

Distribution Systems, &c.: E. T. GREENFIELD [Armouring cables] 24,655/98 and 23,998/05; E. W. SERRELL [Transmission-line poles] 20,995/00; BRITISH THOMSON-HOUSTON Co. (*C. P. Steinmetz, U.S.A.*) [Conductors insulated with cellulose] 21,293/00; G. CONGER [Line poles] 23,990/01.

Dynamos, &c.: T. VON ZWEIGBERGK [Single-phase commutator motors] 25,386/04.

Electrometallurgy, &c.: H. G. TURNER [Furnace linings] 26,065/02.

Incandescent Lamps: L. KAMM [Nernst projector lamp] 25,708/04.

Storage Batteries: T. PESCATORE and TUDOR ACCUMULATOR Co. [Plates] 21,233/00.

Switchgear, &c.: O. RENNERT [Switches and indicators] 25,671/02, and 25,748/02; W. BAXTER [Electromagnets] 22,365/03; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Rheostats] 25,849/03.

Telephony and Telegraphy: E. T. GREENFIELD [Armouring of submarine cables] 24,655/97; E. W. SERRELL [Metal poles] 20,995/00; G. CONGER [Metal posts] 23,990/01; J. A. FLEMING and MARCONI'S WIRELESS TELEGRAPH Co. [Transmitting key] 25,382/03; S. G. BROWN [Cables with twisted iron and copper conductors] 25,669/03.

Traction: E. A. CAROLAN (*General Electric Co., U.S.A.*) [Automatically stopping trains] 26,036/02; E. H. JOHNSON [Automatic brakes for cars with regenerative control] 25,362/03; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Air brakes] 25,856/03; BRITISH THOMSON-HOUSTON Co., H. S. MEYER and B. HOPPS [Electric power transmission system for road vehicles] 25,636/04; M. B. MOUNTAIN, G. M. GIBSON, and A. F. HEAD [Spring suspension of motors] 24,058/05.

Miscellaneous: H. J. DOWSING [Light bath] 23,536/01; H. SUTCLIFFE [Cable drum] 23,773/01.

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ELECTRICAL ENGINEERING

No. 169 [Vol. VI., No. 12] THURSDAY, MARCH 24, 1910. [Price One Penny.
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United Kingdom. 6s. 6d. per Annum.

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

A committee of the House of Lords will commence consideration of a number of London tube railway Bills on Thursday, April 7th. The second reading debate on the London Electric Supply Bill was adjourned in the House of Commons on Tuesday. (Page 196.)

In Mr. W. P. Durtnall's electrical method of ship propulsion, two alternators are run at constant speed, and are connected in cascade in such a way that the frequency of the current they supply to an induction motor driving the propeller can be varied. A clear description of the system is given in connection with a Paper read by Mr. Durtnall at the Institution of Naval Architects last Thursday. In the discussion which followed, the Hon. C. A. Parsons expressed doubt as to whether the system would be conducive to economy. (Page 197.)

A new pattern of condenser in which the air pump is dispensed with, and the air extracted by the circulating water on the ejector principle, has been introduced. (Page 198.)

In compliance with a correspondent's request, we explain the terms "standard cable equivalent" and "attenuation constant" occurring in an article on the new Anglo-French cable last week. (Page 198.)

The electrical equipment of Smith's Docks, North Shields, present an interesting example of the advantages of power taken from a large system. A continuous current supply is obtained from the Tynemouth Corporation station, where a bulk 3-phase supply from the Newcastle-upon-Tyne Electric Supply Company is converted, and a three-phase supply is also available. The whole of the hydraulic and compressed air installations are now worked electrically, and electric pumping is extensively used. (Page 199.)

The discussion of Mr. Miles Walker's two Papers on short-circuit effects with turbo-alternators and the relative merits of salient-pole and cylindrical rotors was resumed in London on Thursday last. Mr. A. H. Law described some short-circuit tests on a Parsons set in the Carville power station, Newcastle. The staying of the end connections was discussed by Dr. Kahn, who also stated that the sudden short-circuit current of an asynchronous machine was only about six times the full load current. Mr. J. H. Rider described a short-circuit which resulted in the sixteen one-inch bolts of a coupling being sheared through. Mr. G. G. Stoney said that a short-circuit at full pressure was not really a severe enough test, as the shock was greater when a machine was paralleled dead out of phase. A method of reducing the shock due to bad paralleling was described by Mr. G. W. Partridge. Mr. J. T. Irwin pointed out that the author, in his calculations, had neglected the forces due to the reaction of the coils against the stray flux from the field, which would be very much increased on short-circuit. (Page 201.)

Mr. R. Orsettich has read a Paper before the Birmingham and Glasgow Local Sections of the Institution of Electrical Engineers, on standardisation of elec-

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trical machinery, in which he outlined the influence of various commercial, mechanical and electrical considerations on the selection of types and design of a series of standard continuous and alternating current machines. (Page 203.)

A NEW form of speed reducing gear was described in a Paper read recently by Mr. P. P. Sandford before the Dublin Local Section of the Institution of Electrical Engineers. (Page 205.)

THE report of the past year's work at the National Physical Laboratory contains many items of interest. Tests have been made to determine the losses in insulating material under alternating dielectric stress. Difficulty is being experienced in setting up tungsten lamp sub-standards for high efficiencies owing to the fluctuations in the light emitted. (Page 205.)

IN a paper read before the Yorkshire section of the Institution of Electrical Engineers, Mr. W. B. Woodhouse discussed the design of overhead lines, and gave a series of working curves and data, with illustrations of road-crossings, &c., used by the Yorkshire Electric Power Co. (Page 206.)

MR. J. S. PECK, of the British Westinghouse Co., has been elected Chairman of the Manchester Section of the Institution of Electrical Engineers. (Page 207.)

THE Chesterfield Corporation have decided against the use of top-covered tramcars.—A proposal by the Merthyr Electric Traction & Lighting Co. to erect overhead wires for the supply of electricity in Dowlais is objected to, and a Board of Trade inquiry has been held.—The Liverpool Tramway accounts for 1909 show a net profit of £82,354.—A decision by the Conciliation Board in relation to the L.C.C. tramway employees involves an additional expenditure of £12,000 per annum.—It is stated that the proposed resolution of the West Hartlepool Corporation to purchase the undertaking of the Hartlepools Electric Tramways Co., is *ultra vires*. (Page 208.)

A 500-KW. convertor is to be installed at Bristol, and a 750-kw. single-phase generating set at Bedford.—A £20,000 electric supply scheme is contemplated at Dundalk, and extensions are proposed as follows:—Falkirk, £12,000; Poplar, £1,766; Woolwich, £4,529; Norwich, £17,783.—The Auckland City Council have approved of the scheme for a new electricity works at the cost of £215,000.—Huddersfield Corporation require 1,000 meters; flame arc lamp carbons are wanted at Hackney; and stores at Wallasey, Colwyn Bay, and Bolton. (Page 209.)

THE Scarborough Electric Supply Co. are giving a trial to the Norwich system of charging.—At the meeting of the Brompton & Kensington Electric Supply Co. last week it was stated that the rates and taxes of the company now amount to nearly 25 per cent. of the dividends paid. (Page 210.)

AMONG the specifications published by the Patent Office on Thursday last was one by T. McClelland and Ferranti, Ltd., for a maximum demand attachment to meters comprising a pointer moved round by the action of a series solenoid on an iron core.—A method of obtaining a high starting torque from large induction motors without the use of resistances by combining two machines is described by Dr. M. Kloss, of Siemens Bros. Dynamo Works.—W. H. Nichols, of W. T. Henley's Telegraph Works Co., covers a fuse carrier, comprising a fibre body with peripheral apertures for the escape of the flame and hot gases and baffles to prevent these reaching the contacts.—A core mixture for flame arc lamp carbons is patented by Gebr. Siemens & Co.—A patent by S. Marietti for fixing metal filaments into tubular supports has been granted in spite of opposition, but that by the Glühlampenwerk Anker-Ges. for fixing filaments by depositing a metal covering on their ends has been refused.—Among the expiring patents is one by A. Graham for a telephone instrument with a rotary Hunnings transmitter, and another by J. Hawkyard and J. Braddock for a prepayment meter mechanism. (Page 212.)

PARLIAMENTARY INTELLIGENCE

IT is announced that a Select Committee of the House of Lords will sit on Thursday, April 7th, to consider the London Electric Railways (Amalgamation), the Baker Street & Waterloo Railway, the Charing Cross, Euston & Hampsted Railway, Metropolitan District Railway, and Metropolitan Railway Bills.

The second reading of the London United Tramways Bill has been postponed until Monday, April 4th.

Mersey Railway Bill was read a third time in the House of Lords on Monday.

Mr. Field has given notice of rejection, on the second reading, of the Rhondda Urban District Council (Tramway Extensions) Bill.

The Bishops Stortford, Harlow, and Epping Gas and Electricity Bill was passed by a Select Committee of the House of Lords last week. The Bill proposes the consolidation of a number of gas undertakings in the Bishops Stortford district, and the incorporation of a new company with a capital of £240,000 for the supply of gas and electricity. The Bishops Stortford Council opposed the Bill, but an agreement was arrived at on the terms that the Council shall be entitled to purchase the electrical undertaking of the company in Bishops Stortford at the expiration of twenty-one years, or subsequently at periods of seven years. The Bill was read a third time in the House of Lords on Tuesday.

The Farnham Gas and Electricity Bill was passed by a Committee of the House of Lords last week. It provides for the incorporation of a company with a capital of £60,000 for the supply of electricity and gas. The Bill was read a third time in the House of Lords on Tuesday.

In answer to questions in the House of Commons last week, Mr. Haldane, the Secretary of State for War, stated that the War Department had decided to extend the electric light installation at Aldershot to a number of other camps in preference to gas. The Aldershot Gas Company tendered, but it had been decided that it would be more economical to extend the War Department's electric light installation, which would, moreover, provide a more satisfactory illuminant.

L.C.C. Tramways.—The Standing Orders Committee have struck certain tramways out of the L.C.C. Tramways Bill owing to absence of local consents. The tramways concerned were in the boroughs of Kensington, Hammersmith, Paddington, Hampstead, St. Marylebone, Islington, Lambeth, and Camberwell. The Bill was read a second time in the House of Commons on Tuesday.

London Electric Supply Bill.—This Bill, which provides for the purchase of the five West End electric supply companies which were omitted from the London Electric Supply Act of 1908, came up for second reading in the House of Commons on Tuesday. The debate upon it was adjourned.

Institution of Mining Electrical Engineers.—A meeting of the Manchester Branch of the Institution of Mining Electrical Engineers will be held on Saturday, April 2nd, at 6.30 p.m., to consider the special rules relating to the use of electricity in mines.

Obituary.—At Langside, Glasgow, on the 17th inst., the death took place of Douglas Sheppard, of Messrs. Siemens Bros. & Co. Mr. Sheppard was a native of New Zealand, and was educated out in that country, completing his education there at Canterbury College. He afterwards came to this country, and was for some considerable time at King's College, leaving there to join the staff of Messrs. Siemens Bros., Stafford. Eventually he became chief of the outside staff for Glasgow and the West of Scotland under Mr. Bell, of the Glasgow office. Mr. Sheppard was known practically all over the country as an expert on turbo running and tests, and was extremely well liked and thought very highly of by his many friends and acquaintances, those who knew him best predicting a very brilliant future for him.

Telegraphic Traffic and Movements of Cable Ships.—The cable between Tourane and Amoy was restored on the 15th inst. On the following day the cables between Para and Maranham and between Ceara and Pernambuco became interrupted, and messages had to be sent by land lines. The Western Telegraph Co., however, had a cable steamer on the spot, with the result that the Ceara-Pernambuco section was restored on the 18th inst. The French cable steamer, *Pouyer-Quertier*, succeeded in restoring the section between Paramaribo and Cayenne on the 19th.—The Saigon-Bangkok line became interrupted on 20th inst. The Turkish administration has given notice that code telegrams are again admitted, but not those in cypher.—The German South American Telegraph Co. has completed another link of its connections to South America by the opening on the 21st inst. of the cable between Teneriffe and Monrovia in Liberia.

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APPLICATION OF ELECTRICITY TO SHIP PROPULSION

At the Institution of Naval Architects on Thursday, Mr. W. P. Durtnall read a Paper in which he described the latest developments of his system of applying electricity in the propulsion of vessels. He pointed out that although the steam turbine has been successful in competing with the reciprocating engine for ship propulsion on the basis of fuel used per shaft horse-power, yet it labours under an important disadvantage. To be efficient, a steam turbine must be run at a high constant speed, but as the propeller, to be efficient, must run at a comparatively low speed, a compromise has to be arrived at, with the result that the propeller speed used is not the most economical, and the turbines must be of great length and diameter, so that the use of superheated steam is precluded.

To overcome this difficulty Mr. Durtnall has developed a system in which the steam turbine drives an electric generator at a constant speed, chosen to give the highest efficiency, and the propeller is driven by a slow-speed motor whose speed can be varied. He employs a simple squirrel-cage three-phase motor as being the most mechanical for transmitting the very large power required, and he varies the speed of this by changing the frequency of the current supplied to it.

On the main turbine shaft a 3-phase alternator with a revolving field magnet is fixed, and also the rotor of a second alternator, which he calls a "transformer generator." Assuming that the main alternator is a four-pole machine and second alternator a two-pole machine, the connections for obtaining the different speeds are as follows:—

For the first speed ahead, the stator of the first alternator is connected to the rotor of the second one (through slip-rings) in such a way that it produces a rotating field in the opposite direction to that in which the set is being driven mechanically. Thus if the speed is 1,000 r.p.m., the frequency of the main alternator will be 33⅓ cycles per sec., and the frequency of the second alternator if excited with direct current would be 16⅔ cycles per sec. But as this second machine is excited with 3-phase current at 33⅓ cycles per sec. it creates a rotating field in the opposite direction; the resultant rotating field in this second machine corresponds to a frequency of 16⅔ cycles per sec. in the contrary direction to the rotation of the rotor, and this is the frequency of the current led from the stator terminals of this machine to the motor. If the induction motor driving the propeller is wound for 42 poles, the speed of the motor, allowing a 1½ per cent. slip, will be 46·8 r.p.m.

For the second speed ahead, the alternator stator is connected directly to the induction motor without the intermediary of the generator transformer; the frequency is therefore 33⅓ cycles per sec., and the speed of the motor will then be about double, say, 92·8 r.p.m., allowing for a slip of 2½ per cent.

For the third speed ahead, two of the three phases of the generator stator are reversed, before connection to the slip-rings of the generator transformer, and thus the rotating field, with which the latter is excited, is now in the same direction as the direction of rotation. The result is an increase of the frequency of this second machine, instead of a decrease as in the case of the first speed, and the frequency of the current generated in its stator will be three times that at the first speed. Allowing a still further slip, say, 3½ per cent., the speed of the motor will be 138 r.p.m.

It is seen that the generator always runs at constant speed, so that the efficiency of the turbine is high.

For reversing, two of the three phases of the connections to the motor are reversed, the connections of the generators being the same as before for all three speeds. Thus the motor turns in the reverse direction, and the torque is high for the first speed astern, in view of the low frequency of 16⅔ cycles per sec., the full output can be developed on reversing, and the first speed astern position of the controller can be used as a very powerful brake.

Assuming a 7,000 b.h.p. turbine with steam at 180 lbs. per sq. in. and 150° F. of superheat, and with a vacuum of 28·5, Mr. Durtnall estimates the steam consumption as follows:—

	Shaft Horse-Power.	Combined Efficiency of Generator and Motor.	Steam Consumption.
First Speed (46·8 r.p.m.)	600	77 per cent.	18·4 lbs. per shaft h.p.-hr.
Second Speed (92·8 r.p.m.)	1,500	83 ,,	13·85 ,, ,, ,,
Full Speed (138 r.p.m.)	6,160	88 ,,	11·66 ,, ,, ,,

The estimated steam consumptions are without allowing for the steam used in the auxiliaries. The combined efficiencies of generator and motor, Mr. Durtnall gives as "guaranteed."

In changing the speeds, the (series) field of the exciter of the main generator is short-circuited before the change is made in the connections between the generator and transformed generator, and all the changes in the connections are made automatically in the control gear. The controller can be operated directly from the bridge.

Besides its mechanical strength and simplicity of construction, the induction motor possesses another advantage, viz., that it is impossible for it to race. In heavy seas, with a lightly immersed propeller, the motor will simply run up nearer to the speed of synchronism, which, of course, it cannot exceed.

In the Paper, some examples are worked out to show the gain in steam consumption claimed for the system. For instance, the author takes a twin-screw cargo boat, fitted with 2,000 i.h.p. triple expansion engines, which, at the full speed of 100 r.p.m., would consume 15 lbs. of steam per i.h.p.-hour, or, say 17·65 lbs. per shaft horse-power-hour. If high-speed turbines on Mr. Durtnall's system are substituted, he estimates that the consumption will be 15 lbs. per shaft horse-power-hour with saturated steam, or 13·9 lbs. with superheated steam.

In the Paper, a modification of the system for use with internal combustion engines is described, in which the generator and the generator-transformer are driven by separate engines, both of the same size. This the author suggests as an alternative for slow-speed cargo vessels in which the direct-coupled internal combustion engine is not suitable owing to its high speed. The example he takes is with two 500 b.h.p. engines running at 350 r.p.m., the generator being an eight-pole machine, the transformer-generator a four-pole machine, and the motor wound for 34 poles. With the three methods of connection described in the previous example, the motor speeds, allowing for slip, would be 40·25, 80, and 120 r.p.m. respectively, and on the second speed it would be only necessary to run one engine, the one driving the ordinary alternator.

For small cargo boats, the combination of a reciprocating engine and a mixed pressure turbine is suggested as another alternative. The reciprocating engine runs, say, at 500 r.p.m., and drives a four-pole alternator, a two-pole transformer-generator, and the exciter, all mounted on the same shaft. The mixed pressure turbine runs at 1,550 r.p.m., and drives a two-pole non-synchronous alternator. For the first two propeller speeds, the reciprocating engine exhausts direct to the condenser, and the connections are as in the case of the first two examples, the turbine set not being employed. For full speed, the engine exhausts into the turbine, and some live steam is also sent into the turbine, so that it runs approximately at its rated speed. The stator of the main alternator is then connected to the rotor of the generator-transformer, just as in the other cases, and the frequency corresponds to a motor speed three times the first speed. The reciprocating engine alone is not sufficiently large to supply the full power at this speed, and, therefore, the non-synchronous alternator, driven by the mixed pressure turbine, is connected in parallel with it. The sizes of the two machines in

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the example taken in the Paper are 250 b.h.p. for the reciprocating engine, and 730 b.h.p. for the turbine.

The question of the comparative weights of the ordinary engine plant and the turbo-generator plant and accessories is only discussed in the case of one of the examples taken in the Paper, viz., that of a twin-screw Atlantic liner wtih 5,000 i.h.p. quadruple expansion engines. For a similar vessel, equipped on Mr. Durtnall's system, he estimates a saving of 3 per cent. in weight of the engine-room plant, and of 13 per cent. to 17 per cent. in boiler weight, in addition to which he mentions the saving in weight of coal at the start of the voyage, owing to the higher efficiency.

A discussion on the Paper was opened by the Hon. C. A. Parsons, who stated that the losses in propeller and turbine efficiency in fast turbine liners were not so serious as the author imagined. In such vessels the propellers had an efficiency within 2½ or 5 per cent. of the efficiency of any propeller, and the steam consumption of the turbines was within 3 per cent. of fast-speed land turbines. For the vessels, therefore, he said, there was no advantage in gearing, whether by electrical or other means. There was thus, in the case of fast vessels, only a gain possible for cruising speeds. For slow-speed vessels, on the other hand, there was undoubtedly a large field for gearing, but, while the combined efficiency of the generator and motor might be taken at 85 per cent., he had developed a helical gearing (described in a Paper before the Institution on Friday) which had a 98½ per cent. efficiency. It was not correct, Mr. Parsons continued, to say that there was a critical speed for turbines, as the curve was very flat, and fairly wide variations on either side were possible, without diminishing the efficiency, if the turbine were designed for the average speed; nor should too much store be set upon superheat, as the superheaters would not last, owing to possible priming and the deleterious action of the salt in the water. Moreover, reciprocating engines could also be run at higher efficiency with superheated steam. Finally, he criticised the general principle of electric driving in two respects. In the first place, if the combined efficiency was 85 per cent. the 15 per cent. was lost as heat, and this would increase the already great difficulties of ventilation, and, secondly, if there were a short-circuit of one of these large machines in such a confined space, everyone in the engine-room would be killed by copper poisoning.

Mr. C. G. Deane spoke in favour of Mr. Durtnall's proposals, and elicited from Mr. Parsons the explanation that the 3 per cent. difference in efficiency between land and marine turbines was without superheat, and assuming that each was run at its rated speed. He pointed out that additional turbines for cruising speeds were utilised. Mr. Futtinger said that he had studied the question of electrical gearing in conjunction with the A.E.G. and Brown, Boveri & Co., but the idea was abandoned on account of the weight of the plant and the difficulty of operating. He was now trying a hydraulic method of gearing. Mr. Holzapfel said that he had made inquiries, both here and on the Continent, for an electrical reversing gear, but had not found one to meet with his requirements. He understood, however, that Mr. Durtnall's motors would work under water, and suggested that they might find useful application for electric winches. Mr. R. J. Walker also expressed his opinion that the use of electric propulsion on the system proposed would mean increased weight.

Mr. Durtnall in his reply said that a 600 h.p. vessel on his system was under construction, and he would publish the actual results of the trials, whether they proved to be for or against electrical propulsion.

CONDENSERS WITHOUT AIR PUMPS

A NEW pattern of condenser, by the use of which the usual air pump is dispensed with altogether, is being introduced into this country by Messrs. Michael Pal & Co. (Parliament Mansions, Victoria Street, London, S.W.). Circulating and condensed water pumps are required, but the air is extracted from the air chamber by the circulating water on the ejector principle. The cold circulating water is drawn from the cooling tower tanks by a centrifugal pump, which imparts to it sufficient head to overcome the tube friction and to raise it to the top of the towers. The water enters the condenser with a somewhat higher velocity than is usual, and first passes through an ejector apparatus in the air chamber, which entraps the air, causing it to be carried out of the condenser with the circulating water. This arrangement is said to be suitable for any kind of steam plant, especially where a high and steady vacuum is required. Several such condensers are at work in Germany, and we are informed that one installed at Charlottenburg gave on test a vacuum of over 95 per cent. Both the pumps, that for circulating the cold water and that for the extraction of the hot condensed water, may be of the centrifugal type, and this fact, coupled with the absence of an air pump, reduces to a very large degree the liability of stoppages.

Although the circulating water pump is necessarily somewhat more powerful than in ordinary condenser plant of equal capacity, the total power required for the auxiliaries is said to be reduced. The chief advantages claimed for the system are the low running costs and the greater safety of working. Further, there is said to be a saving in first cost and in floor space. Messrs. Michael Pal & Co. use this condenser in conjunction with their exhaust steam-turbine plants, where a steady vacuum is of great importance. These plants include a special form of heat accumulator which ensures a continuous supply of low-pressure steam at even pressure, however variable the delivery of exhaust steam. Further, an automatic live steam valve is fitted to the accumulator, and this comes into action directly the supply of low-pressure steam is below a predetermined minimum, and admits live steam to the accumulator to maintain the supply to the turbine.

CORRESPONDENCE

To the Editor of ELECTRICAL ENGINEERING.

TELEPHONE CABLE TERMS.

SIR,—Not being a telephone engineer, and having no pretension to expert knowledge in all the branches of science, I do not mind confessing that I find your very interesting description of the new telephone cable on the Heaviside-Pupin principle (which is known to me) not altogether easy to follow. Would it be asking too much if I inquired as to the exact meaning of "the standard equivalent cable length" of a mile of cable, and how it is calculated (or measured)? Also, what is the exact meaning of the "attenuation constant per mile of a cable"? Taking a common-sense meaning, it would seem that the *less* the attenuation constant is, the *better* the cable. This cannot be the right view, since you state that the cable without its coils had an attenuation per mile of 0·045, while with the coils this was reduced to 0·0140.

It is possible that an explanation of these points would be welcome by more than one of your readers.

I am, yours faithfully,

Cairo House, Balcaskie Road, Eltham, March 20, 1910. M. E. J. GHEURY.

[For convenience in specification and testing, the British Post Office and the National Telephone Company have agreed upon a "standard" cable of certain resistance, capacity, and inductance, which is used as a basis of comparison when specifying or testing telephone lines or cables. This "standard" cable is a dry-core cable, the wires of which have a loop resistance of 88 ohms per mile and an average mutual electrostatic capacity of 0·054 m.f. per mile between wire and wire of each pair, and an average insulation of not less than 200 megohms per mile between wire and wire of each pair, all measurements being made at 60° F. The same standard, we believe, is also employed by the American and other telephone administrations. Thus the expression occurring in our article that the new telephone cable between England and France has a standard cable equivalent of 3·28 miles, means that it would affect the speaking properties of a circuit to the same extent as 3·28 miles of the "standard" cable as defined above.

The attenuation constant of a "loaded" cable of high insulation, such as the new Anglo-French telephone described, is expressed by the formula $\alpha = \frac{R}{2}\sqrt{\frac{K}{L}}$ where R = resistance in ohms, K = mutual capacity (in farads), and L = inductance in henries.—ED. *E.E.*]

Siemens-Schuckert Continuous-current Meter.—The Board of Trade have approved of the Siemens-Schuckert continuous-current meter type G.K., and of the means provided for fixing it.

Central Battery Telephone Exchange at Bootle.—On Saturday, March 12th, at 3 p.m., the National Telephone Co. transferred the subscribers connected to its Bootle exchange to a new central battery equipment installed in new premises at Exeter Road, Bootle, Liverpool, which have been specially designed. The new equipment has been manufactured and installed by the Western Electric Co., Ltd., of North Woolwich, and is of the No. 1 C.B. type, consisting of fourteen subscribers' positions giving accommodation for 1,080 lines, four incoming junction positions, and one exchange testing position. The equipment is of similar design to those previously described in ELECTRICAL ENGINEERING.

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THE ELECTRICAL EQUIPMENT OF SMITH'S DOCKS, NORTH SHIELDS

THE North Shields branch of the Smith's Docks Co. consists of three dry docks ranging from 300 ft. to 435 ft. long, and two pontoon docks 365 ft. and 435 ft. long respectively. In addition to these docks for repairing purposes, there is an extensive shipyard for building steam trawlers, medium-sized cargo boats, and other small vessels, while across the river at South Shields a further set of three dry docks for repairing purposes is in operation. Increasing business recently suggested to the firm the removal of the shipbuilding branch to Middlesbrough, where extensive new works are now in operation, and the devoting of the space thus left at North Shields to greater repairing facilities, a 600-ft. graving dock being in contemplation.

This company is of very old standing, although it has been known by its present name only since 1891. It is really an amalgamation of Messrs. T. W. Smith and Messrs. H. S. Edwards and Sons, founded in 1782 and 1786 respectively. The policy of the firm has always been to keep up with engineering progress, and even before the amalgamation took place electricity was being used to pump out one of the floating pontoons. This was before the days of municipal supply, so that a private plant was put down to operate the pumps electrically. Last year, on the advice of Mr. C. W. Fairweather, consulting electrical engineer to the firm, it was decided to change over and take electrical supply from the system of the Tynemouth Coroporation Electricity Department. The steam equipment, fed by three marine boilers, was scrapped, such hydraulic and pneumatic systems as were in use were operated electrically, and, wherever possible, without incurring too much expense in changing over existing electrical machinery, a three-phase supply system was introduced. Where this was not possible, a D.-C. supply was taken from the town mains. The practical effect of power available from the central station plant is that all three docks can be used at one time, and three ships can be docked together, whereas it was formerly necessary to hold one ship back in order to spread the pumping over a longer period and lighter duty.

The system of electrical distribution is divided between a D.-C. supply from the Tynemouth Corporation main station, which is now being operated as a transforming station for transforming the high-tension three-phase bulk supply from the Newcastle-upon-Tyne Electric Supply Co. to a three-wire low-tension D.-C. distribution at 440 and 220 volts, and a three-phase 40-period supply. The sub-station for this latter supply is erected on the premises, and the three-phase motors which are operated from this centre are, with the few exceptions mentioned later, of the squirrel-cage induction type. In connection with the pumping of the two large graving docks mentioned above, a pump-room is installed on the pier between the docks, the whole of the plant being underground.

The installation consists of two main twin horizontal Worthington pumps each of 16 in. diameter, direct driven by a 150 h.p. Westinghouse A.-C. motor, an 8 in. drainage pump, operated by a 25 h.p. Westinghouse A.-C. motor, to drain the docks after pumping, while for ballast purposes a 17½ h.p. A.-C. motor operates an 8 in. delivery ballast pump, and a 2 h.p. A.-C. motor drives a small priming pump. Space is economised as much as possible by placing the centre line of each combination parallel to the axis of the pier, but inverting the relative position of the motor and pump in one set, so as to bring the two sets close together. The lighting for this room is taken from one phase to earth. It has been found possible to empty the smaller of the two docks completely in an hour-and-a-half when using both sets of pumps, while the larger one takes two to two-and-a-half hours according to the size of the vessel which is being docked. For opening and closing the gates of both these docks a capstan made by Messrs. Clarke, Chapman & Co. is used, the arrangement of chains being such that one of these passes through an eye on one gate to a bolt on the other, the tension of this chain, therefore, drawing both gates close together. Another chain, divided at a point along its length into two separate chains, is suitably arranged for throwing the chain wheels into and out of gear with the drive, which is accomplished by a 25 h.p. slip-ring motor.

In connection with these docks, a Ransomes and Rapier jib crane of 15 tons capacity, at a radius of 45 feet, is also in operation on the three-phase system, having motors of 30, 20, 20, and 10 h.p. for lifting, derricking, slewing, and traversing respectively. On this pier is also a fitters' shop, driven by a 30 h.p. Westinghouse motor. The supply for this crane is taken from a plug box some ten yards away through a flexible armour-covered cable to the crane, and fed through a hollow vertical shaft, on which the crane superstructure rotates, to slip-rings, from which it is taken to the switchboard. Each gear is equipped with an electromagnetic and foot brake for use in cases of emergency.

The other purposes of the three-phase supply are for operating

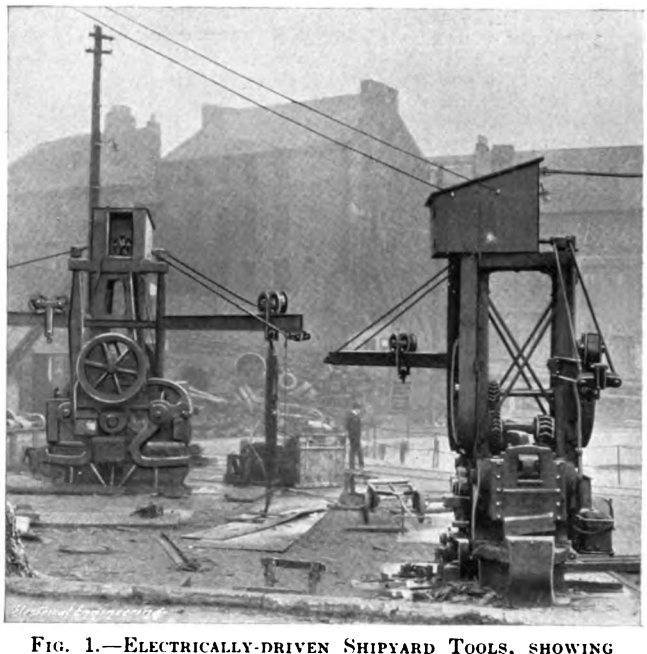


FIG. 1.—ELECTRICALLY-DRIVEN SHIPYARD TOOLS, SHOWING OVERHEAD WIRING.

20 and 15 h.p. Westinghouse motors respectively for punching machines erected in the open for working large plates, the motors being mounted on the top of the machines and supplied by an overhead pole construction, which is clearly shown in Fig. 1, and two 65 h.p. Westinghouse slip-ring motors for driving air compressors, which supply power for working pneumatic tools for the ships being repaired in the docks. Each of these slip-ring motors is controlled automatically by a liquid starter operated by a small motor which is thrown on and off the line by a switch controlled by the air pressure in the air receiver. The pressure at which this switch operates can be adjusted by altering the weights attached to the movable blade of the switch. Fig. 2 gives a photograph of the air-compressor room, and shows this automatic gear very plainly.

A D.-C. supply, of which there are four services direct from the Corporation mains, is used for driving motors for the blasts in the coppersmiths' and blacksmiths' hearths and machine tools; and also for the flame-arc lamps which are used throughout the yard for outside lighting and for the enclosed lamps for inside illumination.

In the shipyard, which forms the middle section of the area covered by the firm, a number of tools are driven by D.-C. motors. Among the heavier machinery may be mentioned a joggling machine driven by a 40 h.p. D.-C. motor, a large punch

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and shears driven by a Westinghouse D.-C. motor, shown in Fig. 3, and large mangles for straightening plates operated by a 17 h.p. D.-C. motor. As the work on the last machine is very fluctuating, a large-scale ammeter is installed in view of the man using the controller, so that he can regulate the rate at which work is being done. A fine plate-planing machine 22 feet in length, is driven by a 30 h.p. Westinghouse A.-C. motor. Close to this machine is a drilling and counter-sinking machine for working on the plates, driven by a 7½ h.p. A.-C. motor.

An interesting feature in the shipbuilding department is the main switchboard, controlling the power circuits, on a platform 30 feet above the ground, and closed in from the shop by glass windows, so that the operator has a full view of every machine in the department. Double-pole fuses and switches are provided for each circuit, together with main switch and fuses, and necessary voltmeters and ammeters.

At the entrance to the pontoon department is situated No. 6 graving dock, which is used for docking the smaller boats. The pumping equipment, which is capable of emptying the dock in about 2½ hours, is contained in an underground room at the side of the dock, and consists of a centrifugal pump, with a capacity of 6,000 gallons a minute against a head of 26 feet, direct-connected to a 70 h.p. Westinghouse vertical A.-C. motor operated by an autostarter, and small draining and priming pumps direct-driven by A.-C. motors. One of the main features of interest in connection with the pontoon department, which also forms one of the outstanding features of the works as viewed from the river, is a travelling jib crane on the wharf side, which is used for such purposes as placing very large propellors, &c., on boats lying alongside the quay. It was constructed by Messrs. Ransomes & Rapier to lift 25 tons at a radius of 43½ ft., and is operated by 4 D.-C. motors of 40 h.p.

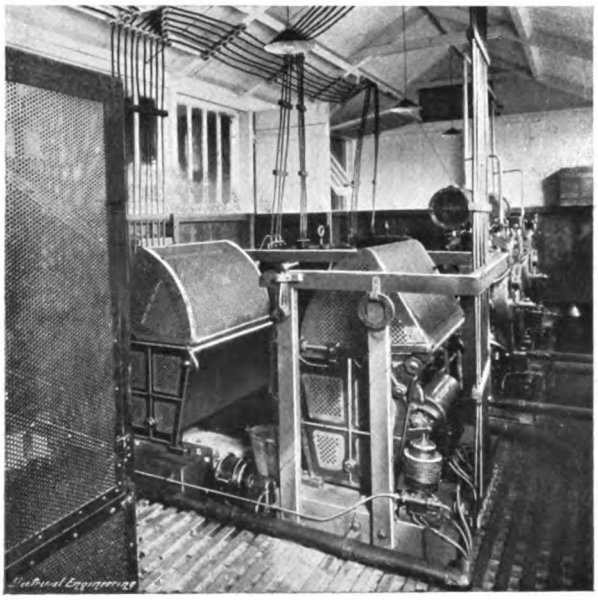


Fig. 2.—Automatic Liquid Starter for Hydraulic Pumps.

for the hoist, 20 h.p. for derricking, 10 h.p. for travelling, and 15 h.p. for slewing.

An extensive fitting shop is in operation in connection with the pontoons, some of the machines, such as lathes and drilling machines, being of considerable power. Amongst these may be mentioned a 4-tool lathe with a bed taking work up to 40 ft. in length, and a planing machine of 10 ft. by 4 ft. These two machines, together with three other lathes, are operated by a 50 h.p. Westinghouse induction motor, which also drives, by means of a rope, belt and friction clutches, a 20-ton overhead travelling crane. The smaller machines in this shop are driven from a shaft by a 30 h.p. Westinghouse motor, whilst the joiners' shop, which is used for ship repairing work, is operated by a 15 h.p. Westinghouse motor.

In the hydraulic house, adjacent to this department, is installed a pump for working the accumulator for the hydraulic system of the works, which is maintained at a pressure of 900 lbs. per square inch. The pump is driven by an 85 h.p. Westinghouse slip-ring motor, which, with the exception of the air compressor plant, one capstan, and one crane equipment, is the only slip-ring motor in the place. It is provided with an automatic liquid starter for starting against load, being controlled by the rise and fall of the accumulator. A 50 h.p. Westinghouse A.-C. motor drives the compressor for the pneumatic hammers and rivetters in the docks, which are supplied at a pressure of 40 lbs. per square inch. In this connection it may be mentioned that the hammers in the blacksmiths' shops were recently converted from steam to pneumatic drive. The blacksmiths' department in this section comprises a series of 20 fires, the blast for which is maintained by a Roots blower, driven by a 10 h.p. Westinghouse A.-C. motor.



Fig. 3.—Electrically-driven Punching and Shearing Machine.

Two other motors, each of the same capacity, operate punching and shearing machines, and a mangle and drilling machine in the high shed (pontoon department). There are, amongst other heavy machinery, a fine set of rolls by Messrs. Hugh Smith & Sons, capable of taking plates up to 30 ft. in length, driven by a 55 h.p. D.-C. motor. In this section the same arrangement of main switchboard is adopted, namely, an elevated gallery at such a height that the whole of the machinery can be seen at one time by the operator, isolated from the dirt and dust of the shop by glass partitions. For the purpose of pumping out pontoons Nos. 7 and 8, a series of four and eight pumps are respectively installed, each pump having a delivery pipe of 18 in. diameter, and being operated by a 60 h.p. Westinghouse A.-C. motor. It may be taken that any further extensions of this set will be carried out by means of three-phase power.

The whole of the A.-C. electrical equipment consisting of three-phase motors, autostarters which are of the oil-immersed type, controllers, and automatic liquid control and electro-magnetic brake gears, was supplied by the British Westinghouse Electric & Manufacturing Co., Ltd. The wiring was carried out by Messrs. Warren, Beattie & Co., of Middlesbrough.

Faraday House Old Students' Association.—The annual dinner of the Faraday House Old Students' Association has been postponed until Friday, April 29th.

Electrically-driven Spirit Pump.—At Messrs. James Buchanan & Co.'s premises in Holborn an electrically-driven pump has been installed, and is put to a novel use. It is arranged to pump various whiskeys from barrels in the basement of the building to large vats on the top floor, so as to obtain certain blends of the spirit. A special suction is provided for adding the required quantity of water to give the liquor the proper density, and the pump is also arranged to discharge air into the vats in order to effect the blending. In view of the nature of the liquor the inside of the pump is tinned, as also is the inside of the copper pipe which has been fitted for conveying the whiskey from the basement to the top floor. The pump, which is capable of dealing with no less than 130 gallons of whiskey per minute, is of Merryweathers' "Hatfield" pattern, and is driven from an electric motor by means of a silent chain, the whole being mounted on bed plate and forming a very compact set.

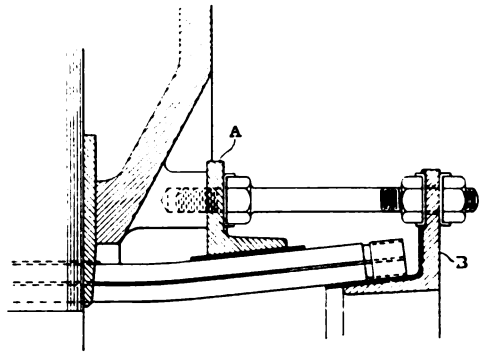
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SHORT-CIRCUIT EFFECTS AND TURBO-ALTERNATOR CONSTRUCTION

THE discussion of the two Papers on the above subjects, read by Mr. Miles Walker before the Institution of Electrical Engineers in London, on March 10th, was resumed on Thursday last. An abstract of the two Papers and of the discussions in Manchester and London on March 8th and 10th respectively, was given in ELECTRICAL ENGINEERING, March 17th, page 183. In the first Paper the author described the effects of short-circuiting large alternators, pointing out that as the armature current took time to demagnetise the field, it might on sudden short-circuit amount to from 20 to 30 times the full load value. The second Paper dealt with the question of salient pole *versus* cylindrical slotted rotors, the author expressing a preference for the latter type.

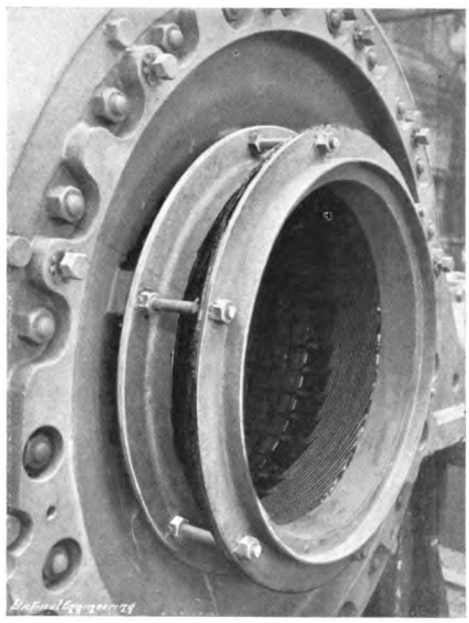
Mr. A. H. LAW (Messrs. C. A. Parsons & Co.), who showed a number of slides illustrating short-circuit effects obtained with a 4,000-kw. alternator in the Carville power house of the Newcastle-upon-Tyne Electric Supply Co. It was short-circuited twice at a pressure of 5,800 volts. The end windings were tied up with lead wires to the frame, and after the test these wires were all found to have slackened about $\frac{3}{2}$ in. According to the oscillograph records, the current rose to nearly 8,000 amperes in about $\frac{1}{20}$ second, and fell in about one second to only slightly above its normal value, but even at four seconds it did not reach the normal value. The method of supporting the coils in the alternator was to have bolts passing through the coils, and, in addition, massive cast-iron clamps were fastened to the coils and carried round to the frame. It was the intention, however, to substitute cast steel, which would then give a factor of safety of about 2½. He knew only of one alternator which had given trouble on short-circuit. This was a 2,000-kw. machine. The supports were damaged considerably, but the windings were not broken down, and the alternator ran for some weeks before the damage was repaired. In another case, a 1,500-kw. two-pole machine was paralleled entirely out of phase with several larger machines through a mistake in coupling up the synchronising lamps, but it withstood the shock without breaking down. He did not agree that two-pole windings were more difficult to support than four-pole windings. It was true that the former had twice the stress in them, but there was twice the length on which to fit clamps. In his remarks upon keeping down the short-circuit current, the author suggested the use of a semi-closed slot deep below the periphery. Did this really present advantages? It was true that it increased the self-induction of the winding, but did it not produce additional voltage drop. Was it not better to increase the self-induction by putting additional wires on the armature than to increase the leakage across the top of the slots? Some makers, including Parsons, preferred to use completely enclosed slots, because it undoubtedly limited the short-circuit current. Messrs. Parsons had recently designed a 1,500-kw. machine running at 3,000 r.p.m. in which it was expected that the momentary short-circuit current would not exceed 12-14 times the full-load value, whilst at the same time the regulation would be within 8 per cent. when throwing on full-load current, with a power factor of 0·8. In conclusion, the speaker mentioned the case of a short-circuit on a Parsons D.-C. turbo-generator with compensating windings in the pole pieces, through the plates in the tank used as an artificial load for testing accidentally coming into contact with each other. The result was that the windings pulled themselves in about ¼ in. on either side and made the walls oval, the bolts holding the pole pieces were torn away, and the armature was pulled up so rapidly that the commutator sheared the lugs and went on half a turn alone.

Dr. M. KAHN (Brush Electrical Engineering Co.) said that as the coils consisted largely of insulating material, it was necessary to employ very heavy clamps, and not to be afraid of getting them close up to the winding. An ordinary barrel winding or the so-called butterfly connections were the most suitable windings. With bolts going right through the winding, the most valuable feature of the barrel winding (namely, all the bars lying close to one another) was lost. It was better to use a supporting ring, with a flanged ring on the opposite side. The supporting ring is bolted to the other ring by bolts outside the winding, as shown in the accompanying figures. With this construction all bars lie flat against one another, so that the attraction between bars cannot produce any deformation of the winding. In addition, the current in one layer flows in an opposite direction to the current in the other layer. When the coils are not packed close together, there should be packing pieces between the mica tubes on the straight part where the coils leave the slots. These can be made in halves, both halves being screwed together so that they grip the tubes. It is advisable to make the inner supporting bolts of non-magnetic material, as otherwise they get hot. Former wound coils with



SUPPORTING RINGS FOR TURBO-ALTERNATOR END-CONNECTIONS. (BRUSH ELECTRICAL ENGINEERING CO.).

solid conductors offer more resistance to deformation than coils of flexible cable, and the open slots which are necessary will not cause ripples if they are inclined at an angle to the axis of the machine. If an asynchronous machine is short-circuited, the



METHOD OF SUPPORTING END-CONNECTIONS OF BARREL WINDING (BRUSH ELECTRICAL ENGINEERING CO.).

volts are counterbalanced by the reactance voltage, and the short-circuit current is only about six times the full-load current. In addition, the short-circuit current automatically cuts off the magnetising current of the machine.

Mr. J. H. RIDER (Chief Electrical Engineer, L.C.C. Tramways) mentioned one or two bad short-circuits. One was on a 3,500-kw., 94 r.p.m., three-phase generator, due to bad paralleling. The coils were of the open type, unsupported at the ends, and practically the whole of the end windings collapsed inwards. All the mica tubes were broken, and, of course, the machine broke down. Another was on a 5,000-kw. Dick-Kerr turbo-alternator, coupled to the turbine with a coupling in which were sixteen one-inch bolts. The instant the short-circuit took place, the whole of these bolts were sheared through, but not a single clamp or coil of the alternator moved. This was excellent testimony to the construction of the alternator, which was a four-pole machine running at 750 r.p.m. In comparison with the simplicity of the clamps on this machine, he rather wondered at the large number which were being put upon the Westinghouse machines now being erected at the L.C.C. Greenwich power house (see ELECTRICAL ENGINEERING, March 17th, p. 183, Fig. 3). It did not seem that there was safety in the number of clamps so much as in the positions in which they were

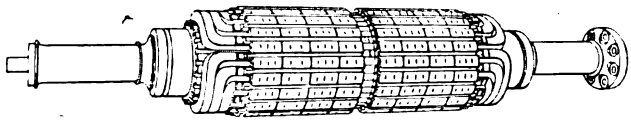
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placed. If coils, after short-circuits, generally went inwards, then no useful purpose was served in placing large clamps outside the coils. With regard to the relative advantages of salient-pole and cylindrical rotors, was it a fact that the fields of the latter required more excitation? The above-mentioned Westinghouse generator, which had the same number of stator slots, the same number of turns in the stator coils, and the same speed, required nearly 50 per cent. more energy than the Dick-Kerr salient-pole type generator working alongside it. With regard to Mr. Walker's compensating device, how would a machine with this work in parallel with machines without it?

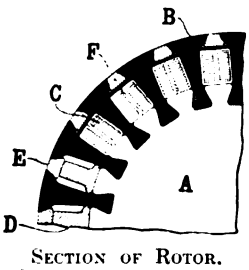
Mr. E. H. RAYNER (National Physical Laboratory) showed some oscillograph records of the effects of switching on a transformer on an actual unloaded cable network. The voltage curve was, of course, symmetrical, and showed very slight ripples, but the current curve gave evidence of the same effect noticed by Mr. Walker, viz., a shifting of the zero line and pronounced ripples for some considerable period after switching in. He then referred to the large quantity of heat which had to be dissipated in the stator in the case of high-speed turbo-alternators, and estimated that in the 5,000-kw. machine referred to in the Paper, this would amount to some 5 kw. per phase. This had to be got rid of, through a comparatively short length of metal, but through several thicknesses of insulating material.

Mr. G. G. STONEY (Messrs. C. A. Parsons & Co.) said that a short-circuit test at full pressure was hardly sufficient. A machine ought really to be thrown in out of phase with all the other machines running in parallel with it. According to Mr. Walker, however, this was the worst case that could take place, so perhaps as a regular test it would be excessive.

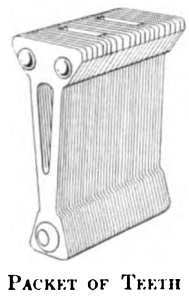
Mr. P. W. TURNER (A.E.G. Foreign Department) described the construction of the A.E.G. turbo-alternator rotors for high peripheral speeds. (See ELECTRICAL ENGINEERING, Jan. 27th, 1910, p. 58.) Machines of 3,000 kw. had been constructed to run at 3,000 r.p.m. The central portion of the rotor is forged solid with the shaft, and these have been made up to a weight



ROTOR OF A.E.G. TURBO-ALTERNATOR.



SECTION OF ROTOR.



PACKET OF TEETH STAMPINGS.

of 28½ tons. The teeth are quite separate, and are fitted in dove-tail slots. Metal wedges *F* forced in above the coils *C* lift up the roots of the teeth *B* against the sides of the dove-tail slots. Iron wedges *E* are placed above the iron bars *D* in the middle slots. The teeth are made in 6-in. lengths, and are tested to 28 tons per square inch at the fracture, but the working stresses are only 4 to 5 tons per square inch. Bolts go through the stampings and short-circuit them. The coils consist of strip copper insulated with mica. They are built up with the teeth external to the rotor core, and the whole is then slid into position.

Mr. G. W. PARTRIDGE (Chief Engineer, London Electric Supply Corporation) thought that consulting engineers might allow as much as 27-30 per cent. pressure drop on load instead of 16-18 per cent., especially when automatic regulators were used. Instead of using choking coils to limit the short-circuit current as mentioned in the Paper, better results might be obtained with resistances. He recommended the use of two oil switches in series on each generator, the first controlled by an instantaneous relay, and the second by a time-limit relay. When synchronising, the first switch would be left open and the synchronising would be done on the second, in which case, should the machine be put in out of phase, the resistance would limit the current. When paralleled, the first switch would also be closed. Then, in the case of a short-circuit, this switch would come out instantaneously and the resistance would then serve to limit the current. Perhaps, however, the quickest relay would take about ¼ second to act, and consequently the first rush of current would not be prevented. He was paralleling in the above manner in connection with the supply to the London, Brighton & South Coast Railway, and it acted very well.

Mr. J. T. IRWIN (Central Technical College) suggested that Mr. Walker had overlooked, when considering the forces on the coils, the effect of the stray fields from the rotor. Assuming that under normal conditions the field strength per pole was three times the armature strength, then, with an armature current of 20 times the normal, and lagging 90 degrees, as was the case at short-circuit, it would be necessary, in order to maintain the field flux, that the ampere turns of the eddy current in the pole face should amount to some seven times the normal. This would mean that the leakage flux would be seven times greater. Estimating the leakage of the machine taken by Mr. Walker, he came to the conclusion that the leakage flux on short-circuit would be at least as high as the flux due to the current in the stator coils, and that the effect of these two fluxes would be added, with the result that the forces would be at least twice as great as those estimated by Mr. Walker.

Mr. MILES WALKER, in reply, dealt first with Mr. Irwin's remarks. The additional leakage due to the eddy currents in the pole would, he agreed, contribute considerably to the forces acting upon the winding. In answer to Mr. Law as to why he did not test his machines at higher than one-third full voltage, he said he was afraid of cracking the bed-plate. Apart from this, there was the risk of stripping the turbine blades. Several more modern machines had been short-circuited since at full voltage, and had stood the test well. Some consulting engineers now specified that the machines must be short-circuited as part of the test. He still thought a two-pole winding was more difficult to stay. By dividing the coils up into smaller batches, the forces were not so great. With regard to the harmful leakage mentioned by Mr. Law in connection with the form of slot proposed to reduce the short-circuit current, it would perhaps be better to make the slot wide at the top as well as deep. As to the number of clamps, also mentioned by Mr. Rider, machines with half the number had shown a movement of the coils, although they stood up; he thought the extra number advisable. The coils did not always go inwards; it depended on the direction of the current. Dealing with Mr. Rider's query as to why a machine with a cylindrical rotor required more exciting current, Mr. Walker stated that extremely strong field magnets were put in in order to obtain better regulation. The extra current required was not a serious matter in relation to the very much better regulation. Paralleling compensated with non-compensated machines had been tried with success in Glasgow, where a 4,000-kw. compensated machine was run in parallel with non-compensated machines, and ran perfectly well. The reason was that the compensated machine was not compensated for wattless load, and it was the wattless current that helped in the parallel running. The compensated machine tended to take up rather more than its share, not of the load, but of the wattless current, as it tended to hold its volts up better than the other machines. This did not affect the parallel running, but only the power factor of the particular machine. In fact, A.-C. machines in parallel must of necessity share the load in proportion to the output of their engines, although with D.-C. machines this was not the case. He did not understand Mr. Rayner's remarks about the 5-kw. loss. This would mean one per cent. copper loss, which was high for a turbo-alternator. Mr. Partridge's suggestion would certainly save the machine if the operator made a bad parallel, but when the resistance was short-circuited it would be of little use in limiting the short-circuit current, because all the damage was done long before even an instantaneous acting current breaker would come out.

Several written communications to the discussion have been received. Dr. R. POHL (Phœnix Dynamo Manufacturing Co., Ltd.) favours the salient-pole rotor as giving the required output with the smaller expenditure of material. Highly saturated teeth are being employed in salient-pole rotors, and high current densities can be obtained with sub-divided field coils of copper strip wound on edge. The slightly larger leakage factor is of little importance. The smaller weight, mean length of turn, distance between bearings, and the greater accessibility render the salient-pole type the most suitable in all cases except for bi-polar machines. External choking coils may be used to limit the short-circuit current, and these also protect the stator end coils against pressure rise.

Mr. J. C. MACFARLANE (Crompton & Co.) refers to the fact that the extra stray flux from the field on short-circuit reacts on the stator coils, and may account for the very heavy forces observed. He agrees that the cylindrical rotor is the best, as the iron takes up the heat from the copper and dissipates it from its large circumferential surface. To increase this surface, which is the most valuable to dissipate heat, a core may be constructed of alternate packets of discs of different diameter. An experimental core of this kind, with only twice the circumferential surface of a plain core, got rid of 25 per cent. more heat than a plain core of the same dimensions and for the same temperature rise. This percentage could easily be raised to 100. By having teeth of different lengths, a helical passage could be made which would drive air along the surface.

Mr. A. G. ELLIS (Alioth Co., Basle) points out that the teeth in the interpolar space of a cylindrical rotor carry only a small part of the total flux and correspond to the interpolar spaces in the salient-pole type.

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STANDARDISATION OF ELECTRICAL MACHINES

A PAPER entitled "Some Notes on Standardisation of Electrical Machines" was read by Mr. R. Orsettich before the Glasgow Local Section of the Institution of Electrical Engineers on March 8th, and was also discussed by the Birmingham Local Section on March 9th. The author defined standardisation as selecting for manufacture a definite number of types and sizes as answering average requirements, and in designing them in such a way that they are eminently suited for production in large quantities. To carry out successfully the production of machines on a large scale there should be as few types as possible, and as many parts as possible in common amongst the different types, also, the aim of the design should be concentrated on the production of perfectly interchangeable and mechanical details, even if the cost of machining is somewhat high, with a view to reducing the cost of assembling the different parts, which can only be done individually.

Commercial considerations require a sufficient number of standard sizes to minimise the likelihood of being underbid by firms happening to have a size nearer the requirements, notwithstanding the larger total capital outlay and small turnover for each type. The recommendations of the Standard Committee, who went into this matter very thoroughly, have unfortunately not met with complete success, because they reduced the number of sizes below what had been accepted as normal practice by a number of firms. In the author's opinion, a line of standard continuous-current machines between 1 h.p. at 2,000 r.p.m., and 100 h.p. at 1,000 r.p.m., there should be from eighteen to twenty types, and practically the same number for a line of three-phase motors between 1 h.p. at 1,500 r.p.m., and 100 h.p. at 750 r.p.m. These numbers are based on an approximate output of some 500 machines per year of the smaller size up to about 25 machines per annum of the larger size. Special machines cannot be entirely avoided, but they should only be undertaken at prices which should not only cover the expense of designs, drawings, and patterns, which are usually included, but the extra attention required in following it through the shop, the delay caused by stopping important work at the machine tools, the extra adjustments in fitting a new design together, and the risk of alterations after test, due to its novelty.

Some remarks were made on the organisation of stores of standard materials, and for usual conditions it was recommended that in addition to parts common to several types, parts belonging to individual types should be manufactured in advance and kept in stock, because of their requiring either a long time to obtain the material, or because the machining has to be done with special care or with expensive appliances.

Passing on to considerations of mechanical design, it was advised that for continuous-current machines where the types of the frame and the number of poles is settled beforehand, a separate diameter should be used for each length unless the manufacture is very small indeed. For alternating-current machines, where the same frame can be used for two or more lengths of core or different numbers of poles, it will be quite satisfactory to have two lengths for each diameter. The length of the commutators should be made sufficient to carry the amperes corresponding to a voltage of 230, with the maximum output allowed for in the standard list. As commutators are intended to be kept in stock as finished articles, it will not be advisable to reduce this length when the motor is supplied for higher voltages, especially as the excess in length will be reduced when narrow brushes are used for a higher voltage. The question of using a longer commutator than standard for very low voltages has to be considered, and space has to be allowed for this purpose on the shaft of the machine.

The frame, made of cast-iron for the sake of quick delivery, should be shaped in such a way so as to be suitable for use as a semi-enclosed machine. The construction of the frame is affected by the question of the commutating poles. In machines with fairly large diameters it will be possible to retain round poles. The commutating poles will then have to be fixed either on flat facings on the inside of the shell bolted on from the outside, or secured by one large central bolt forged in one piece with the commutating pole. In the case of machines with small pole-pitch, square main poles will generally be necessary, and they can be laminated with advantage. The method of fixing will then be by machining all round the internal cylindrical surface of the shell, and bolting the poles to it from the outside. It is not advisable to cast-weld the laminations in the iron of the frame, as is often done for round poles.

With regard to bearings, the shield type was recommended for small machines, and the necessity of arranging these so that they can be turned round without any alteration when the motor is to be fixed to wall or ceiling was mentioned. Some form of reduction gear should be standardised for each size of motor. In speaking of armature construction, the author said that a separate spider should not be used for armatures of less than 10 in. diameter, as the value of the stampings which are saved is not sufficient to balance the cost of the spider, and the ventilation is handicapped.

The design of brush-holders lends itself better than any other part to thorough standardisation. The opinions of the users are divided very much between the box and radial types, and it is advisable to arrange for both types of brush-gear to be exchanged for one another whenever required.

The general standardisation of large units cannot be carried out to the same extent as for the small units. It is, however, possible to institute a system of sizes, and to select the most suitable size out of this series when estimating or when executing any order. A standard series of direct-current machines is started with, say, 25 in. or 28 in. bore diameter, and will extend up to, say, 120 in. by differences of 4 in. to 5 in. in the smaller sizes, up to 10 in. in the larger ones. The length of the core can be made of two different dimensions, say, 10 in. and 14 in., thus giving about thirty standard types. In settling the dimensions of the frame one could keep the flux per pole practically constant or increasing very slightly only, and increase the number of poles in proportion to the diameter. This practice is quite suitable for slow speeds, but has the disadvantage of giving too many bars on the commutator when using lap winding. It will therefore be advisable to increase the flux per pole at the same time as the number of poles.

For large alternating-current machines a similar system of standardisation can be adopted, but more latitude is allowed on account of the possibility of varying the length of the core without affecting the pattern of the frame or of the magnet-wheel. Between a diameter of 2 ft. and a diameter of 10 ft. approximately 12 diameters will be found sufficient, the gap in between the smaller sizes being approximately 5 in. and the larger ones 12 in. On account of the varying number of poles to suit the various periodicities and speeds, it will not be advisable to make complete dies for the stampings of the stator, but it will be more suitable to arrange independent cutting dies for the inside and outside diameters, so that deep or shallow stampings can be produced. The poles should be made out of stampings, and here again a line of standard poles can be conveniently designed to suit a number of pole-pitches.

In passing on to electrical considerations in design it was pointed out that the art of practical designing for manufacturing should consist not in fixing in every instance the very best dimensions that can give the correct output, efficiency, regulation, and temperature rise, at an apparently satisfactory price, but in trying to obtain a design which will give an equally satisfactory commercial machine, made up with existing elements, patterns, dies, tools, &c. Thus the adoption of two lengths of core for each diameter is a disadvantage from a purely electrical point of view. When using a long core as required for laminated poles, it will be found again that this is not quite as satisfactory as a round core, but if in order to obtain a suitable ratio to give the room required for round poles one had to go to the expense of adopting a much larger diameter, there is no doubt that the little sacrifice in the electrical design will be fully repaid in the cheapening of the production of the machine and in increasing its field of application. In alternating-current machines the inducement to use long cores would be larger than for continuous-current machines, but the effect of the length of core will have to be accurately investigated on account of the altered conditions of the leakage. This will, however, be met best by adopting machines with long cores for fewer poles, and narrow machines for slow speeds, as they have necessarily a shorter pitch.

The stampings of the continuous-current machines should be arranged for one, or at the maximum two numbers of slots only, and these can be provided with such a wide range of windings as to cover all practical requirements. The number of commutators for a given type of stampings should not be more than two at the most, and should be arranged in such a way that the higher number of bars can be used for 500 volts with the slowest speed, and, therefore, with the largest number of turns per commutator bar, and the lower number of bars should be still sufficient to give the highest speed at the lowest voltage.

The fixing of the windings for the different outputs should be done by starting from the best possible average output of the machine, and by systematically trying all possible combinations of coils in the slots, without alteration to the number of com-

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mutator bars. The armature coils must, of course, be wound in such a way that the same coil can be connected up in "wave" or "lap" windings according to the requirements.

The question of stocking complete armature coils suitable for standard winding is a difficult one to settle, as a stock of this kind has only a limited life. The tape covering, after being varnished, becomes oxidised and brittle, so that it would be impossible to place the coils in any slot, even with the greatest care, if the coils have been made many months beforehand.

The question of the carbon brushes to be stocked is a trying one, as it is only by having a large variety of carbons that sometimes it is possible to work in a type to give a certain output, and in this direction the high conductivity brushes and those made by the Morgan Crucible Company have done much to help the designer. On the contrary, the brushes with graded resistance, also issued by the same company, have not met with so much success, on account of their unsatisfactory behaviour when heating up, and of the difficulty of not being able to reverse the direction of the machine without changing round all the brushes.

In fixing the winding of two- or three-phase machines, the suggestion is often made of leaving the coils disconnected, to meet a large number of voltages by grouping together the poles in one or more parallel circuits, or by connecting either in star or mesh. It will, however, be found in practice that they are only suitable for exceptional cases, because the stocking of a motor which is not completely wound is not a satisfactory arrangement. The machine has to be returned to the winding department for connecting up on receipt of the order, and is often not in its best condition if it was kept in stock for months with a large number of loose connections hanging from it. The best solution appears to be to wind rotors completely for a given number of poles, and stock the motors in all the components without winding the stator.

Discussion at Glasgow.

Prof. F. G. Baily (Heriot Watt College, Edinburgh) asked why, if standardising had reached such perfection with the larger manufacturers, did it generally take two months to obtain a machine? He thought that electrical manufacturers had something to learn from their older brothers, the steam-engine makers; in their case, however, the range of sizes was comparatively small, and undoubtedly this factor made for the cheapening of production. He was inclined to wonder whether all the types and sizes put forward by the ordinary motor maker were necessary. Also it appeared to him that it would be more satisfactory if certain makers specialised in small plant and other makers in the larger sizes upwards, as was done in the production of oil engines. Prof. Baily thought that all classes of electrical plant should be standardised much more than is the custom, and said that the number of variations and differences in comparatively small and unimportant details of design was positively appalling. It was often objected that over-standardisation led to fixity of type, but standardisation encouraged change, as there were so few patterns to alter

Mr. Campbell McMillan (Electric Control, Ltd.), referring to special machines, said that there was often a deadlock between the customers and the makers due to one side or the other, or both, taking up an obstinate attitude. Mr. McMillan thought that the best policy for the maker to adopt was not to refuse to supply special machines or to supply them at ordinary rates, but to insist on a large portion of the extra cost of their production being charged, and to point out that he could not be responsible for delay. One could not be too firm, however, as the new machine might happen to be the forerunner of a new design which might eventually become very popular.

Mr. J. R. Barr (Heriot Watt College, Edinburgh) devoted considerable time to a minute criticism of the author's statement that it was inadvisable to alter the length of commutator and armature for different voltages. He claimed that the retention of one length of core for either high or low voltage was not in accordance with modern practice, and suggested that entirely different lengths of core should be used in the case of 500-volt and 250-volt machines. He further suggested that the overall dimensions of a machine for any given output need not be altered, as with a lower voltage one needed a proportionately long commutator and short armature, and in the case of high-voltage machines a short commutator and long armature. In his opinion the correct procedure was to settle the lengths of core first and afterwards the diameter, and gave various academic rules for fixing the proportions of design.

Mr. W. L. Spence (Messrs. Spence & Ionides) took exception to Mr. Orsettich's description of "rain-proof" motors as "enclosed ventilated," which latter term he would apply to machines with air-cooling tubes and a fan. The use of the same end shields for both A.-C. and D.-C. machines he thought was wrong, as it rendered the interior of the machine particularly inaccessible and cramped the design of other parts. Mr. Spence was of opinion that the cylindrical end covers were best. He noticed that the author had not touched on the question of ball-bearings. In his opinion they should only be used at the commutator or slip-ring end, and not at the pulley end, but he did not think that they would give satisfactory results on heavy drives. He disagreed entirely with the author's views on spiders; he thought that they should be used down to the smallest possible sizes of machines, as they very considerably simplify the process of winding and entirely obviate the risk of having a well-ground and centred shaft spoilt by being dented by a hammer or otherwise while in the winding shop. Mr. Spence was surprised at the author's opinion that any type of good brush-holder was admissible; in his opinion the rocking-arm type of brush-holder has many serious defects, and would not compare with the box type of holder for sparkless running.

Mr. Orsettich, in reply, said that the buyer very rarely made concessions to the manufacturer. In one case 40 machines were rejected by a railway company owing to the depth of the wearing surface of the commutator being $\frac{1}{8}$ in. less than that specified. In another case an insurance company rejected several machines on account of the insulation in the slots not being as specified. The specification called for 45 per cent. mica and 55 per cent. of fibre, and the total thickness was not specified. In the actual machines the thickness of mica was 55 per cent., and of the fibre 45 per cent. Mr. Barr's suggestion that the length of the core should be altered for different voltages was quite out of the question under manufacturing conditions. With regard to Mr. Spence's remarks, an objection to cylindrical end shields was that the tendency was for the feet to be too cramped owing to the reduced length of the frame. In one new line of motors which the author's firm were producing, however, they were adopting this principle. He was not at all in favour of ball-bearings, but he could not agree with Mr. Spence's condemnation of the rocking type brush-holders. The principal objection to the box-holder was the chattering and noise which they often gave rise to.

Discussion at Birmingham.

Mr. S. P. Smith (General Electric Co.) held that the two chief factors to be considered were labour and material, and the question was which should be sacrificed in order to lower the cost of a machine. The material usually cost more than the labour, therefore the designer should cut down the cost of the material and use good labour. This did not mean that inferior material should be used, as in his experience the best material was the cheapest. He considered that finality had not been reached as regards ventilation and insulation, and saw no reason why, if suitable materials were used, the capacity of machines should not be increased by permitting a temperature rise of, say, 170° F. instead of 70° F., as is usual at present.

Mr. N. B. Rosher (Messrs. Moffett & Rosher) remarked that in his opinion the number of types and varieties of machines which a manufacturer had to stock was excessive and unreasonable, especially with respect to A.-C. machines, as there were at least 16 different frequencies in use at the present time. With regard to the position of the slip-rings, he agreed with the author that the best position was outside the bearing bracket, but this had the slight disadvantage that when a rotor had to be taken out it was necessary to remove the slip-rings from the shaft unless the bearings were split. He asked the author to state his views as to the use of ball-bearings, and also as to the most suitable metal for slip-rings. On the subject of terminals he was in favour of a cast-iron terminal box, which could be screwed to either side of the magnet frame at will. As steel conduit is so frequently used for running the cable to the motor, the best arrangement was to connect the conduit to the terminal box by flexible metallic tube. With reference to Mr. Smith's plea for a 170° F. temperature rise, Mr. Rosher stated that machines are regularly supplied for special work to one of the Government departments with a permissible temperature rise of 180° F.

Mr. A. E. Gott considered that motor speeds at the present day were too high. He asked for information respecting split frames and bearings, and described a standard form of terminal board which could be used for any kind of motor, and which he had found to be very satisfactory in practice.

Mr. A. C. Anderson thought that there should be two lengths of core for each diameter, and referred to satisfactory experience with enamelled wire for field coils of small motors.

Mr. A. Willmott (Electric & Ordnance Accessories Co.) preferred the use of steel castings to iron, and said that a proper code system for all parts and material and thorough inspection during manufacture was essential if the costs were to be kept down.

Mr. Holt (Messrs. H. B. Brooks) held that conservative rating of machines was desirable. In his experience the life of patterns was from four to five years, or only as many weeks if the castings were bought out, therefore the cost of patterns should be reduced. He had found enamelled wire satisfactory for field coils, but no good for armatures where the wire has to be bent and worked upon to any extent.

Mr. Orsettich, in reply, said that either malleable iron or phosphor bronze were used by his firm for slip-rings, usually with carbon brushes. His experience of ball-bearings was all against their use for electrical machines. He defended the stocking of high-speed motors on the score that they are asked for by purchasers. With regard to split frames and bearings

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his view was that they should be split when two men cannot lift an armature or when the armature exceeds 14 in. in diameter. On the subject of steel castings, he held that a firm which possessed an iron foundry would naturally use iron castings, otherwise if the castings had to be bought he agreed in the use of steel castings.

A NEW REDUCTION GEAR

MR. P. P. SANDFORD read a Paper on March 10th before the Dublin Local Section of the Institution of Electrical Engineers, in which he described a new speed-reducing gear designed by Mr. J. A. Liddle, of 28 Rutland Street, Edinburgh, originally designed for an electric capstan, but capable of a variety of applications.

The gear is on the sun and planet principle, and consists in driving one train of gears or planets by a spur pinion or sun wheel on the spindle of the prime mover. These planets run round inside a fixed ring with internal teeth, and carry with them the gear cage in which they are housed. All the planets and gear cages rotate in the same direction, giving a rolling instead of a sliding motion. The gear cages each drive succeeding cages by a central pinion or sun wheel fixed to one side until the desired reduction or acceleration in speed is obtained. This reduction or acceleration is directly proportional to the square root or power of the number of sets of gears. The reduction or increase of speed of the first set of gears is multiplied as the root or power of the number of succeeding sets of gears. This reduction or increase of speed is obtained with spur wheels and pinions, whose diameters do not differ to any extent, if at all, and this gives very important results. These pinions are carried on studs, which are supported at both ends, and run in an oil bath.

Tests have shown efficiencies up to 80 per cent. with moderate powers, and the efficiency is said to increase with the load, and owing to the way in which the load is balanced great advantages are claimed over ordinary gearing both as regards strength and silence.

Discussion.

Mr. T. Tomlinson asked for some further particulars of the differences in design for horizontal or vertical shafts. He thought that good circulation carried away the heat generated by the motor better in the vertical than in the horizontal pattern, also that the friction was less in the former case except as regards the footstep bearing.

Mr. Mark Ruddle (City Electrical Engineer, Dublin) thought that the vertical motor practically halved the friction loss, but with the pattern of reduction gearing advocated he hardly saw how the efficiency increased with the power transmitted. He hardly saw how the friction decreased with the load; the efficiency of such gears usually depended upon the size of gear and the power transmitted.

A member asked how the efficiency compared with ordinary spur gearing, and thought that the author's gear did not appear to be particularly efficient, although the design was compact and practical.

Mr. Sandford, in reply, said that the efficiency of spur gearing varied very widely in actual practice, depending according to the conditions under which it was run. He had known instances where it was as high as 97 per cent., but such an efficiency was seldom maintained in practice. The cost of ordinary gear was usually so high as to render its use prohibitive in a great many instances, whereas the gear he had described was considerably cheaper. The first set of this gearing had been developed for use on an electric capstan, and the manager informed him that it could not be damaged, although it was out-of-doors in all weathers and received unskilled attention. The men working the capstans took great delight in breaking new ropes to show what the capstan could do. The saving due to the use of a smaller motor running at a higher speed would often counterbalance the cost of the gear. Additional bearings were required in the case of the gear for horizontal use which slightly reduced the efficiency.

THE NATIONAL PHYSICAL LABORATORY

THE General Board of the Laboratory met at Bushey House, Teddington, on Friday last, and several visitors were also present. After the meeting, at which the report of the work for the past year was accepted, the members of the Board, with the visitors, made an inspection of the laboratories.

The report covers a wide range of subjects, and we can only make brief mention of those of particular interest to our readers. The electrostatic wattmeter referred to in the last report (see Electrical Engineering, March 25th, 1909, p. 287) was in use early in the year. A large number of observations have been made with a similar instrument, up to 10,000 volts, of the loss of energy in insulating materials under dielectric stress. The results confirm those of other experimenters. With varnished cloth the loss increased with a rise in temperature, and a rapid heating up took place just before breakdown. A complete description of the 20-kw. H.T. apparatus mentioned in last year's report is given. Fine adjustment from comparatively low pressures up to 100,000 volts is possible with this apparatus. An investigation has been made into the dielectric strength of ebonite. That made from pure Para rubber gave a value as high as 150,000 volts per millimetre.

Besides a large amount of work on flame standards, the photometric department have carried out a series of tests with a view of establishing a set of electrical sub-standards. At present, however, though the metalised carbon filament lamps at 3 and 2 watts per candle are satisfactory, it has not been possible to utilise tungsten lamps except at an efficiency too low to obviate the colour difficulty when testing metal filament lamps. In all, over 890 carbon and metal filament lamps, three arc lamps, and one quartz mercury vapour lamp were tested during the year.

Much has been done in connection with telephone work. A variety of loading coils and other inductive coils have been tested, and a study has been made of the effect of the high frequencies of telephone work. The effect of leakage on the effective resistance has also been investigated. Attention has also been given to submarine telephone cables, and tests have been made of the permeability of iron strip for lapping the conductors to increase their self-inductance. The lapping of the strip affected it adversely, but the permeability was improved by annealing the complete conductor in hydrogen. A number of tests have been made of the losses in transformer iron with stampings assembled into a square with interleaved joints. The results agreed well with those obtained by the ring method.

A series of tests was made on a large accumulator by the D.P. Battery Co. A cable was tested at various temperatures from 0° to 100° C. The insulation resistance decreased considerably as the temperature rose, but the values during cooling agreed closely with those taken during heating. A standard series of tests is being arranged for dry cells. At the request of the Wiring Rules Committee of the Institution of Electrical Engineers, a number of heating tests have been made on cables with different coverings, and in various conduits and casings. The results are now being considered by the committee. An additional test has been specified for the insulating materials for the Admiralty, viz., that the material should be exposed to the heat from an arc at various distances of between 2″ and actual contact for five minutes at each distance, the surface resistance being measured after each exposure and after the material had cooled.

A Crompton motor-alternator of 15 K.V.A. for supplying an induction furnace presented by the English Gröndal Kjellin Co., has been added to the equipment of the thermometric department, and a new apparatus for the comparison of thermo-couples has been completed.

In connection with the usual exhaustive work dealing with units and standard cells, a large Lorenz apparatus, made entirely of phosphor bronze, is being installed for the purpose of making an absolute determination of the ohm. The general test work has increased considerably. Although there have been fewer ammeters and voltmeters tested than in the previous year, the number of meters tested has increased very much. Remarkable increases in the number of primary cells and fuses tested are noticeable.

Bergmann Works in Canada.—It is stated in the Canadian papers that the Bergmann Elektricitätswerke of Berlin intends to erect works in Canada, primarily for the manufacture of tungsten filament lamps, and eventually for the manufacture of electrical goods and apparatus generally.

Coherers.—Dr. W. H. Eccles read a Paper before the Physical Society on March 11th, describing an investigation into the relations between the energy given to the detector in the form of electrical vibrations and the energy delivered by the detector, as direct current, to the circuit of the indicating instrument. The detector under examination was placed in a circuit containing suitable inductance and capacity, which was secondary to a primary circuit. The primary could be set into electrical vibration by breaking a known current in it. The response of the detector was measured by comparing the sound in its telephone with the sound produced in the same telephone by interrupting a measurable direct current. The power delivered to the detector and to the telephone was determined by extrapolation from measurements on stronger currents with the thermogalvanometer. The results of experiments on coherers made of oxidised iron wire dipping into mercury, and on coherers made of a clean iron point touching an oxidised iron plate, show that in a self-restoring coherer the current increases more and more rapidly as the E.M.F. is raised, till, in general, a point of inflexion is reached, and then the current increases more slowly. If W represents the power in watts delivered to the coherer, and w the power passed to the telephone circuit, then $w = m(W - a)$ where m and a have values settled by the magnitude of the current through the detector. The quantity m for a good low resistance iron-mercury coherer has been found to be as high as 0·06; while a is usually near $1{\cdot}0 \times 10^{-4}$ watt. The author puts forward the hypothesis that the properties of an oxide coherer may arise solely from the temperature variations caused in the minute mass of oxide at the contact by the electrical oscillations and by the applied E.M.F.

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OVERHEAD LINE CONSTRUCTION

A PAPER entitled "Some Notes on Overhead Line Construction" was read before the Yorkshire Section of the Institution of Electrical Engineers at Leeds on Wednesday, February 23rd, by Mr. W. B. Woodhouse (Chief Engineer to the Yorkshire Electric Power Co.). In his introductory remarks, the author said that the legal restrictions here were much more onerous than those of other countries, and that amendment of the present conditions was much needed on modification of the veto possessed by local authorities, compulsory wayleaves, and less stringent Board of Trade regulations.

Regarding the choice between copper and aluminium for conductors, it was remarked that a comparison of the relative costs of these on the basis of resistance was obviously not sufficient to decide the choice; the strength and cost of the supports must also be regarded. Copper had for many years been used for overhead conductors, but a satisfactory specification for hard-drawn copper wires had not yet been generally agreed upon. Such a specification should indicate the breaking stress, the ratio of the stress at the elastic limit to the breaking stress, the ratio of stress to strain within the elastic limit, and the behaviour of the metal under torsion and under repeated bending.

The Board of Trade figure, he pointed out, included a factor of safety of five for the safe stress. So long, however, as the present factors of safety are required by the Board of Trade, the author considers that aluminium is not likely to be extensively used here. The ratio of the diameter of an aluminium cable to that of a solid copper wire of equal resistance per unit length is (for sizes of copper wire from No. 8 to 4/0) 1·44 : 1.

Mr. Woodhouse then proceeded to a detailed method for the determination of sag at any temperature, allowing for wind pressure and elasticity, and embodied the results, together with information as to strength of wooden poles in the set of working curves given in Fig. 1. The way in which these can be

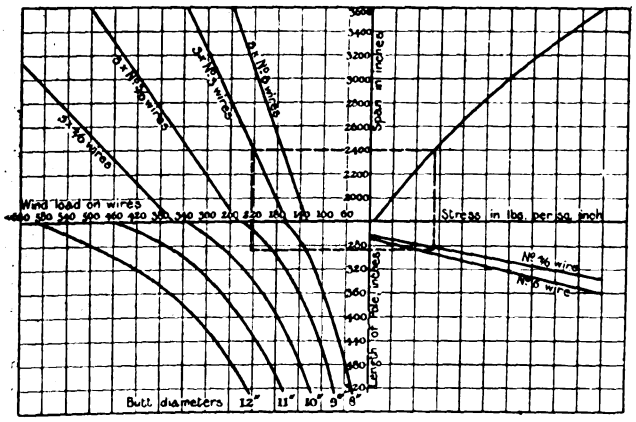


FIG. 1.—WORKING CURVES FOR TRANSMISSION LINE DESIGN.

used to steady the effects of varying the span or the size of the poles is best seen by an example. Thus, if three No. 3 wires are to be used the span is assumed at any likely figure, say 200 ft. (it may be fixed by physical conditions). Reference to the second quadrant and the line corresponding to three wires of No. 3 gives the wind load on wires which is equal to the net pole-strength required. The minimum head room being 20 ft., reference from the first to the fourth quadrant gives the maximum summer sag and therefore the length of pole required (20+summer sag)=height to point of loading (24 ft.). Following the abscissa from this point into the third quadrant to its intersection with the ordinate representing the net strength required gives, if the point falls on a "diameter" curve, the size required (namely, diameter=9·5 in.); if it falls between curves the next larger diameter must be chosen.

It may be noted that the heights corresponding to the intersection of an ordinate in the third quadrant with the "diameter" curves will give the scantlings of a series of poles of varying height and equal net strength.

For spans up to 100 yards wooden poles are cheaper than iron, for longer spans lattice-work iron towers may show an advantage in cost. Wooden poles are usually of red fir, winter felled, and creosoted. The poles should be well seasoned before creosoting, and, if properly treated, will have a life of 15 to 20 years under average conditions. The taper of the poles is a matter beyond our control, but it is advisable to use only poles having a maximum strength of rupture at the ground section, as in course of time this part of the pole will decay most rapidly. Assuming the load concentrated at the pole-top, the proportion of taper to secure this is that the diameter at the top should be not less than two-thirds of the diameter at the ground. The depth to which it is necessary to set the poles in the ground depends, of course, on the nature of the soil—usual practice is to allow from 5 to 8 ft.

The previous consideration has dealt only with normal stresses. Of abnormal stresses the breaking of all wires in one span, and the consequent loading of the support by the unbalanced tension in the remaining spans, is the most important. It is obvious that a support which is elastic in the direction of the wires will in such a case reduce the tension. The advantages of flexible poles in line construction have been pointed out by Mr. A. P. Trotter, and a method of analysing the above case given (Proc. Inst.C.E., Vol. CLXIX., p. 183). In addition to the flexibility of the poles there are many modifying circumstances tending to prevent the wrecking of a number of spans due to such a cause as the above.

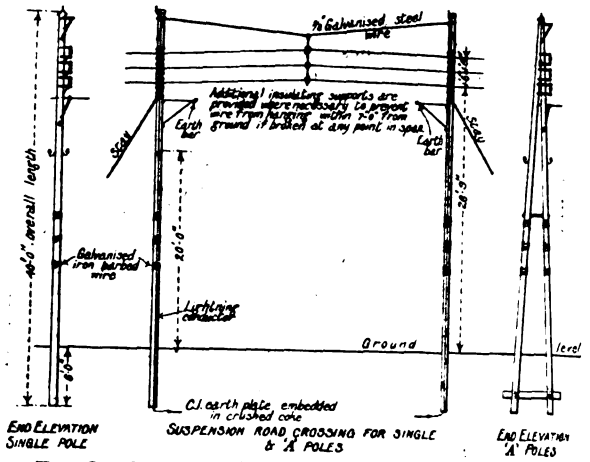


FIG. 2.—CATENARY ARRANGEMENTS AT ROAD CROSSING.

The special work required at angles, road, and railway crossings, will, however, considerably add to the designer's duties. In such cases as road crossings, safety and security are of paramount importance, and there are many types of cradles and supports in use; the type of road crossing adopted by the writer is a catenary suspension (Fig. 2); cradles are unsatisfactory and unsightly, and this suspension appears to possess advantages. The type of railway crossing approved by one of the principal railway companies is given as an example of sound but simple construction (Fig. 3).

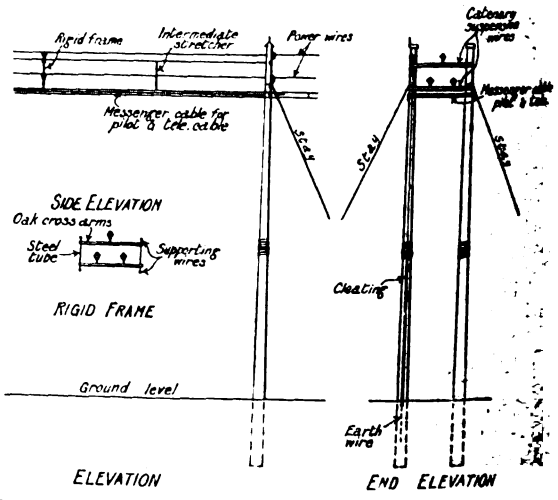


FIG. 3.—CATENARY ARRANGEMENT AT RAILWAY CROSSING.

The choice between a bracket and a cross-arm depends on the spacing and relative position of the wires. A symmetrical spacing is, of course, the best, but for moderate distances this is not of so much importance as the distance between wires; the minimum distance is determined by the possibility of short circuits due to birds or the swaying of the wires. Some tests made by the writer to determine the amount of the latter

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showed that a No. 4/0 wire spanning 50 yards with a 3 ft. 6 in. sag swung 3·5 in. each way during a severe gale.

The total cost of an overhead line may be divided into four parts:—Cost of wires, supports, labour, and wayleaves capitalised.

The cost of wires per mile is decided entirely by electrical considerations and with a portion of the labour costs is independent of the number of supports. The cost of supports per mile varies with the number, some items being increased in cost with an increased span and some decreasing. If the number of supports per mile is decreased the poles must be stronger to meet the extra weight and wind load, they must be longer to maintain the same head-room against the increased sag of the wires, and the foundations must be made more secure. The brackets, arms, insulators, stays, &c., must be stronger and the labour of erection per pole is increased. Against these increases per pole, however, we must set the decreased number of supports, and therefore for any particular line there is a most economical span to be found. Using single poles under the present Board of Trade rules, a span exceeding 100 yards is not economical.

DISCUSSION.

Mr. W. EMMOTT (Halifax) considered that a certain amount of flexibility in the supports was a desirable feature, as if the poles were too heavy the wires were more liable to break.

Mr. WILSON HARTNELL (Leeds) remarked that the really important matter was the question of what could be done to lessen the legal difficulties which at present stand in the way of the erection of H.-T. overhead construction in this country. Legislation should facilitate instead of hinder the erection of such lines, so that they could be constructed more economically in sparsely populated districts, where the danger is slight.

Prof. G. D. ASPINALL PARR (Leeds University) dealt with the design of insulators, and asked if Mr. Woodhouse tried glass instead of porcelain. He understood that the difficulty of the alkaline glaze had been surmounted in the States, so that they could be used for high pressures in damp atmosphere.

Mr. H. H. WRIGHT (Halifax) wished to know what system of protection against lightning the author adopted, and he described a water-jet method he had seen in Norway on a 30,000-volt line.

Mr. H. E. YERBURY (Electrical Engineer, Sheffield Corporation Tramways) agreed that easier conditions should be granted where the line is carried over arable land, &c. He was in favour of the Board of Trade having power to make final decisions in cases of obstruction. Lattice-work poles appealed to the speaker, but painting was an important item to consider.

Mr. WOODHOUSE, in reply, said that the really serious question was the restrictions they had to fight against. It would be much better if some form of compulsory wayleaves could be adopted in open country, as now they were entirely dependent on the personal prejudice of the landlord. He had not used glass insulators in the open, but his experience on high-tension switchboards has not been happy. For outside work the strength and cheapness of porcelain was preferable. He had used the horn type of lightning protector, but no type could be relied on to act infallibly in every case.

Dublin Section of the Institution of Electrical Engineers.—A conversazione of the Dublin section of the Institution of Electrical Engineers was held at the rooms of the Royal Dublin Society last Saturday, when, in addition to music and lantern lectures, &c., demonstrations were given of electric cooking and Röntgen rays.

Tax on Electricity in Greece.—According to the *Elektrotechnische Zeitschrift*, a tax is about to be imposed by the Greek Government on electricity and gas used for lighting and heating. The amount is fixed at 10 per cent. of the cost of production. It appears that only domestic lighting and heating are concerned, as gas and electricity used for industrial and public purposes are exempt.

British Westinghouse Engineers' Club.—The fourth annual dinner of this Engineers' Club was held at the Grand Hotel, Manchester, on Friday last, and was attended by about two hundred members of the staff. Mr. J. S. Peck presided, and Mr. Newcomb Carlton, managing director of the company, was present. Mr. D. N. Dunlop, sales manager of the supply department, proposed the toast of the company, coupled with the name of Mr. Carlton, who, in his reply, regretted some of the limitations placed by trade unions on productive output, and said that it was in the interests of employers and employees alike that both should work together. Mr. Blunt, general sales manager, proposed the toast of the works organisation, to which Mr. Lange, managing director of works, replied. Mr. Tearle and Mr. Peck also spoke, and several members of the staff contributed to an excellent programme of music.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[READERS APPLYING TO ANY OF THE UNDER-MENTIONED FIRMS FOR COPIES OF THE CATALOGUES OR PAMPHLETS REFERRED TO ARE REQUESTED TO MENTION "ELECTRICAL ENGINEERING."]

METAL FILAMENT LAMPS.—A revised price list from the Electric & Ordnance Accessories Co. (Aston, Birmingham) gives notice of reduction in the prices of "E.O.A." metal filament lamps.

CABLES.—A pamphlet from Messrs. W. Geipel & Co. (Vulcan Works, St. Thomas Street, S.E.) describes the properties of "Firmacit" cables, which are covered with a special acid and alkaline vapour-proof material rendering them particularly suitable for overhead work and for use in chemical works, dye works, oil refineries, mines, &c.

ELECTRIC OVEN.—A leaflet from Messrs. F. A. Wilkinson & Partners, Ltd. (Harpenden, Herts) describes an electric oven for cooking and hot water supply. This is a development of the Wilkinson heater described in ELECTRICAL ENGINEERING, May 13th, 1909, p. 541.

EXHAUST STEAM PLANT AND COOLING TOWERS.—A book is to hand from Michael Pal & Co. (Parliament Mansions, Victoria Street, London, S.W.), describing the low-pressure turbine plants with exhaust steam accumulators on the Schwarz system for which they are sole agents for the United Kingdom and colonies. A large number of diagrams and photographs are included, as well as a description of a complete plant at the Hibernia Colliery. Various patterns of jet and surface condensers are described, including a new condenser without an air pump, referred to elsewhere in this issue. A large number of cooling towers are illustrated. These are constructed either entirely of impregnated wood or with an exterior iron frame, the latter construction enabling higher and stronger towers to be built. The book concludes with an illustrated description of cooling and cleaning plant for blast furnace gases. This comprises a special design of washing tower, and, where very clean gases are required, as, for example, for running internal combustion engines, a centrifugal cleaner in which the gas is mixed with water in the form of a fine spray, which causes all the dust particles to increase in weight by taking up water and to fall out of the stream of gas.

Wireless Telegraph Notes.—It is stated that the Grand Trunk Pacific Railway Co. have asked the Canadian Government for authority to erect wireless telegraph stations across the mountains to connect Edmonton with Prince Rupert.

At the annual meeting in London last week of the Association of Chambers of Commerce, a motion by Major S. Flood Page, expressing the opinion that it is desirable that all passenger ships for oversea traffic should be fitted with wireless telegraphy, was passed. The Executive Council was requested to urge the Government to introduce a Bill making this compulsory.

It is stated that the Argentine Government is considering a plan, in connection with other interested nations, for the establishment of wireless telegraphic communication with Europe, Asia, and Africa. The proposed stations will extend from Tierra del Fuego in the southernmost part of the Republic, along the Argentine, Uruguayan and Brazilian coasts to the Fernando de Noronha, Cape Verde, and Madeira Islands to Gibraltar, and from thence to the countries of Europe along the Atlantic and Mediterranean coasts, and from the Mediterranean coast to Asia and Northern Africa.

The Zanzibar Government have issued regulations providing that no wireless telegraph station may be erected in Zanzibar except under licence. Persons establishing wireless telegraph stations without such licence are liable to a fine not exceeding £100, or to imprisonment for a term not exceeding twelve months, or to both, and in either case forfeiture of the apparatus.

The Admiralty are contemplating the installation of a wireless telegraph station at Scarborough.

20,000-h.p. Turbo-alternator for Paris.—The French house of the firm of Brown, Boveri & Cie. (Baden, Switzerland) has received an order from the Compagnie Générale de Chemins de fer et d'Electricité for a 20,000-h.p. turbo-alternator complete with surface condenser plant. The set will run at 750 r.p.m., and will generate three-phase current at 25 cycles, 10,250 volts. This set, which will be the largest yet constructed in Europe, will be installed in the St. Denis central station, Paris.

Manchester Local Section I.E.E.—At the annual general meeting of the Manchester Local Section of the Institution of Electrical Engineers on Tuesday, Mr. J. S. Peck (British Westinghouse Electric & Manufacturing Co., Ltd.) was elected Chairman, in succession to Mr. S. J. Watson, Chief Electrical Engineer to the Bury Corporation. The Vice-Chairman is Mr. W. Cramp, and the Committee are as follows: C. J. Beaver, Dr. F. H. Bowman, A. A. Day, A. P. M. Fleming, J. Frith, Prof. E. W. Marchant, T. L. Miller, S. L. Pearce, Dr. E. Rosenberg, Prof. A. Schwartz, C. D. Taite, and A. P. Wood. The Hon. Sec. and Treasurer is Mr. H. W. Wilson.

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LOCAL NOTES

BELFAST: *Tramway Centre Poles.*—At the weekly meeting of the Electrical and Tramways Committee on the 21st inst., the General Manager of the tramways reported that the alteration from centre poles to side poles in certain streets had been carried out with very satisfactory results.

BIRMINGHAM: *Proposed Tramway Extensions.*—Residents of the Harborne & Quinton districts have petitioned the City Council to extend the tramways there.

CHESTERFIELD: *Top Covered Cars.*—A motion that the Tramways Committee should prepare an estimate of the cost of fitting top covers to the cars, was negatived at the last meeting of the Council. It was pointed out that the cost of top covers would be £1,700, and that it was doubtful whether the present motors were large enough for the extra weight. Further, the undertaking was only just making a profit, although the cars ran at a loss for four days of the week. Week-end traffic was the only thing the committee had to look to, and the present state of the finances would not permit of any large capital expenditure of this character.

DOWLAIS: *Opposition to Overhead Wires.*—Although the Council have given consent to the Merthyr Electric Traction & Lighting Co. to erect overhead wires for the supply of electricity in Dowlais, the local Chamber of Commerce objected, and consequently a Board of Trade inquiry has had to be held. Mr. A. P. Trotter, Electrical Adviser to the Board of Trade, held the inquiry on the spot on Thursday, and reserved his decision. For the opponents to the scheme, the Electrical Engineer at the Dowlais works was called, and expressed the opinion that the climatic conditions of Dowlais were not suitable to overhead wires, the place being very exposed and swept by violent storms.

DUDLEY: *New Storage Battery.*—The new storage battery which has been installed at the Corporation Electricity Works was put into operation last week. When the undertaking was started in 1899, the generating plant consisted only of two 150 h.p. sets, but additions have gradually been made, and the present capacity is now 2,500 kw. The motor load now aggregates 1,100 h.p.

EASTLEIGH: *Provisional Order Revoked.*—The Board of Trade have revoked the Electric Lighting Provisional Order granted to the Council in 1904.

HUCKNALL TORKARD: *Provisional Order Revoked.*—The Board of Trade have intimated their decision to revoke the Council's electric lighting order.

HULL: *Underground Telegraph Cable.*—Provision has been made in the Postmaster-General's current estimates for the cost of carrying an underground cable from Leeds to Hull. The Hull Chamber of Commerce has been working at this matter for several years.

KINGSWOOD: *Overhead Wires.*—The Kingswood Electric Supply Co. are still negotiating with the Council concerning the erection of overhead wires. The company have repeatedly assured the Council that the carrying out of the scheme largely depends upon the ability to adopt overhead wires, as the cost of underground wires in such a scattered area would be prohibitive.

LINTHWAITE: *Cost of Repairing Tramway Track.*—With reference to our note last week concerning the cost of repairing the tramway track in Linthwaite, which the Council has been ordered to undertake, the Huddersfield Tramways Committee have rejected an offer to take over the track for £5,000.

LIVERPOOL: *Tramway Accounts.*—The gross profit from the Corporation tramways for 1909 was £192,522, and after meeting capital charges there is a net profit of £82,354, an increase of £7,780. The sum of £54,903 is transferred to reserve, renewals, and depreciation, and £27,451 to relief of rates. Working expenses show a decrease of £6,866 15s. The number of passengers carried during the year was 121,532,940, a decrease of 394,943 over 1908. The experiment with running first-class cars is being continued, and they are to be run on a further section. The department has 546 cars in stock, and an ordinary day's service consists of 407.

LONDON: *London County Council: Tramway Employees.*—Sectional Committee of Conciliation Board No. 1, which deals with disputes between the Council and its tramway employees, has given a decision concerning certain matters of detail regarding Sunday labour, spread overtime, recognition of signing on and off time, and holidays. The result will be an increased expenditure of £12,000 per annum. The Highways Committee, after very careful consideration, are satisfied that the Board has arrived at its decision after being convinced that its proposals are fair alike to the Council and to the men. They therefore recommend the Council to adopt them.

Fulham: Loans.—The Finance Committee of the L.C.C. have sanctioned a loan of £3,868, mainly for additional boilers. A mild complaint is made that the work had been completed before the loan was sanctioned.

Hammersmith: Street Lighting.—The Finance Committee of the L.C.C. have sanctioned a loan of £2,000 in connection with the use of Osram lamps for street lighting. We referred to some of the results of the change in our issue for March 3rd, p. 155.

Marylebone: Loan.—A loan of £4,500 has been sanctioned by the Finance Committee of the L.C.C. as balance of cost of a site acquired for electrical purposes.

MACCLESFIELD: *Provisional Order Revoked.*—The Board of Trade have revoked the Electric Lighting Provisional Order granted to the Council in 1901.

PENZANCE: *Electric Supply.*—As the Penzance & District Electric Supply Co. have failed to put the Electric Lighting Provisional Order which they hold for Penzance into effect, the Board of Trade have informed the Council that they propose to revoke it. The Electric Lighting Committee will report at the next meeting of the Council.

WEST HARTLEPOOL: *Proposed Purchase of Tramways Co.*—In a short article in our issue for March 10th, p. 171, we mentioned, in connection with the supply of electrical energy to the Hartlepools Electric Tramways Co., that the West Hartlepool Corporation intended to promote a Bill in Parliament for the purchase of certain of the company's lines. It was also intended to include in the Bill an application for running powers over other routes, and also powers to make certain extensions. The Hartlepool correspondent of the *Yorkshire Daily Post* now learns that the resolution authorising the Bill to be promoted is not operative. It was arrived at by a majority of two, but there were only twenty-eight members of the Council present at the meeting. Altogether the Council is constituted of thirty-two members, but it is necessary for a resolution of this character to be passed by a majority of the whole Council.

WORCESTER: *Street Lighting.*—Mr. C. M. Shaw, the Borough Electrical Engineer, has been experimenting with street electric lamps, and reports some very satisfactory results. He proposes to take over forty-four additional street gas lamps and convert them to electricity.

YORK: *Electric Tramways.*—By the opening of an extension of the electric tramways from Nessgate to Dringhouses, the total length of line now being worked is four miles. The completion of the system is being pushed forward rapidly.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BEDFORD.—The Electricity Committee require a 750-kw. single-phase generating set. Particulars from Borough Electrical Engineer, and tenders by March 28th.

BOHEMIA.—The Patzau Municipal Authorities have decided to erect electricity works.

BRISTOL.—A 500-kw. converter is to be obtained at an estimated cost of £1,225.

CUBA. The Legislature has sanctioned the erection of an electricity works at Polondron, Province of Matanzas. Señor Antonio Larraz, of Bolondron, has the concession.

DUNDALK. A Local Government Board inquiry was held last week regarding a loan of £20,000 for a municipal electric lighting scheme.

FALKIRK. The Council contemplate extensions to the electricity undertaking at an estimated cost of £12,000. Mr. W. W. Lackie, Chief Engineer to the Glasgow Corporation, has been appointed Consulting Engineer for the new works.

INDIA.—Detailed plans are in preparation for a municipal electric lighting scheme.

LONDON: *Poplar.*—A loan of £1,766 has been sanctioned by the Finance Committee of the L.C.C. for electric lighting purposes.

Woolwich.—A loan of £4,529 has been sanctioned by the Finance Committee of the L.C.C. for mains extensions.

NEW ZEALAND.—The Auckland City Council have adopted the scheme of Mr. A. Wyllie, City Electrical Engineer, for the erection of electricity works, at an estimated cost of £215,000. The scheme provides for four 3,000 kw. D.-C. generators and two 1,000 kw. A.-C. generators, the various estimates being as follows:—Buildings and sites, £65,300: boiler-house, £26,100; engine-room, £58,800; sub-stations, £10,000; mains, £46,000. This sum, it is estimated, will cover the whole of the capital expenditure during the next five years. The Council already possess a small generating station, which was erected in 1906.

NORWICH.—The Electricity Committee recommend a loan of £17,785 for electrical extensions. It is intended to instal an exhaust steam turbine.

TAVISTOCK. Messrs. Drake & Gorham have placed before the Council a proposal to erect electricity works. A ratepayers' meeting has decided in favour of such a scheme.

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Miscellaneous

ABERDEEN.—Portions of the tramway track are to be relaid at an estimated cost of £11,226.

BOLTON.—Stores are required by the Electricity Department. Particulars from Borough Electrical Engineer, and tenders by March 31st.

COLWYN BAY.—Tenders are invited for stores for the Electricity Department by April 9th.

GOVAN.—The Electricity Committee require stores. Particulars from Borough Electrical Engineers, and tenders by March 29th.

H.M. OFFICE OF WORKS.—Tenders are invited from manufacturers only for the supply of metal filament lamps of British manufacture. Particulars from Storekeeper, H.M. Office of Works, 12 Lambeth Palace Road, London, and tenders to the Secretary, Storey's Gate, London.

HUDDERSFIELD.—The Electricity Department requires 1,000 single-phase A.-C. meters. Tenders by March 31st. Particulars from Borough Electrical Engineer.

LONDON: *Hackney.*—The Electricity Department require 80,000 pairs of yellow flame arc lamp carbons. Particulars from the Town Clerk, and tenders by April 7th.

SOUTHAMPTON.—The Council invite tenders for rails, poles, cast-iron pole bases, granite setts, &c. (See an advertisement on another page.)

WALLASEY.—Tenders for stores for the Electricity Department are invited by April 18th. Particulars from the Borough Electrical Engineer.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

PROVINCES.

AUCKLAND (Durham).—A resolution in favour of adopting electricity in the workhouse infirmary has been passed.

BARKING.—School. Secretary, Education Committee.

Skating rink. Builder, A. Blake, Wakering Road.

CHESTER.—School, Victoria Road (£3,000). Thos. Mayers, builder, Rowton.

DARLINGTON.—Additions, Workhouse (£3,500). Pallister & Son, Crook, Durham.

DUNFERMLINE.—Workshops and offices, Woodhead Street (£3,000). Normand & Thomson, 21 Queen Anne Street, Dunfermline.

EDINBURGH.—Coach works, McDonal Road (£2,750). Architects, P. R. McLean, 24 St. Andrew Square, Edinburgh.

Cox's factory, Gorgie Mills (£2,500). Architects, G. Beattie & Son, 136 George Street, Edinburgh.

EXETER.—St. Luke's College (£5,000). Builders, G. Setter & Son, Exeter.

GATESHEAD.—School (£4,000). Builder, F. W. Purser, West Street, Gateshead.

KING'S NORTON.—Baths (£7,000). Architect, J. P. Osborne, 95 Colmore Row, Birmingham.

LIVERPOOL.—Works, Pall Mall. Architects, R. Owen & Sons, Crosshall Street, Liverpool.

NEWCASTLE.—Children's institute (£7,000). Shewbrooks & Hodges, Grainger Street West, Newcastle.

STOKE-ON-TRENT.—Theatre and entertainment hall, Church Street, for the King's Hall Co., Birmingham.

TENDERS RECEIVED AND ACCEPTED

LONDON: *London County Council.*—The contract for the supply of the whole of the compressors for the construction of the main sewer from Battersea to Deptford has been awarded by Messrs. Griffiths & Co., the main contractors, to Messrs. Reavell & Co., Ltd., of Ipswich. There are in all 24 compressors to be installed at the various shafts and to be electrically driven, some by single-phase motors through automatic clutches of Messrs. Reavell's construction, some by two-phase motors through gears, and some by continuous-current motors directly coupled to the crankshafts of the compressors.

The tender of the Standard Engineering Co. for smiths' shop equipment for the second portion of the central car repair depôt is recommended for acceptance at £1,366 13s.

The tender of Messrs. Walter Scott, Ltd., for the supply of 2,000 steel fishplates at £10 10s. per ton is recommended for acceptance.

Battersea.—The Council have accepted the following tenders for annual supplies to the electricity department:—Oils, Price's Patent Candle Co.; engine-room stores (with the exception of packings), Pryke & Palmer; packings, R. Beldam & Co.; Nernst lamps and globes, Electrical Co., Ltd.; carbon filament lamps, British Thomson-Houston Co., Ltd.

Poplar.—The Council received the following tenders for extensions to meet next winter's load:—Cables: Western Electric Co., Ltd. (accepted), £3,959; W. T. Henley & Co., £4,080; Callenders Cable Co., £4,097 10s.; Siemens Bros. & Co., £4,106; British Insulated & Helsby Cables, £4,145 17s.

Switchgear:—Johnson & Phillips, Ltd. (incomplete), £471 3s.; British Westinghouse Co. (accepted), £484 5s.; Ferranti Ltd., £485 17s.; British Thomson-Houston Co., £516.

Converting plant:—British Westinghouse Co., Ltd., motor-generators, £2,700; Bruce, Peebles & Co. (accepted), motor-converters, £2,785; British Westinghouse Co., Ltd., rotary converters, £2,810; British Thomson-Houston Co., Ltd., motor-generators, £3,115; Dick, Kerr & Co., motor-generators, £4,160.

WATFORD.—The following tenders are accepted:—W. T. Henley's Telegraph Works Co., Ltd., twelve months' supply of cables; W. Cory & Son and E. Foster & Co., twelve months' supply of coal; Babcock & Wilcox, Ltd., fitting new close pattern links for chain grate stokers, £66.

The Midland Railway Co. have placed an order with the British Vacuum Cleaner Co., Ltd., for a 40,000 cubic feet of air per hour capacity plant, for the special purposes of cleaning a whole composite main line train in half an hour. This plant is capable of dealing with two tons of dust every 60 minutes. It is driven by a 16 h.p. electric motor, and is arranged so that 20 men may be using cleaning implements at one time. The same firm have also been favoured with orders from the North-Eastern Railway Co. for a complete installation at their station hotel, York, and from the Great Central Railway, Great Western Railway, and the Portuguese Railway at Lourenço Marques, for the new portable electric cleaners, which are driven by motors of one-third horse-power and upwards.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £61 5s. to £61 15s. per ton (last week, £61 10s. to £62).

ELECTRICAL INSTALLATIONS, LTD.—We are informed by Messrs. Electrical Installations, Ltd., of Bassishaw House, Basinghall Street, that they have no connection whatsoever with a firm of similar name who called a meeting of their creditors in Manchester last week.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—J. G. Bauer, trading as the Electrical & General Engineering Co., 17 Gracechurch Street, London, has been adjudicated bankrupt. The first meeting of creditors will be held on April 1st at 12 noon at Bankruptcy Buildings, Carey Street, London, where the public examination will take place at 11 a.m. on April 28th.

W. C. Ellis, electrician, Applegate Street, Leicester, has been adjudicated bankrupt.

Mr. L. W. Wykes, 24 Friar Lane, Leicester, chartered accountant, has been appointed trustee in the bankruptcy of Alan McAlpin, electrical engineer, 44 Cank Street, Leicester.

CANADIAN AGENTS WANTED.—A London firm wish to appoint energetic and reliable agents in all the principal cities of Canada for the sale of their machinery, tools, electrical apparatus (both scientific and commercial), power generators, &c. Full particulars from the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W.

HIGH-TENSION INSULATORS.—Messrs. Feld Bros. & Co., Ltd., 25 Budge Row, London, have taken over the sole agency for Great Britain of Messrs. Rosenthal & Co., Bavaria, for their high-tension insulators.

CHANGE OF ADDRESS.—The Engineers' Department of the North Metropolitan Electric Power Supply Co. has been removed to the Manor House Offices, Seven Sisters Road, Finsbury Park, N.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Colne & Trawden Light Railway Co., full dividend on the 6 per cent. preference shares for 1909; Gateshead & District Tramways Co., 6 per cent. on the ordinary shares for 1909.

METROPOLITAN ELECTRIC TRAMWAYS.—Subscriptions have been invited for an issue of £250,000 five per cent. debenture stock at 91. The company are now operating 53 miles of tramways and light railways in the North Metropolitan area, forming a complete network of lines connecting the suburban districts of Middlesex and Hertfordshire with London.

NEW PUBLICATIONS

Practical Curve Tracing. By R. Howard Duncan. (London: Longmans Green & Co.) 5s.

The Depreciation of Factories, Mines and Industrial Undertakings, and their Valuation. By Ewing Matheson. Fourth edition. (London: E. and F. N. Spon.) 10s. 6d.

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COMPANIES' MEETINGS AND REPORTS

OXFORD ELECTRIC CO.—At the annual meeting on Thursday, Sir Henry Mance, the Chairman, stated that the contract with the Corporation for street lighting has been extended for another four years, and the company had promised to introduce some of the latest and best forms of arc lamps. It was creditable, he thought, to the engineering staff that, notwithstanding the fact that they had generated 60,000 more units, the expenditure on coal had been rather less than in the previous year.

VICKERS, SONS & MAXIM.—The profit for 1909, including the sum brought forward from 1908, was £474,716, and the directors recommend a dividend at the rate of 10 per cent. upon the ordinary shares. The net profit was less than in the pervious year.

BROMPTON & KENSINGTON ELECTRICITY SUPPLY CO.—At the meeting last week, it was stated that although there was an increase of 10,976 lamps connected during 1909, the revenue declined to the extent of £2,300. This result was mainly due to metal filament lamps. Owing, however, to economies in working, the net decrease in revenue was only £713. During the year a new switchboard has been erected at a cost of about £3,000. Mr. H. R. Beeton, who presided, also drew attention to the growth of rates and taxes. These now amounted to a sum equal to nearly 25 per cent. of the dividends, and forced the company to charge the public 10 per cent. more for current than would otherwise be the case.

RIO DE JANEIRO TRAMWAY LIGHT & POWER CO.—An interim report has been published, in which an increase in the rate of dividend from 4 per cent. to 5 per cent. is foreshadowed. The earnings for last year amounted to £626,000, or an increase of £65,000. A further 62,000 shares are to be issued at par, existing shareholders having the right to apply for one share for every five now held.

CITY OF LONDON ELECTRIC LIGHTING CO.—Mr. J. B. Braithwaite presided at the annual meeting last week, and mentioned that the capital expenditure during 1909, viz., £58,940, was heavy on account of extensions of plant and offices at Bankside. It would also be heavy during the current year. Parsons turbines were being installed, in addition to an economiser.

LIVERPOOL DISTRICT LIGHTING CO.—The net profit for 1909 was £3,448, and the directors recommend a dividend of 4 per cent. for 1909, after setting aside £975 for depreciation.

BRITISH INSULATED & HELSBY CABLES.—It was stated at the meeting on Monday that the diminution of gross profit for 1909, viz., £131,767 against £193,831 for 1908, was largely due to the smaller volume of business done. Two causes were put forward, (1) the introduction of metal filament lamps rendered it necessary for supply authorities to extend their mains, (2) the total cessation of new tramway enterprise. Further, owing to the approach of the purchase by the Government of the National Telephone Co., both these concerns, who are large customers of the company in normal times, have been very sparing with their orders. But for the recent expansion of the company's business into channels not strictly coming within their special business as cable-makers, the depression would have been more severely felt.

BOURNEMOUTH & POOLE ELECTRICITY SUPPLY CO.—Mr. A. H. Sanderson, presiding at the annual meeting on Thursday, said that metal filament lamps had been more rapidly adopted in Bournemouth than in most other places. The reason was that there were no factories in Bournemouth, and the company, having to rely upon its lighting business, was exceptionally susceptible to such economies as might be effected by the new lamps. In the circumstances, the Board had thought it wise to increase their charge of lighting by ½d. per unit, and so far there had been no indications of the loss of any consumers in consequence.

SCARBOROUGH ELECTRIC SUPPLY CO.—At the annual meeting on Thursday, it was stated that the directors proposed to give a trial to the Norwich system of charging for electricity upon the basis of a standing charge of 15 per cent. on the rateable value of the premises supplied, *plus* 1½d. per unit for all energy consumed.

FOLKESTONE ELECTRICITY SUPPLY CO.—The net profit for 1909 was £7,691, and after transferring £4,300 to depreciation, a dividend at the rate of 5½ per cent. for the year is recommended, carrying forward £341. The company have taken over the consumers of a private supplier of electricity in Folkestone.

NEWCASTLE-ON-TYNE ELECTRIC SUPPLY CO.—At the annual meeting on Monday, Dr. J. T. Merz, the Chairman, said that the receipts for the present year, compared with the same period for last year, were 10 per cent. better. The unsettlement in the coal trade had had a serious effect upon trade on the north-east coast, but so far as the company's supplies of coal were concerned, provision had been made so that the directors did not think the output from the works would be seriously affected, even if the coal dispute were to get worse.

GALLOWAYS.—At the annual meeting last week, Mr. C. Leonard Agnew, the new Chairman, stated that when he had taken over the Chairmanship of the company he found the management of the whole business very slack. The directors had formed themselves into a permanent sitting Committee of Inspection, and they hoped, with hard work, to bring the company round to its old position in the engineering world. It had been decided to electrify both the company's works, and good progress had been made with the Knott Mill Works during the latter part of last year, from which important savings were expected. A scheme for the reduction of the company's capital from £330,000 to £166,064 was withdrawn by the Board after considerable opposition at the meeting. Under this scheme it was proposed to reduce the value of the ordinary shares from £10 to 1s. each.

NEW COMPANIES

LOBITO, BENGUELLA & CATUMBELLA ELECTRIC LIGHT & POWER CO., 16 Victoria Street, Westminster, S.W. Capital, £200,000. To generate electric power at the Falls on the Catumbella River, Province of Benguella, Angola, Portuguese S.W. Africa, and elsewhere, and to adopt an agreement with the Peninsular Development Syndicate. The first directors are Sir Robert H. Drummond Hay, C.M.G.; H. Reeve, C.M.G.; A. S. Collard; B. D. Fox; and F. W. Kerr.

WRIGHT ELECTRIC SALES CO., 5 Upper Mill Hill, Leeds. Capital, £2,000. To take over the business of electrical engineer and dealer in electrical appliances carried on by H. J. Wright.

MAXIM LAMPS WORKS, Shernhall Street, Walthamstow. Capital, £8,000. To take over the business carried on by the Receiver for the debenture holders of the Maxim Electrical Co., Ltd. The subscribers are F. Taussig, 46 Stanwick Mansions, W. Kensington, electrical engineer; and J. F. Poynter, 56 Shernhall Street, Walthamstow, electrical engineer.

WALKER, HORROCKS & CO., Cornwall Buildings, 45 Newhall Street, Birmingham. Capital, £5,000 (2,500 preferred ordinary shares). To carry on business of suppliers of electricity, &c.

PONTELEC WELDING PATENTS. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, London, E.C. Capital, £30,000 (10,000 seven per cent. cumulative preference shares). To acquire and use inventions relating to electric welding, and to adopt an agreement with the Universal Electric Welding Co. of America, L. S. Lachman, E. B. Koopman, and M. Lachman.

DAWLISH ELECTRIC LIGHT & POWER CO., Warren Cottage, The Warren, Starcross, Devon. Capital, £10,000. To supply electrical energy in Dawlish.

FORS ACCUMULATOR FOREIGN PATENTS, 110 Strand, London. Capital, £3,000 (952 preference shares). To acquire certain foreign patents granted to H. F. Joel.

SURFACING MACHINERY, 14 Lower Essex Street, Birmingham. Capital, £10,000 (7,500 preferred shares). To acquire an invention relating to improvements in the manufacture of electric rotary floor surfacing, scrubbing, and polishing machines.

APPOINTMENTS AND PERSONAL NOTES

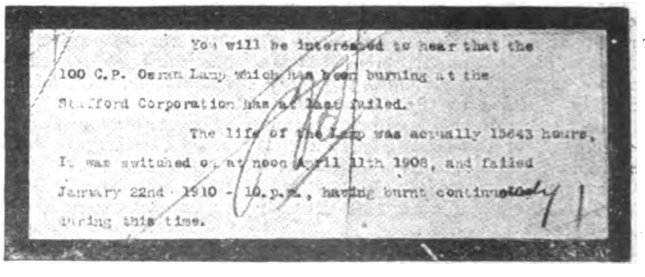
Mr. P. E. Smith, who is in charge of the Electrical Standards Division at the National Physical Laboratory, is proceeding to Washington in April as the British representative at a conference to complete the work of the International Conference on Units of 1908. Great Britain, France, Germany, and the United States will be represented.

The Battersea Borough Council received 122 applications for the position of commercial assistant to the Electricity Department at £2 a week with commission. Mr. C. W. Woodhead, Wilberforce Road, Finsbury Park, was appointed.

The will of the late Mr. Charles Emmott, who was a director of the Cleveland & Durham County Electric Power Co., Ltd., has been sworn at £24,500, with net personalty at £12,780.

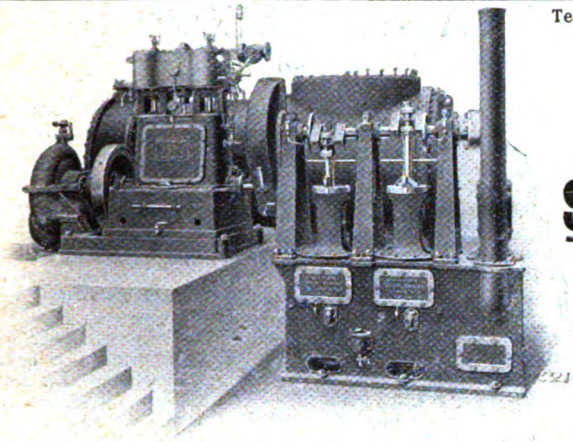
The Maidstone Electricity Committee are to appoint an additional meter inspector and general assistant at a salary of 30s. per week.

IN MEMORIAM


You will be interested to hear that the
100 C.P. Osram Lamp which has been burning at the
Stamford Corporation has at last failed.
The life of the lamp was actually 15643 hours,
It was switched on at noon April 11th 1908, and failed
January 22nd 1910 - 10 p.m., having burnt continuously
during this time.

The above is a reproduction from a letter received by the General Electric Co. (Osram Lamp Department). The lamp in question is the same one that was referred to in ELECTRICAL ENGINEERING of February 10th (page 85), and has at last burnt out. It was running the whole time on its proper voltage, and gave a good light up to the end of its 15,643-hours' life.

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Surface Condensing Plant.

Telegrams: "Belliss, Birmingham." Est. 1852. London Office: 8, Victoria St., S.W.

BELLISS & MORCOM, Ltd.,

Engineers, BIRMINGHAM.

SELF-LUBRICATING ENGINES

Sizes from 5 to 2,700 B.H.P.

CONDENSING PLANTS,

Surface or Jet Types of any capacity.

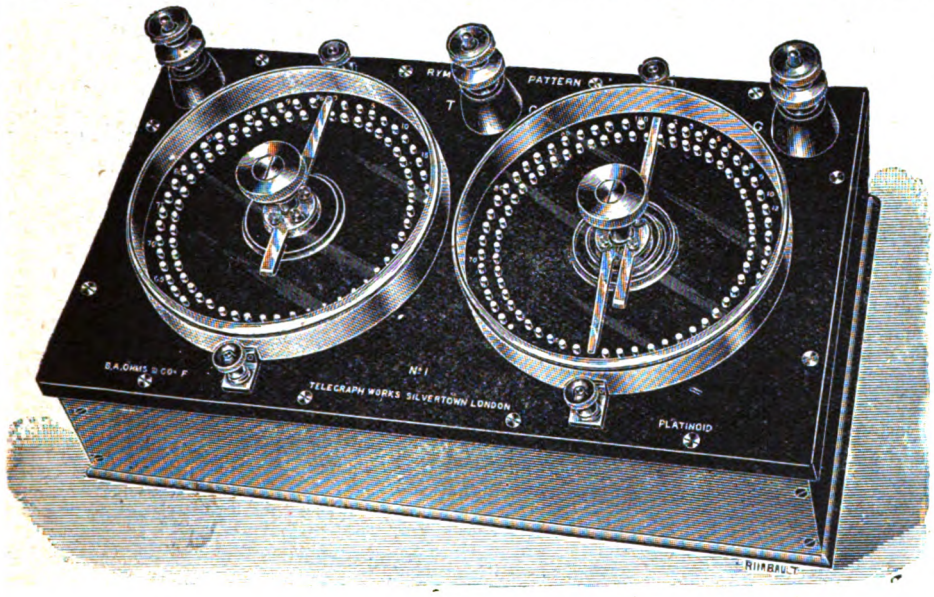
AIR COMPRESSORS,

from 250 to 15,000 c.f. per minute.

EXHAUST TURBINES,

from 200 Kilowatt upwards.

SILVERTOWN INSTRUMENTS



Universal Shunt.

Can be used for all the tests for which the Kelvin and Varley slides are suitable.

The India Rubber, Gutta Percha and Telegraph Works Co., Ltd.

Head Offices: 106, Cannon Street, London, E.C.

Works: Silvertown, London, E.

TUDOR ACCUMULATORS

WITH

AUTOMATIC REVERSIBLE BOOSTERS.

Many large Plants at work in Electric Railway, Tramway, & Power Stations.

COMPLETE BATTERY & BOOSTER PLANTS

DESIGNED TO SUIT SPECIAL CONDITIONS.

THE TUDOR ACCUMULATOR CO., LTD., 119, Victoria St., LONDON, S.W.

Works: DUKINFIELD, near MANCHESTER.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published March 17th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

4,258/09. **Electrolytic Meters.** W. B. THORPE. This specification covers the electrolytic meters and time-limit relays described in ELECTRICAL ENGINEERING, October 14th, 1909, p. 891. The connections of the various resistances, and the means of producing and recording the successive explosions of the evolved gases in the case of the meters, are described. Fifteen claims, four figures.

5,459/09. **Maximum Demand Indicator.** T. MCCLELLAND and FERRANTI, LTD. An iron core attached to a pointer is drawn into a series solenoid. The pointer returns to the zero position when the current ceases to flow through the solenoid, but leaves a second free pointer to indicate the maximum. A pawl and ratchet device, mechanically connected with the counting mechanism of the main meter, serves to retard the movement of the main pointer. Three claims, three figures.

6,956/09. **Starting Induction Motors.** SIEMENS BROS. DYNAMO WORKS, LTD., and Dr. M. KLOSS. In order to obtain a large starting torque from two asynchronous motors, the rotors have been mechanically and electrically coupled together, and acted on by two stators the phase of the fluxes in which could be adjusted 180 electrical degrees with respect to each other. The rotor E.M.F.'s therefore opposed each other. According to the present invention, the motors are made of unequal output, so that though the currents in the two rotors are equal, the E.M.F.'s are different. With 180° phase displacement, the smaller motor acts as a generator, while the larger one gives a high starting torque with a small supply and low losses. If more convenient, a transformer may be interposed between the two rotors. The arrangement is described as particularly suitable for ship propulsion. Six claims, two figures.

12,744/09. **Fuse Carrier.** W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., and W. H. NICHOLS. The several fuse wires are threaded through a wide fibre cylinder lined with asbestos and fixed to binding screws on the copper end plugs which are integral with the tongues. The holes at the ends are only large enough to let the fuse wires pass through, but additional peripheral passages are provided, so that when the fuse blows, the flame passes out through these on to a flange at each end, which directs the hot gases on to a shield of fibre. A construction is described in which the cylinder has an aperture for the introduction of the wires and choking material. A sleeve is rotated round the cylinder to close up the aperture. Three claims, three figures.

20,882/09. **Hand Lamp.** H. B. JENKINS. The flexible cable is led into a gland which is externally threaded and screws into a stuffing box. The lamp holder screws into the other end of the stuffing box. The handle is bored to take the gland and stuffing box. The cable is gripped by a split bush of vulcanised fibre contained in the stuffing box, and closed on the cable by the pressure of the gland. Two claims, three figures.

21,374/09. **Arc Lamp Carbons.** GEBR. SIEMENS & Co. To increase the light emitted from flame arc carbons, they are made of a sheath of pure carbon and a core consisting of 60 per cent. of a mixture of molybdates and tungstates of cerium, lanthanum, or didymium, 20 per cent. of iron tungstate and 20 per cent. of the fluorides of the rare earths to ensure uniform vaporisation and quiet burning. Tar or waterglass may be used as a binding medium. Three claims.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: JABURG, 7,471/09; GEIGER, 17,909/09; BLOXAM (*Geb. Siemens & Co.*), 20,311/09; TIMAR [Striking mechanism] 27,560/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: NAVARRO [Cable supports and insulators] 27,757/09.

Dynamos, Motors, and Transformers: MOSER [Alternating-current generators and boosters] 5,003/09 and 8,345/09; MURPHY [Current rectifier] 5,081/09; CROMPTON & Co., MACFARLANE and BURGE [Regenerative control apparatus] 5,168/09 and 21,113/09; SIEMENS BROS. DYNAMO WORKS and KLOSS [Suppressing harmonics in generator E.M.F. wave-forms] 13,041/09; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) 19,210/09; R. BOSCH [Insulation of windings] 22,479/09; ALLGEMEINE ELEKTRICITÄTS GES. [D.-C. motor-generators] 24,306/09; SCHULZ [Unipolar turbo-dynamo] 2,814/10.

Electric Ignition: HALL, 12,286/09.

Electrometallurgy and Electrochemistry: JUSTICE (*Consortium für Electrochemische Industrie Ges.*) [Manufacture of peroxide of hydrogen] 22,019/09.

Switchgear, Fuses, and Fittings: ADDISON [Automatic transformer switch] 5,427/09; MORGAN [Conduit clips] 6,493/09; BRAMPTON and OSBORNE [Conduit fittings] 10,348/09; KEY ENGINEERING Co. and ANDREWS [Conduit] 10,607/09; ZAMBONI and STERLING [Lamp reflectors and shades] 15,208/09; KENNEDY-MCGREGOR [Switches] 15,578/09; SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Mercury switch for automatic railway signalling] 25,962/09; FALK, STADELMANN & Co. and CHARLES [Fixing lamp globes] 27,472/09; STERLING TELEPHONE & ELECTRIC Co. (*Telephon Fabrik A.-G. vorm J. Berliner*) [Switches] 28,184/09.

Telephony and Telegraphy: DE BINGHAM [Telegraphic recording apparatus] 27,862/08; HEYWORTH [Secret telephone transmitters] 5,114/09; CLEMENT [Telephone exchange] 18,950/09; CARBONELLE [Transmission of half-tone illustrations] 19,516/09.

Traction: CROUCH and ETCHELLS [Train-lighting and heating systems] 25,844/08; CROMPTON & Co., MACFARLANE and BURGE [Regenerative control] 5,168/09 and 21,113/09; SIEMENS & HALSKE A.-G. [Shunting waggons] 23,533/09.

Miscellaneous: ETCHELLS [Safety switches for lift gates] 6,495/09; BARKER [Synchronous running of phonographs and cinematographs] 8,858/09; LE BLANC [Electrical control of searchlights] 12,970/09; SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Electric control of clocks] 18,005/09; GRAY (*Seabolt*) [Electric clock-winding mechanism] 21,940/09; VON MEYENBURG [Vacuum cleaner] 24,368/09; JONES [Fire alarms] 30,305/09.

The following Specification is open to Inspection at the Patent Office before Acceptance, but is not yet published for sale.

Electric Ignition: MUELLER [Magneto generator] 17,664/09.

Opposition to Grant of Patents

14,483/08. **Metal Filament Lamps.** S. MARIETTI. This patent has been granted in spite of opposition. The specification describes tubular supports and leading-in wires, and a method of fusing in the filaments. (See ELECTRICAL ENGINEERING, Aug. 5th, 1909. Vol. V., p. 714.)

20,915/08. **Metal Filament Lamps.** T. MCKENNA (*Gluhlampenwerk Anker-Ges.*). This patent has been refused as the result of opposition. The specification, abstracted in ELECTRICAL ENGINEERING, Nov. 4th, 1909, Vol. V., p. 950, describes the fixing of filaments to leading-in wires by first depositing a soft metal covering on the ends of the former electrolytically.

3,604/09. **Depositing Metal on Metal.** A. SANG. The opposition to the grant of this patent has failed. (See ELECTRICAL ENGINEERING, Jan. 6th, 1910, p. 16.)

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

6,579 of March 25th, 1896. **Telephone.** A. GRAHAM. A rotary Hunnings transmitter is mounted in a case with a fixed receiver, and a movable shutter is connected with the transmitter, so that when it is moved in order to use the instrument, the transmitter is rotated, and the carbon shaken up. A switch for cutting out both receiver and transmitter when the shutter is closed is also described.

6,985 of March 31st, 1896. **Prepayment Meter Mechanism.** J. HAWKYARD and J. BRADDOCK. The coin is dropped through a slot into a fixed cylinder, and then connects together a slotted rotary sleeve and a slotted core provided with an external handle.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: C. W. ATKINSON [Isolating faulty sections] 25,903/04.

Dynamos, &c.: H. TRAUN [Vulcanised rubber insulating collars for shafts, &c.] 28,736/97; M. DERI [A.-C. commutator motors] 26,870/02; V. I. FEENY (*C. Wirt, U.S.A.*) [Metal brushes] 26,445/04.

Electric Ignition: M. S. NAPIER, 26,488/03.

Electrometallurgy, &c.: SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Primary cells] 23,813/99; O. IMRAY (*Hoeder Bergwerks Verein*) [Furnace] 26,145/03.

Incandescent Lamps: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Fitting caps to bulbs] 26,292/04.

Instruments, &c.: C. D. ABEL (*Compagnie Anon. Continentale des Compteurs de Gaz*) [D.-C. motor meter] 24,470/01; H. H. LAKE (*R. Arno, Italy*) [Three-phase meters] 26,673/02.

Storage Batteries: EKSTROMER ACCUMULATOR Co. and E. L. OPPERMANN [Plates] 25,902/04.

Switchgear, &c.: L. HIGGINBOTTOM, J. H. HINDLE and T. MANNOCK [Lift motor control and brake] 28,457/97; E. A. CAROLAN (*General Electric Co., U.S.A.*) [Rheostat] 26,382/02; J. Y. JOHNSON (*Elektrizitäts A.-G.*) [Excess voltage protective device] 26,058/03; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Switch] 26,172/04.

Telephony, &c.: W. P. THOMPSON (*Ges. für Drahtlose Telegraphie*) [Tuning in wireless telegraphy] 26,367/04.

Traction: F. SCHEINIG [Rail-joint] 21,805/00.

Miscellaneous: H. H. LAKE (*Soc. L. Gaumont & Cie.*) [Synchronous running of phonographs and cinematographs] 26,187/02.

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ELECTRICAL ENGINEERING

No. 170 [Vol. VI., No. 13] THURSDAY, MARCH 31, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*
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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

A Paper read recently in America describes a device which has been used successfully for the production of H.T. insulators. (Page 214.)

The following books are reviewed in this issue:—"The Dynamo: its Theory, Design, and Manufacture," by C. C. Hawkins and F. Wallis; Fowler's Electrical Engineer's Pocket Book, Fowler's Mechanical Engineer's Pocket Book, and "The Ideal Code Condenser," by A. Kolkenbeck. (Page 215.)

The contract for lifts for the Royal Line Building, Liverpool, includes seventeen electric lifts, travelling at speeds up to 400 ft. per min. (Page 215.)

An article by Mr. C. C. F. Monckton describes experiments on the use of spark gaps in compressed air for wireless telegraph transmission. (Page 216.)

In a Paper read recently before the Yorkshire Local Section of the Institution of Electrical Engineers, on the rating and testing of motors for intermittent work, Dr. R. Pohl pointed out the misleading nature of tests consisting of short runs on full load, and the harmful effect of this method of rating on design. He suggested an equivalent intermittent test, and an alternative system of short test runs at a reduced voltage and current calculated to give the same temperature rise as the actual cycle of operations. (Page 217.)

A relay with time attachment for use in connection with lift bells, actuated by the trains on tube railways, is described on page 218.

The new generating station at Carolina Port, Dundee, which was opened recently, is equipped with two 2,000-kw. 6,000-volt turbo-alternators, and presents a good example of remote control high-tension switchgear. Particular interest also attaches to the arrangements for condensing water supply from the river, which includes specially arranged electrically-driven pumping plant a short distance away from the station. (Page 219.)

The British Thomson-Houston Co. will shortly be placing on the market metal filament lamps with drawn tungsten filaments of very great strength. (Page 220.)

The Highgate Hill tramway has been opened under electric traction by the London County Council. A special form of brake has been designed for use on the hill. (Page 221.)

The Willans-Impulse "Disc and Drum" type steam turbine differs from the Willans-Parsons turbine in that a single impulse disc is substituted for the high-pressure part of the drum. The steam is expanded to atmospheric pressure in nozzles before reaching any part of the rotor. (Page 221.)

Some further reductions are being made in the price of metal filament lamps. (Page 221.)

Mr. H. F. Street (Borough Electrical Engineer, Southampton) has presented a report advocating a charge of ½d. per unit for heating and cooking. (Page 221.)

Among the specifications published by the Patent Office on Thursday last were two by Crompton & Co.,

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Ltd., J. C. MacFarlane, and H. Burge for a system of regenerative control, in which the working motors are connected across the supply mains in series with the dynamo of a Ward-Leonard motor-generator. Special shunt windings are arranged on the working motors to give them a series characteristic, and a series winding on the dynamo limits the current which may be taken from the mains.—A flame arc lamp without feeding mechanism or supporting stops is described by H. J. Jaburg.—The patent covering the Key Engineering Co.'s system for laying cables on the solid system in fibre tubes is also published.—A method of eliminating the circulating currents due to the third harmonic in three-phase alternators, connected in parallel with earthed neutrals, is covered by Dr. M. Kloss. An equal and opposite E.M.F. of the same frequency and magnitude is introduced into the local circuit by means of an auxiliary three-phase transformer.—A patent by J. O. Elmore for the manufacture of tubes by depositing metal electrolytically on a rotating mandrel in a tank of special construction, expires during the current week, after a life of fourteen years. (Page 222.)

THE Electric Lighting Act, 1909, comes into force to-morrow (Friday). (Page 223.)

AN article by Mr. E. P. Austin deals with the conditions which arise when power supply is carried out from traction circuits. Various troubles are occasioned by the sudden variations of voltage, and these are best met, in the author's opinion, by commutating-pole motors. The influence of the position of a fault relative to the motor is discussed, and notes are given as to the construction of suitable fuses for use under these conditions. (Page 223.)

THE repair and maintenance of the overhead equipment of the Aberdeen tramways has been transferred from the electrical engineer to the tramway manager. —Metal filament lamps are to displace carbon filament lamps, and possibly arc lamps, for street lighting in Ayr.—The "fixed price" system of charging for electric supply is to be adopted by the Weymouth Council.—A special grant is to be made from the Halifax tramway profits to assist the Finance Committee.—Through tramway running has been inaugurated between Accrington, Rawtenstall, and Bacup.—The Luton Electricity Committee, by a transfer of £846 to the general district rate, have repaid the sum required to meet early losses on the undertaking. (Page 224.)

NEW plant is required by the Liverpool District Lighting Co., Walthamstow Council, and Hammersmith Borough Council.—Grimsby Council propose to spend £2,000 on street lighting.—An electric lighting plant for a New Zealand theatre is to be purchased in London. (Page 224.)

AFTER taking £25,000 from reserve fund to meet special expenditure, the report of Messrs. Willans & Robinson for the December half-year of 1909, shows a loss of £7,267.—The report of the Underground Electric Railways Co. of London for the December half-year shows a profit of £463, after meeting interest on all classes of bonds. (Page 226.)

Telegraph Traffic.—Direct communication between Saigon and Bangkok was restored on the 25th inst., and the Fao route was restored on the 27th inst. The only interruption to record is that of the El Arich route, which failed in two places, viz., between Adana and Beyreuth, and between Alep and Beyreuth.

Railway Engineering.—A special railway number of *Cassier's Magazine* has been issued. Among the articles of especial interest to our readers is one by T. Rich on the development and design of the electric locomotive, copiously illustrated with photographs and diagrams of electric locomotives old and new. J. S. Hobson contributes an article on railway signalling practice in America, dealing with a number of electric and electro-pneumatic systems, and current British practice in the same field is described in a fully illustrated article by J. F. Gairns. G. Pendlebury writes on tramway repair works. The New York tunnels and their construction, railway workshops, and machine tools are the subjects of other articles.

ARRANGEMENTS FOR THE WEEK

SATURDAY, APRIL 2ND.

Institution of Mining Electrical Engineers: Manchester Branch.
6 p.m. At Grand Hotel. To consider Special Rules Relating to the Use of Electricity in Mines.

TUESDAY, APRIL 5TH.

Institution of Electrical Engineers: Manchester Students' Section.
7.30 p.m. Supper and Smoking Concert at Grand Hotel.

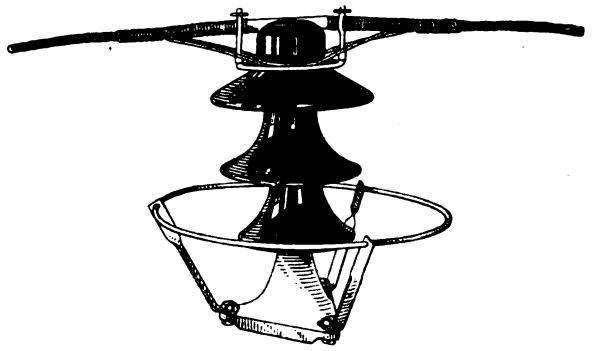
Faraday Society.
8 p.m. At Institution of Electrical Engineers, 92 Victoria Street, London. "The Electrical Theory of Dyeing," by Prof. W. W. Haldane Gee and W. Harrison.

THURSDAY, APRIL 7TH.

Institution of Electrical Engineers.
8 p.m. At 25 Great George Street, Westminster, London. "The Progress of Electric Braking on the Glasgow Corporation Tramways," by A. Gerrard.

THE PROTECTION OF H.T. INSULATORS

IN the course of a Paper read recently before the American Institute of Electrical Engineers, Mr. L. C. Nicholson described a device which is used with a considerable measure of success on the 60,000-volt transmission lines of the Niagara, Lockport & Ontario Power Co. for the protection of insulators from the destructive effects of power arcs over their surface initiated by lightning discharges. Experience has enabled insulators to be made more and more puncture-proof, but the author points out that even if all insulators were capable of resisting puncture, they would continue to be shattered by a power arc following a flash over. A device to meet this need was therefore developed. The arrangement now used is shown in the accompanying illustration, and consists of two metal rings concentric with the insulator, a lower one which is situated near the base being considerably larger in diameter than the insulator parts, and supported by earthed metal risers attached to the pin;



H.T. INSULATOR, FITTED WITH ARCING RINGS.

and an upper one somewhat larger than the neck of the insulator, just opposite the tie-wire, suspended from the transmission cable, and electrically connected to it.

These rings serve as electrodes, to which the power arc automatically transfers immediately after its formation between the tie-wire and pin, over the surface of the insulator. When holding between these rings, the arc is removed sufficiently from the insulator to prevent injury to the porcelain by heat.

Experiments have shown that the lower arcing ring would take the arc immediately after its formation to the pin (which was accomplished by means of a fuse from tie-wire to pin, placed well up under the insulator parts), almost irrespective of the location of the ring with reference to the base of the insulator.

The upper ring was found necessary to prevent burning of the tie-wire. In experimental tests a 30,000 kw. 1,200 ampere arc was withstood without any damage to the insulator, and since the arcing rings have been in use on the actual lines, there has been an extraordinary diminution in the number of insulators disabled.

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REVIEWS OF BOOKS

The Dynamo: its Theory, Design, and Manufacture. By C. C. Hawkins and F. Wallis. Two volumes. Fifth edition. 1,134 pp. 9 in. by 6 in. 594 illustrations. (London: Whittaker and Co.) 21s.

"Hawkins & Wallis" has long been known as one of the standard works on current generating machinery, but, unlike some "standard works," it has not been allowed to stand still and rest upon its past reputation. When we take down from our bookshelves a copy of one of the earlier editions, we are struck by the change in size which has been necessitated to keep pace with advances in the subject, as the old single volume had only just over 500 small pages, as compared with the eleven hundred odd larger pages of the two new volumes. The revision, however, has not consisted merely of addition, as in the successive editions much that had become obsolete has been expunged. Since the book was first written, dynamo design has not only progressed, but it has also in some ways narrowed down into more definite channels. As pointed out in the preface, whether for continuous or alternating current, the drum armature with toothed core has so far displaced all other types that it has become superfluous to consider at length any other varieties. In consequence, the ring, disc, and other arrangements almost disappear from the pages. Extensive new developments, however, more than take their place.

In speaking of the new matter, particular mention should be made of the treatment of the theory of commutation, which is largely based on the researches of Arnold, the full study of the commutating pole now so widely used, and the new matter concerning the problems of mechanical construction, &c., introduced by the high speeds necessitated with steam turbine drive. The range of the book is too wide for us to deal in detail with every chapter, but in speaking of the general arrangement it may be said that a very happy combination has been arrived at between the clear expositions of elementary principles, the mathematical treatment of theory, and the indication of methods to be employed in the practical designing office. The book has become less of a general text-book and more of a designer's work of reference, but embodies the experience of a practical designer who is at the same time a student of the science and literature of the subject. The main characteristics are thoroughness and clearness of style, and excellent use is made of diagrams and drawings to illustrate the points discussed. These have evidently had much more care devoted to their preparation than is often the case with technical books.

There is no marked division in the subject-matter between the two volumes. The first, after treating of general principles, makes a start upon continuous-current machinery, but the most valuable chapters on armature reaction, commutation, and the heating of dynamos are reserved for the second volume. After these follows a chapter headed "The Design of Continuous-current Machinery," in which questions of output and speed in relation to diameter and length of core are dealt with, together with a few pages on measurement of losses; and the continuous-current dynamo section closes with some notes on the working and management of these machines. The five succeeding chapters deal with the alternator; and in the last, some descriptions are given of typical machines of both kinds. This is no mere collection of catalogue illustrations with suitable inscriptions, but goes into matters of detail in typical modern practice, and works out data relating to actual machines in a way characteristic of the thoroughness of the whole work.

Although his name still appears on the title-page, Mr. F. Wallis has been prevented by the calls of other duties from taking part in the rewriting of the book, so that the larger proportion of the present work is from the pen of Mr. Hawkins alone.

Fowler's Electrical Engineer's Pocket Book, 1910. 575 pp. 6¼ in. by 3¾ in. **Fowler's Mechanical Engineer's Pocket Book, 1910.** 654 pp. 6¼ in. by 3¾ in. (Manchester: Scientific Publishing Co., Ltd.) 1s. 6d. each.

These two engineering pocket books, of which revised editions for 1910 have just made their appearance, are too well known to need detailed descriptions. Both have been revised to a considerable extent, and in the case of the mechanical volume the principal directions in which expansion has taken place are in relation to economy of power plant and the use of mechanical and electrical appliances in mining. Although this volume is principally intended for mechanical engineers, electrical matters receive some attention, and it is quite a sign of the times that the Home Office Rules on electricity in mines should be included in the mechanical and not the electrical volume. A glance through the Electrical Engineer's Pocket Book, however, shows that in most respects it is thoroughly up to date, except, perhaps, as to metal filament lamps, as apparently the compiler has not yet heard of 200-volt tungsten lamps of less than 40 c.p., or of 200-volt tantalum lamps at all. Here and there in the testing sections the proportion of space given to old-fashioned and modern methods is not quite what it might be. These and similar small faults do not, however, detract from the utility of the excellent collection of tabular and descriptive matter or its easily accessible arrangement.

The Ideal Code Condenser. By Alfred Kolkenbeck. 11 pp. 13 in. by 9 in. (London: The Central Translations Institute, 16 Eastcheap, and Salisbury House, London Wall, London.) One guinea.

This is a special code system in the form of a 13-figure code, which enables several existing codes to be employed at the same time at the rate of two phrases to one code word, while the recipient is informed from which code to read each part of the message. In addition to this an automatic check is conveyed as a safeguard against mutilations. The system has been thoroughly tested, and it is claimed that all the combinations are pronounceable. All the instructions are printed in English, French, and German in parallel columns.

A LARGE ELECTRIC LIFT INSTALLATION

The lift equipment of the new Royal Liver building at Pierhead, which is being carried out by Messrs. R. Waygood & Co., Ltd. (Falmouth Road, S.E.), is the subject of the largest lift contract ever placed in this country.

There will be in all seventeen electric lifts. Fifteen of these will be passenger lifts arranged for load up to 800 lbs. Four of these lifts will travel at a speed of 300 ft. per minute, the height of travel being 148 ft., and the lifts will each serve eleven floors. There will be six express lifts running at a speed of 400 ft. per minute, serving seven floors; two express lifts running at 400 ft. per minute, serving three floors; two express lifts travelling 163 ft. at a speed of 400 ft. per minute, serving three and four floors respectively; and one lift with a travel of 208 ft. at a speed of 400 ft. per minute, and serving six floors. The express lifts will run at full speed until reaching the first floor which they serve, and will then slow down automatically to a speed of about 200 ft. for serving the upper floors. These lifts will be arranged in batteries similar to those in the large buildings in America. Ten of these lifts will be arranged in centre of building, six being express lifts, and four similar lifts will be arranged at the Pierhead entrance. The machines will in each case be fixed overhead.

The motors will be manufactured by the J.L. Manufacturing Co., Ltd., and will be rated at 25 h.p. The motors will be coupled direct to machine-cut worm and wheel winding gear, with case-hardened steel worms and wheels, which will be of large diameter with cast-iron centres and rim, and teeth of phosphor-bronze enclosed in cast-iron case, the thrust of the shaft being taken by Hoffman ball bearings. Each gear will be fitted with large V-grooved winding sheave arranged to plumb from centre of cage to centre of countrweight, and provided with an outer bearing on the end of shaft, supported by bracket from the cast-iron base plate upon which the whole machine is mounted. Each cage will be suspended by four best steel wire ropes, and counter-balanced by a cast-iron weight.

The cages will be constructed with steel frame and suspension bar, with special safety gear fitted beneath the cage and operated in case of failure of suspension ropes by an independent safety rope. A special speed governor will also be provided to prevent undue acceleration when travelling. The cages and balance-weights will be guided by special tee iron runners with gun-metal guides mounted on each cage and weight.

The controller will be specially designed to secure correct acceleration and accurate control, and provided with special automatic slowing-down device so as to reduce the speed whenever the lift is approaching a stop.

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Each lift will be fitted with bell and indicator, and a special flash-light indicator will be fitted to each floor so as to indicate the position of the lift.

There will also be two goods lifts, each of which will be designed for a load of 1 ton at speed of 150 ft. per minute, travelling 165 ft. These lifts will also be operated by electric control with car switch. Special interlocking gear will be fitted to all gates both for passenger and goods lifts, to prevent any gate being opened unless the cage is opposite same, and to prevent the lift being started unless all the gates are properly closed.

COMPRESSED AIR SPARK-GAPS FOR WIRELESS TELEGRAPHY

By C. C. F. Monckton

IN some recent experiments on the reception of radiotelegraphic signals when transmitting with a spark-gap in compressed air, as compared with signals received when an ordinary spark-gap was used, the aerial circuit consisted of a raised capacity averaging 60 to 70 ft. from the ground with a spark-gap, three turns of inductance and a capacity formed of a network of wires lying on the ground. This aerial was charged by a 12-in. induction coil with hammer make and break. The relative surging currents in the aerial were measured by a hot-wire instrument in a secondary circuit in tune with the sending circuit. The make and break of the induction coil was not adjusted except when stated. The pressure readings were measured above the atmospheric pressure. Signals were received at a station sixty miles distant with a very similar aerial, in tune with the sending aerial. Three turns of inductance 9 in. in diameter in this circuit formed the primary of a receiving transformer. The secondary consisted of 48 quadruple turns of 19/0·005 mil. wire on a bobbin 8 in. in diameter, in series with an adjustable condenser set at 0·00014 mf. A recorder with mercury-steel revolving coherer was placed as a shunt across this condenser. This adjustment of the condenser made the secondary circuit in tune with the sending circuit.

Experiments were carried out as follows:—The sending key was pressed for a short interval to enable readings of the surging current, and the current taken by the induction coil. Then a letter of the alphabet was signalled for two minutes. At the receiving station the only adjustment made was to determine the greatest distance that the secondary coil could be removed from the primary and good signals recorded. In general, if the secondary coil were removed 1½ in. further, the signals were still readable, but if removed another inch only flicks were recorded.

The distance between the coils was measured edge to edge.

In the table below let—

P = Air pressure above atmosphere round spark-gap in lbs. per square inch.
C_1 = Current through primary of induction coil in amperes.
U = Pressure at terminals of primary of induction coil in volts.
C_2 = Relative surging current in aerial.
D = Distance between primary and secondary coils of receiving transformer in inches.
L = Length of spark-gap in ordinary air in inches.

Table I.—*Spark-gap $\frac{1}{10}$" in Compressed Air.*

P.	C_1.	V.	C_2.	D.	Remarks.
0	3	10	0·6	0	Signals unreadable
10	4¼	10	1·15	1	
15	4½	10	1·25	1⅜	
20	4¾	10	1·3	2¼	
30	5	10	1·4	3	
40	5	10	1·45	4	
50	4⅜	10	1·4	5¼	
60	3¾	10	0·5	0	Signals unreadable.
50	5¼	14	1·75	5½	Break and make adjusted.
60 *A*	6	16	2·00	6⅛	Do.

The experiment was here tried to see how far the secondary receiving circuit was in tune with the sending circuit. Under the conditions *A* the readings of the condenser were:—

Good signals, 22°; no flicks, 23°; and no flicks, 20½°.
1° = 0·0000058 mf. about.

Table II.—*Varying Lengths of Spark-gap in Ordinary Air.*

L.	C_1.	V.	C_2.	D.	Remarks.
0·1	3	10	0·7	0	Signals unreadable.
0·2	4½	10	1·3	2¾	
0·3	5½	10	1·5	4½	Break and make adjusted.
0·4	7	10	1·6	5½	Do.
0·5	7¼	14	1·9	6½	Do.
0·6	7¼	14	1·9	7	Do.
0·7	7	20	2·1	7⅛	Do.
0·8	—	—	—	—	Spark failed.
0·7	8¾	20	2·3	7¼	Break and make adjusted.
0·8	9	20	2·4	5	Spark constantly failing.

Table III.—*Spark-gap ⅛ inch in Compressed Air.*

P.	C_1.	V.	C.	D.	Remarks.
0	4½	10	1·3	2¾	
10	4¾	12	1·5	4½	
15	5½	12	1·55	5⅜	Make and break adjusted.
20	5½	12	1·75	5¼	
30	7	12	2·20	0	Spark failing: no signals.
40	7	12	—	—	No spark.
20	6½	14	1·9	6	Make and break adjusted.
30	7⅓	20	2·4	7	Do.
40	8¾	20	—	—	No spark.

An attempt was made to signal with a $\frac{1}{20}$th inch spark as follows:—

Table IV.

P.	C_1.	V.	C_2.	Remarks.
40	3½	10	1·25	No signals received.
50	3¾	10	1·48	Do.

Resonance curves were taken with the ordinary spark with the spark in compressed air. Very similar results were obtained. Then the earth capacity was raised 30 ft. from the ground and more resonance curves taken.

In the following table, R = condenser reading in subsidiary circuit in degrees, C_2 = surging current in subsidiary circuit when ordinary $\frac{3}{16}$-in. spark was used, C_3 = surging current in subsidiary circuit when $\frac{1}{10}$-in. spark in air compressed 40 lbs. per sq. in. was used.

Table V.—*Resonance Currents.*

Induction coil current 4¾ amperes.
" " pressure 20 volts.
Condenser 10° difference = 0·000105 mf.
Condenser reacting 50° = 0·00084 mf.

R.	C_2.	C_3.	Remarks.
20	0	0	
30	0·1	0·1	
40	0·8	0·7	In taking all the surging current readings there was a considerable variation. The current was rather more steady with the compressed-air spark-gap than with the ordinary spark-gap.
45	1·5	—	
48	1·75	2·35	
50	2·4	2·45	
52	1·6	1·95	
55	1·0	1·4	
60	0·7	0·9	
70	0·4	0·6	
80	0·3	0·5	

Contrary to expectations, the results appear to show that there is no advantage in using compressed air round the spark-gap. At the same time that the dielectric strength of the air is enormously increased, so also is the resistance to the oscillatory spark; both appear to increase at about the same ratio.

Supply Statistics for Switzerland.—According to the annual returns of the electricity works in Switzerland, published in the 1910 year book of the Swiss electrotechnical societies, there were 636 supply undertakings in the country at the end of 1909 (excluding purely traction stations), as against 607 for the year 1908. Of these, 235 were purely generating concerns, 57 were combined generating and transforming concerns, and 344 were transforming concerns only. Full particulars were available from 176 generating stations, with a total capacity of 217,400 kw. Of this, 66,000 kw. was purely water-power, and 146,000 kw. was in combined water-power and heat-engine stations.

Tramways & Light Railways Association.—As we have already announced, the annual congress of this Association will be held on Thursday and Friday, May 12th and 13th, at Dublin. Papers will be read during the congress as follows: Mr. R. S. Tresilian, Secretary, Dublin United Tramways Co.; Mr. Fred Coutts, General Manager, Paisley & District Tramways Co.; Mr. Harry England, General Manager, Wakefield & District Light Railways Co.; Mr. J. R. Salter, General Manager, Lancashire United Tramways Co.; and one or two others to be announced later. A short discussion will follow the reading of each paper. The headquarters of the Association during the Congress will be at the Imperial Hotel, Lower Sackville Street, Dublin.

Electric Smelting in Norway.—During the last few weeks some important trials of the smelting of iron ore in electric furnaces have been made by the Tinfos Co., of Tinfos, near Notodden, Norway. The ore is that obtained from the mines near Kragero and Arendal, and the plant is of such a capacity that some two tons of iron have been produced per day of 24 hours. The company intends to continue the experiments with a view of erecting large iron works at Notodden. A Government Committee has visited the experimental plant, and the members have expressed great satisfaction with the results. It is stated that the smelting industry had declined owing to the increase in the price of fuel, and that a fresh impetus is expected with the application of water-power to supply the necessary energy for electric smelting.

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MOTORS FOR INTERMITTENT WORK

DR. R. POHL read a Paper entitled "Rating and Testing of Motors for Intermittent Working," before the Yorkshire Local Section of the Institution of Electrical Engineers on Thursday, March 10th. Under intermittent work he included cases where the alternate periods of work and rest were both short, so that the temperature reached a practically constant value. The chief point to be considered was the formulation of conditions for a short test run which should be equivalent in the temperature which they produce to the actual cycle of operations for which the motor is intended.

In view of the variability of the load, the load factor is better defined as the ratio of the square of the virtual current to the square of the full-load current than simply as the ratio of the time of running to total time. Heavy starting currents can thus be taken into account.

A motor working with a definite load factor will have a temperature curve as shown in Fig. 1, consisting of parts from the heating and cooling curves.

A continuously running motor has reached its final tempera-

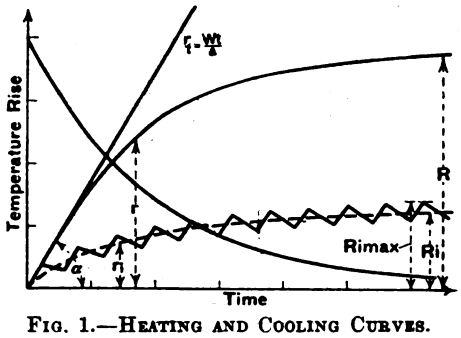


FIG. 1.—HEATING AND COOLING CURVES.

ture when the rate of heat dissipation is equal to the rate of heat generation.

An intermittently running motor will similarly have a final temperature rise—

$$R_i = \frac{W_m}{b}$$

provided that the rate of cooling, *i.e.*, the value of b, is the same whether the motor be running or standing. Hence, from the definition of load factor

$$R_i = \frac{W \times f}{b} = R \times f.$$

The heating curve is an exponential curve of the form—

$$r = R\left(1 - e^{-\frac{t}{T}}\right)$$

where T = time constant of the motor (in hours), and t = length of run (in hours).

The value of T may be expressed as $\frac{a}{b}$ where a = watt hours stored for degree of temperature rise.

For the consideration of test runs of half an hour or less, however, with which we have mostly to deal in practice, we may greatly simplify the result, and use the approximation

$$R_t = \frac{Wt}{a}.$$

Whilst the final temperature rise of an intermittently running motor with given loss depends on the factor b, we now find that the rise after a short full-load run depends on the factor a, and that the latter consists of constituent parts altogether different in character from those forming b. The temperature rise under working conditions is determined by the heat-dissipating properties—*i.e.*, mainly the surface; that under conditions by the heat-storing properties—*i.e.*, mainly by the weights. These two properties are practically independent of each other. It is on account of this essential difference that a short time run is in principle unsuited as a test for intermittently running machines.

The connection between the temperature rise under working conditions and that after a short full-load run are then gone into, and it is pointed out that this depends on the knowledge and character of the time constant. Fig. 2 gives curves for arriving at the conversion factor for half-hour rating. The value of the time constant, however, is not easily ascertainable, and examples are given showing variation from 1·35 for a 10 h.p. motor at 900 r.p.m., at quarter-load factor, to 3 for a 100 h.p. motor at 400 r.p.m. Indeed, the value is not even constant for a given machine, because some of the factors forming it, chiefly the specific dissipation, depend on the speed.

The variability of T necessitates its experimental determination from heating and cooling curves, if any reliable information about the temperature under working conditions is to be obtained from the results of a short time run. Without experimental determination of T the results of a short time run are of little value. The average purchaser of a crane-rated motor, however, cannot be expected to be conversant with these facts.

There are rare instances in which the experienced crane-maker specifies one-hour tests for the larger, and half-hour tests for smaller size motors, and occasionally special requirements are indicated. But the general practice is to specify half-hour tests indiscriminately, and without any reference to the time constant or the load factor.

The results of these short time tests, however, are very misleading, and the conversion of the results by means of the time constant cannot be regarded as a practicable proposition. The customary testing practice places the problem before the designer of producing a motor with a minimum cost of material capable of giving a specified output for, say, half an hour, without its temperature rise exceeding a certain limit. The loss in

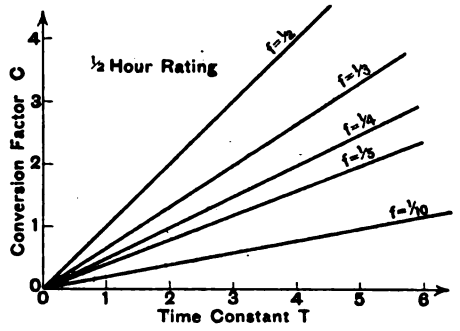


FIG. 2.—CONVERSION FACTORS FOR HALF-HOUR RUNS.

watts for a given output cannot very well be reduced below a known minimum, and the temperature after a run of half an hour depends otherwise only on the heat-storing qualities. With this in view, a heavy cast-iron carcase may be used in place of a light steel frame, and the weight of the other inactive portions may be increased, keeping at the same time the heat distribution factor as high as possible. On the other hand, there is little inducement to pay much regard to the cooling properties which do not directly enter the problem. The final temperature rise under working conditions, however, does not depend at all on the weight, but on the cooling properties, and as these are not appreciably improved, the alterations merely result in a larger time constant, but not in a genuine increase in the capacity of the machine under working conditions.

Thus the practice of short time tests, in addition to being deceptive, is leading the progress of design into wrong channels by establishing a false basis of rating. Indirectly, it retards healthy developments; such, for instance, as improvements in the dissipation from the surface of totally enclosed machines. The test adopted should give direct and reliable information on the temperature rise of the machine under working conditions. It must take the load factor duly into account, which in every instance is to be specified. The factors which determine the temperature rise during the test should be identical with those on which it depends under working conditions, *i.e.*, the heat dissipating qualities, and the method adopted must thus indirectly lead to the cooling surface, and not the weight, being considered the basis of rating.

The real load curve must inevitably be replaced by a curve of more simple form, yet equal load factor, and the duration of the working period will have to be extended.

After discussing various suggestions, Dr. Pohl puts forward the following specification. The temperature rise of machines for intermittent working shall be found by subjecting them to a prolonged test, consisting of successive periods of running and of rest. The running time to be ten minutes, the standing time adjusted in accordance with the specified load factor; the duration of the test to be sufficient for the mean temperature to attain a practically constant value. The last run to be of five minutes' duration, immediately after which the temperature is to be measured.

Another system of testing, which avoids the objections of

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frequent starting and stopping, is to replace the curve of irregular and intermittent load by one of constant and continuous load, adjusted in such a manner that the loss becomes practically equal to the mean loss under working conditions. Now the mean loss is approximately equal to $W \times f$, therefore the object will be obtained though not accurately, yet nearly enough for practical purposes, if we run the motor continuously with its pressure, and current reduced in proportion to the square root of the load factor, *i.e.*—

$$\text{Test voltage} \ldots = \sqrt{f} \times \text{normal voltage.}$$

$$\text{Test amperage} = \sqrt{f} \times \text{normal amperage.}$$

It is obvious that first of all the copper losses throughout the motor will be exactly f times the copper losses at full load, as desired, and this applies both to the armature and field, whether the motor be shunt or series wound.

The iron losses in the armature are also reduced approximately in the desired proportion on account of both the flux and the speed being smaller than the normal. The friction losses are the only ones which are reduced appreciably less than in the desired ratio.

Taking the sum of all the losses, we find they are very little higher than $W \times f$. The method is applicable to all stationary machines, such as transformers, and also sufficiently accurate for totally enclosed motors for intermittent working; but an objection, however, seems to stand in the way of the employment of a continuous test for all ventilated motors. The temperature of these machines being dependent not only on their losses, but to a large extent on the effectiveness of their ventilation, it will be argued that in spite of the equality in losses, the temperature rise after a continuous test must be lower than it will be under working conditions, when the motor is standing for a considerable portion of its working period. To what extent this argument is correct depends firstly on the importance of the ventilation on the temperature rise generally. In this connection it must be remembered that nearly all crane motors are slow-speed machines.

The test speeds, however, are considerably less than the full-load speed, and an intermittently working motor revolves in practice for a much greater portion of the total period than its load factor f indicates. In the case of series motors the ventilating effect is still further increased during the periods of reduced load on account of the rise in speed. The temperature rise of an intermittently working motor of the ventilated type depends therefore not only on the load factor, but on the whole shape of the load curve. Considering the uncertainty as to the temperature rise of ventilated motors due to the large variety of load curves corresponding to the same load factor which are found in practice, I come to the conclusion that the continuous test is applicable to ventilated machines as well as to totally enclosed ones. In the case of shunt-wound crane motors, we have to distinguish between the load factor of the armature, and that of the field. It will be found in most cases that they do not differ much from each other, and that the test as above described is directly applicable. Otherwise the following modification of the continuous test might be specified:—

$$\text{Test voltage} \ldots = \sqrt{f_{\text{field}}} \times \text{normal voltage.}$$

$$\text{Test amperage} = \sqrt{f_{\text{arm}}} \times \text{normal amperage.}$$

The continuous test is also applicable to all alternating-current machines, where necessary, with slight modifications.

Discussion.

Mr. Wilson Hartnell thought that too little attention had been paid in the Paper to the cooling curve, which was a very important matter. The gist of his argument was that a motor cools more quickly when at a high temperature than at a lower one at the beginning of a test. He contended that by testing a few motors to obtain their rising and falling temperature curves such practical results could be obtained that it was possible to foretell the final heating of a motor when tested only long enough to obtain the initial portions of its own curves.

Mr. A. J. Cridge (Electricity Department, Sheffield Corporation) suggested that the Institution should take in hand the formulation of a satisfactory specification for the testing of both continuous and intermittent running motors.

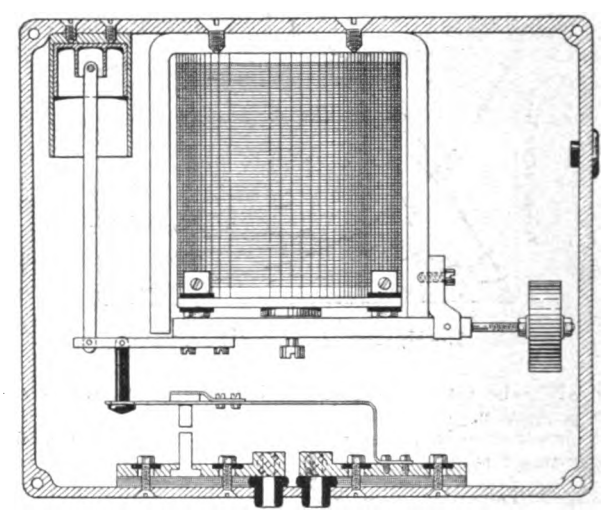
Mr. H. E. Yerbury (Electrical Engineer, Sheffield Corporation Tramways) would disassociate traction motors from crane motors, as the former would not be considered intermittent or short-period service motors. He advocated that all motors should be tested above their full working load with no attempt to copy actual working conditions, as, unless there was a margin in safe temperature rise above the working load, trouble would arise sooner or later.

Mr. Wardale (Sheffield) said that auxiliary motors used on battleships were always subjected to short-time tests. He suggested that Dr. Pohl should test a set of motors according to his proposed method, and then test them again in actual service on a crane and compare the results.

Dr. Pohl, replying, agreed with Mr. Hartnell that the initial rate of cooling was more rapid when the temperature was high than when it was low. The very complication of the present methods of arriving at the value of T induced him to search for a more practical method of testing. If they had Institution rules it would tend to standardisation and reduce the number of special designs. Mr. Wardale's suggestion for a dual test would not give any valuable results, as crane duty is very variable.

A TIME RELAY FOR BELLS

THE accompanying illustration shows a form of relay which has been specially designed by the M. & C. Manufacturing Co. (Conduit Place, Paddington) for use with lift bells on the Tube Railways. Bells are provided, which are caused to commence ringing as soon as an approaching train enters a certain section of the line through the action of relays connected to the track signalling circuit; and the object of this new relay is to interrupt the bell current after a definite interval (in practice about seven seconds), as otherwise it would



"M. & C." Time Relay.

continue to ring as long as the train was on the section in question. The action of the apparatus is very simple. The armature is connected to a dash-pot so that it takes some time to be drawn up, and it is only at the close of its travel that the head of the pin engages with the contact spring and lifts it. The apparatus is substantially made, and carbon contacts are provided. The coil is necessarily of a considerable number (over 5,000) of turns as the apparatus has to work with the signalling current which is as low as 0·043 ampere.

Wireless Telegraphy.—Crystals of the same substance vary greatly in their sensitiveness and in the treatment they should receive to obtain the best results for detecting electro-magnetic waves. It would appear that generally, to obtain the most sensitive results, there should be a very slight contact between the substances employed, but if a crystal can be found sensitive under a fairly hard pressure, the adjustment remains constant for a considerable time. Mr. S. R. Drayton, the chief operator on the Trinidad Government stations, finds that, of all the contact detectors at present tried, the silicon is the most reliable. Using no battery for ordinary working and a fairly hard pressure, this detector remains in adjustment for several weeks if it be short-circuited when transmitting, and a knock does not throw it out. To test if the detector be in adjustment, a fraction of a volt is switched on to the detector and telephone receiver in series; the click in the telephone tells whether the adjustment is correct.

According to a recent note in *The Times*, the Royal Mail Steam Packet Company have arranged for an installation of wireless telegraphy in their steamer the *Nile* for the Brazilian service. The Liverpool and North Wales Steamship Company will have an installation in *La Marguerite*; the Lloyd Brazileiro Steamship Company will have installations in 18 more of their ships; the Pacific Mail Steamship Company will have the United Wireless Company's (de Forest) system in the *Manchuria*, the *Mongolia*, the *Siberia*, the *China*, and the *Algoa*. The Norway, Mexico, and Gulf Steamship Company will use wireless in two of their boats, while the Union Oil Company, California, will have installations of the United Wireless system in three steamships.

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NEW GENERATING STATION AT DUNDEE

FOR some time the resources of the original generating station at Dundee have been insufficient to keep pace with the rapidly increasing demand for current for lighting, power, and tramway purposes, and it was none too soon that the fine new generating station at Carolina Port, designed by Mr. H. Richardson (City Electrical Engineer), was opened by Prof. J. A. Ewing, F.R.S. The new station has several interesting features, and presents a good example of a compact, up-to-date plant with large turbo-generator units and remote control switchgear.

The site is advantageous in being near enough to the Tay to enable condensing water to be taken from and returned to that river without the use of cooling towers, although coal has to be brought by railway, but is disadvantageous in that, owing to the nature of the ground, expensive foundations were required. The station is built on foundations consisting of over 300 ferro-concrete piles driven some 30 ft. into the ground, over which is a "raft" of reinforced concrete, a material used also somewhat extensively in the construction of the building itself. The general arrangement is seen from the section in Fig. 1. It may be said to consist of four parallel bays devoted to coal storage, boilers, turbo-generators, and switchgear respectively. One end is closed by a temporary partition, so that extensions can be made by prolonging each bay and repeating the units of each part of the equipment. At present two units only, each of 2,000 kw. capacity, are installed.

The coal-handling plant is very complete. Coal is brought in trucks by an electric locomotive (supplied by the British Thomson-Houston Co., Rugby), and these are emptied into a hopper by a tippler driven by a 4 h.p. electric motor. From this receiving hopper the coal is taken by a tray conveyor to the main bucket conveyor, which carries it to the overhead bunkers of 700 tons capacity, situated over the firing floor. This conveying plant, as well as the boilers, was supplied by Messrs. Babcock & Wilcox, Ltd. The latter, four in number, each of an evaporative capacity of 20,000 lbs. of water per hour, are of the usual double-drum water-tube type, fitted with chain grate automatic stokers, and integral superheaters, giving a superheat of 150° F. The economisers are placed immediately behind the boilers, and the flues have been kept as short as possible. The single chimney is between the two groups of boilers, and natural draught is relied on entirely. The feed pumps are steam-driven, and their exhaust, which is not allowed to mix with that of the turbines on account of its greater proportion of oil, is employed to heat the feed water.

The two units of generating plant forming the initial equipment each consists of a 2,000 kw. 6,000-volt 50-cycle four-pole alternator, of Messrs. Dick, Kerr & Co.'s standard high-speed type, with direct-coupled exciters, running at 1,500 r.p.m., and driven by a Willans-Parsons standard turbine fitted with a hand-operated overload bye-pass valve and electrical control to the governor. Each set is capable of an overload of 25 per cent. for two hours, and 50 per cent. for half an hour. The generators are arranged so that the stators can slide lengthways to give access to the rotors, and are ventilated through air passages from below. The condensing plant, which, as usual, is placed immediately below each turbine, is of the "contra-flow" pattern; with Edwards' electrically-driven air pumps, and is mounted on springs to allow for expansion. The air-pump discharge is pumped by a separate force pump up to the engine room floor, where it is measured by a Lea recorder.

One of the most interesting features of the station is the pumping system for the circulating water, which, as already mentioned, is derived from the River Tay. A section of the pump room, sunk in the riverside is shown in Fig. 2. A pair of vertical shaft 16 in. centri-

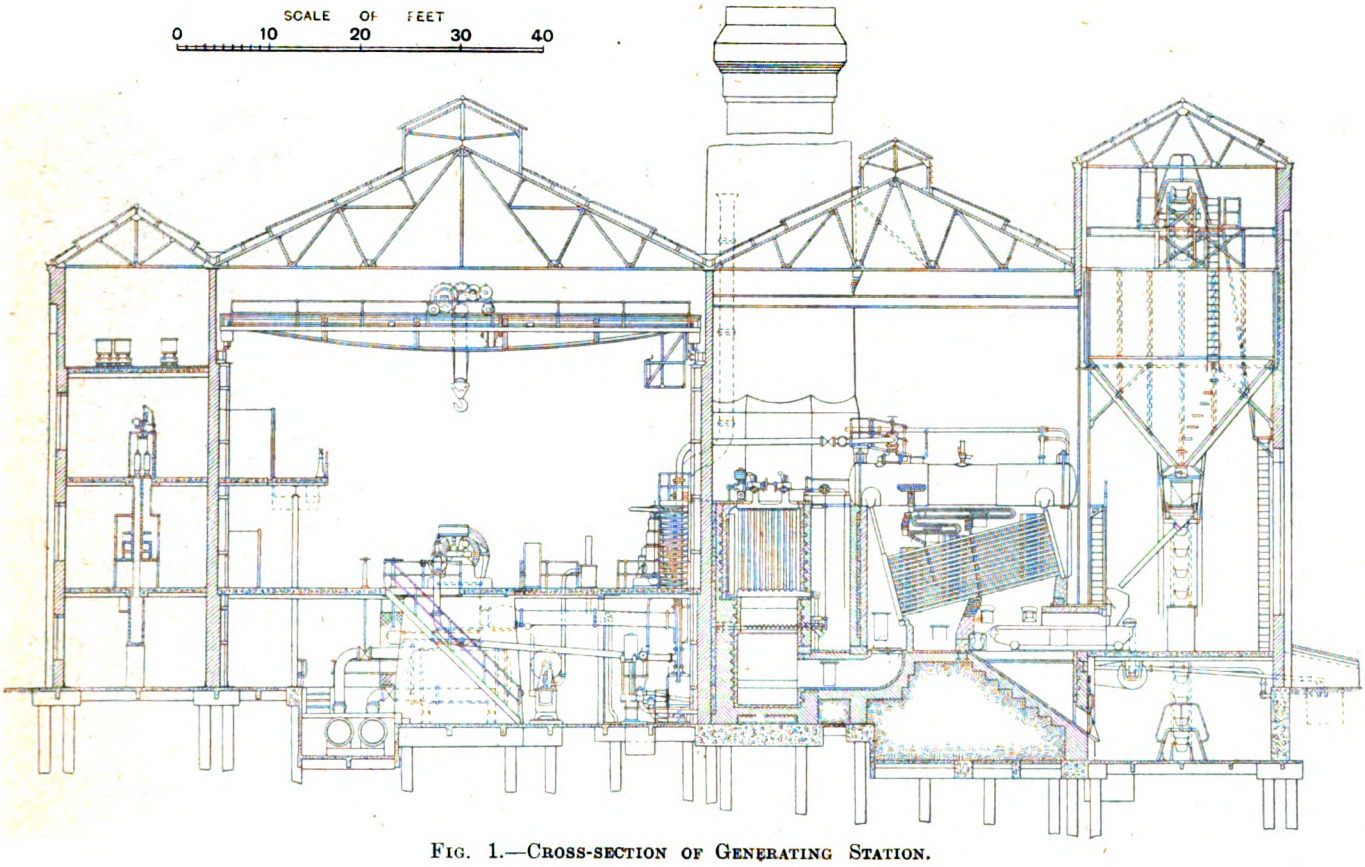


Fig. 1.—Cross-section of Generating Station.

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fugal pumps, driven by 63 b.h.p. direct-coupled motors, are installed, and these are controlled entirely from the engine room. The maximum rise and fall of the tide amounts to about 18 ft., and in order to reduce the power required and avoid constant regulation due to the varying head, a closed system of piping with the outlet of the discharge pipe below the water level was provided. To make sure that water can always be obtained in emergencies, the pumps are placed below the lowest water level, and should the syphonic action fail, they can be speeded up to supply the full quantity of water. The main pipes are 30 inches diameter, and an air pump connected to a

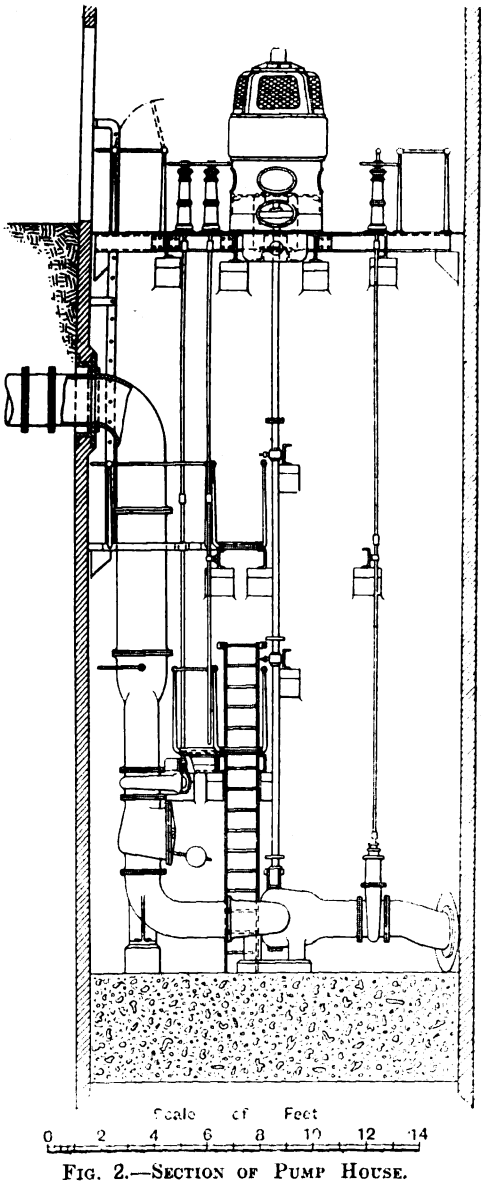


Fig. 2.—Section of Pump House.

barometric pipe is provided to remove air which has been carried in with the water. The engine room plant is completed by two 300 kw. motor generators, providing continuous current to feed the district near the station, and to supply auxiliaries, two steam-driven auxiliary sets serving as exciter and auxiliary stand-by sets, and a 15 kw. motor-generator used for charging a small Tudor battery used principally in connection with switchgear control circuits.

The main switchgear is situated in its own portion of the building, but the operating gallery, which contains also the continuous current board, overlooks the engine room. The whole was supplied by the British Thomson-Houston Co., and embodies their latest form of motor-operated oil switch, in which the actual opening and closing is performed by springs afterwards coiled up by the motor ready for the next operation. The gear is arranged on three floors; the lowest contains the cable dividing boxes, the static dischargers for the outgoing feeders, and the isolating switches. The 'bus-bars in their moulded concrete cells are on the first floor, and the oil switches themselves on the third floor. Triple-pole time-limit overload relays are used on the feeder and motor generator switches, while the generator switches are protected by Andrew's reverse power relays. A Tirill regulator takes charge of the constancy of the 'bus-bar voltage, and a complete system of indicating lamps is provided in connection with the switches. There are two separate sets of 'bus-bars, but these can be coupled when required by an oil switch.

The E.H.T. supply is taken to three sub-stations at Clepington, Dudhope, and Lochee, all equipped with rotary converters, supplied by the British Westinghouse Co., and provided with special boosters, so that they can be used for either the traction or the lighting supply.

B.T.-H. MAZDA LAMPS WITH DRAWN TUNGSTEN FILAMENTS "Mazdawire."

SINCE the first introduction of the tungsten lamp, many improvements have been made in the processes of manufacture of the pressed or built-up tungsten filament with the object of increasing its strength, and, although a large measure of success has been attained so that the best filaments now on the market have the appearance of sound wires, they still have low tensile strength and small resistance to flexure.

The processes which have hitherto been used are well defined: the first, which has been enormously successful, being the process in which the metal is shaped by means of a carbonaceous binder, which by a subsequent treatment is eliminated; another process is one in which the plastic colloid of tungsten alone is used as the basis for forming filaments, and another the B.T.-H. patented process in which the tungsten is held together by a ductile alloy which is shaped by drawing or pressing into the filamentary form and then treated to remove the metal binder.

These processes have been carried to a high state of perfection, and lamps are now made which have been proved to be thoroughly satisfactory for the market requirements. But in a new art, such as tungsten lamp manufacture, it is inevitable that radical developments will take place from time to time owing to the continuous striving of all the manufacturers to perfect their product. For several years the resources of the research department of the General Electric Company of America have been devoted to the development of a process of manufacture which would so condition tungsten that it can be drawn into filaments, and the British Thomson-Houston Company, who are the owners of the patent rights in Great Britain, are now able to announce the successful result of this work, and their patents claim this invention broadly. An abstract of the patent appeared in our issue of January 6th, 1910 (p. 5).

The B.T.-H. Co. will shortly place on the market lamps containing pure drawn tungsten filaments, which, they inform us, are as strong as steel of the same section. This remarkable result has never hitherto been achieved, and has been stated by the majority of the well-known metallurgists and workers with tungsten to be impossible of achievement. But by the process in question tungsten of surprising ductility and strength is produced, so that it becomes possible to draw it into the finest filaments necessary for incandescent lamps.

Until the process of manufacture is fully established, the drawn filaments will only be supplied on one or two types of lamps.

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HIGHGATE HILL TRAMWAYS

TRAFFIC was opened on Friday on the Highgate Hill section of the L.C.C. tramways. The line was previously worked on the cable system by a company, but after a period of disuse, has been equipped electrically on the conduit system by the London County Council. A six-minute service is to be run, and special cars, somewhat smaller than the standard L.C.C. cars have been constructed. The chief point of interest in the equipment is the provision of an entirely new form of mechanical brake of great power, for use on the hill, which acts on the slot rail, gripping it simultaneously from above and below. For this purpose a specially constructed slot with heavier rails than usual has been provided. The new line forms a connection at the Archway Tavern with the London County Council lines to the City, Holborn, and Euston Road, and also with the Metropolitan Electric Tramway Company's line to Finchley and High Barnet.

THE WILLANS-IMPULSE "DISC AND DRUM" STEAM TURBINE

THE new pattern of steam turbine which has recently been introduced by Messrs. Willans & Robinson, Ltd., of Rugby, under the name of the Willans-Impulse "Disc and Drum" type turbine, is a combination of the impulse and Parsons turbine, and differs from the present Willans-Parsons turbine in that a single impulse disc is substituted for the high pressure part of the drum. This reduces the length between the bearings by about two-thirds, and is said to eliminate the weak points both of the Parsons and of the impulse turbine.

The steam is expanded in the nozzles of the turbine from boiler pressure down to atmospheric pressure, after which the velocity generated is extracted in a compound velocity disc fitted with two rows of revolving impulse blading and one row of fixed impulse blading. This disc is bolted direct to the low-pressure drum. The same pressure exists on both sides of the disc, which is therefore steam-balanced. The steam, after leaving the disc at atmospheric pressure and temperature (but with the velocity extracted from it) then passes to the rows of Willans-Parsons blading mounted on the low-pressure drum. In this way the turbine has large clearances at all points, and has the great advantage that in most cases steam is not admitted to it at a greater temperature than 212° F. In other words excessive temperature and consequent distortion is confined solely to the nozzle box or nozzle passages, the casing and rotor not being exposed to steam of a higher temperature than 212° F., excepting in special cases. Where steam at a higher temperature than 212° F. is admitted to the turbine, the temperature is still much below that at which steam is admitted to a turbine of the pure Parsons type. This design is further claimed to ensure maximum economy over a wide and varying range of load, due to the fact that the high-pressure steam to the impulse disc is controlled by nozzles which can be opened or closed automatically or by hand.

The same method of connecting the two end-shafts to the "drum" has been adopted, as in the standard Willans & Robinson turbines. The single impulse disc is fitted between the drum and the end-shaft at the high-pressure end, and in no way interferes with the rigid attachment of the end-shaft to the drum. The low-pressure drum is balanced by means of a piston at the low-pressure end of the turbine on the Fullagar system, instead of at the high-pressure end. This means that the low-pressure drum is balanced by steam being admitted to the exhaust end of the drum, so that the low-pressure gland at the exhaust end of the turbine has atmospheric pressure on both sides of it, thus avoiding the tendency of steam to leak outwards, or of air to leak inwards.

REDUCTION IN THE PRICE OF METAL FILAMENT LAMPS

AS will be seen from our advertisement pages, the General Electric Company, Ltd., announce reductions in the price of certain sizes of Osram lamps which will come into force to-morrow, April 1st. The 100–135-volt 25-, 32-, and 55-watt lamps will be reduced from 3s. to 2s. 9d. each, the 200–260-volt 32- and 40-watt lamps from 4s. 3d. to 4s. each, and the 200–260-volt 55-watt lamps from 4s. 3d. to 3s. 9d. each. It will be seen that while the lower candle-powers of the high-voltage lamps are reduced 3d. in price, the price of the 55-watt lamp is reduced by 6d., so that now this lamp will actually be 3d. cheaper than 200-volt lamps of smaller candle-power. Doubtless all these reductions are due to a cheapening in manufacture, but we understand that the reason a lower price in proportion has been fixed for 55-watt lamps is two-fold: It will assist station engineers, by encouraging the public to use 55-watt lamps rather than 25- or 32-watt lamps, while in addition to this it is the 55-watt lamp that is principally used for public lighting in competition with gas.

We announced in our issue of February 10th an improvement in the efficiencies of some sizes of Osram lamps, including the 50 Hefner c.p. 200-volt lamp, which now consumes 55 watts instead of 63, and users of Osram lamps will welcome still more the latest move of the General Electric Company in the matter of prices.

There will doubtless be a large demand for Osram lamps for the next week or two from regular users of these lamps who have been holding back their orders owing to the unsettling effect of the reductions in the prices by other makers, and we recommend our readers to requisition the stock of Osram lamps that they require with as little delay as possible, in order to secure early deliveries.

The British Thomson-Houston Co., Ltd., are reducing the price of two sizes of their Mazda lamps. The price of the 200- to 260-volt 45-watt 32 British c.p. lamp will now be 4s., instead of 4s. 3d., and the 50-watt 40 British c.p. 100- to 135-volt lamp will be sold at 2s. 9d., instead of 3s.

½d. PER UNIT FOR HEATING AND COOKING

THE Southampton Council have adopted, by 26 votes to 4, the recommendation of Mr. H. F. Street, Borough Electrical Engineer, to adopt a uniform charge of ½d. per unit for electricity supply for heating and cooking. In his report, Mr. Street pointed out that it is only by the adoption of a rate considerably under that charged at present (1d. per unit) that gas cooking can be competed with, and he argues that if other undertakings can supply power at ½d. per unit, electricity for heating and cooking can be supplied at the same rate. It is only suggested that this rate apply to houses where electric light is already installed, and where no great capital expenditure is required for services, &c. Mr. Street states that the output of the station could be doubled with only 28 per cent. increase in expenses, and anticipates that a total working cost of ½d. per unit would be attained under the better conditions of load factor which the increased heating and cooking load would bring about. He explains that the greater part of the heating and cooking load would come on at other times of the day than the lighting peak, especially in the small houses, in which he particularly hopes to further the adoption of electric cooking.

Mr. Street is certainly offering the householder a very good bargain, and there is no doubt that many householders in other places than Southampton would be glad to be able to obtain current for heating and cooking on these terms. He and other station engineers who are endeavouring to develop this class of load are longing for the day when a good oven, with a heating element that can be renewed easily and cheaply, can be obtained for about £4. This should surely not be difficult of attainment when central station engineers are doing their utmost to increase the demand for such apparatus by lowering the price of current.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published March 24th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

5,168/09 and 21,113/09. **Regenerative Control.** Crompton & Co., Ltd., J. C. MacFarlane, and H. Burge. These two patents refer to a system of automatic control suitable for tramcars, omnibuses, flywheel storage sets, &c. According to the first specification, two working motors are connected across the mains in series with the dynamo of a Ward-Leonard motor-generator. By this means the voltage across the motors can be varied from zero to twice the supply pressure. The motors have fields connected across the mains, and are designed to run at normal speed when supplied at twice the supply pressure. In order to strengthen the motor fields automatically during periods of retardation, and to diminish them during acceleration, auxiliary field windings, connected in series and shunted across the dynamo and one motor, are employed. These windings strengthen the fields as the speed diminishes, thus giving the motors series speed-torque characteristics without the necessity of using series windings. An opposing series winding on the generator field limits the current which may be drawn from the mains. (Three claims, two figures.) The second specification covers this latter series winding separately, and for the case where one motor only is used. If the motor is regenerating, the series winding on the generator assists its main field winding. One claim, one figure.

7,471/09. **Arc Lamp.** H. J. Jaburg. An arc lamp without feeding mechanism contains three electrodes. Two are convergent and are supported by being always in contact at their lower ends, while the third is hung vertically alongside and parallel to the plane of the other two, with its point always at a constant distance from the apex formed by the other electrodes. All three electrodes are hung from a common supporting member, and descend by gravity as they are consumed. The arc is struck between the two converging electrodes and the vertical one. The latter passes through a sliding collar on the economiser, which is acted on by a differential coil and strikes and controls the arc. Eight claims, two figures.

10,348/09. **Wiring Conduit.** A. Brampton and F. Osborne. A construction is described in which the securing screws between the two halves of the fitting are enclosed in sleeves around which the cable passes. The sleeve may be in the form of a loose roller round the screw, or may consist of two necks, one on each half of the fitting, tapered and recessed respectively, to engage each other and completely enclose the screw. Five claims, five figures.

10,607/09. **Laying Cables.** The Key Engineering Co., Ltd., and L. Andrews. For laying cables on the solid system, a trough or tube of bitumenised wood fibre is employed. A segmental strip of the wall of the tube is removed longitudinally for inserting the cable and the bituminous filling-in material. The latter is poured in in a semi-liquid condition, and becomes firmly attached to the wall of the trough. Bridge pieces are inserted at intervals to hold the cable in position. The longitudinal strip is pressed into position after the trough is filled. This construction is claimed to withstand bending without cracking or detachment of the bituminous material from the trough. Four claims, three figures.

13,041/09. **Eliminating Circulating Currents due to Harmonics.** Siemens Bros. Dynamo Works and Dr. M. Kloss. When two three-phase generators are coupled in parallel, and their neutral points connected together, any difference in the amplitudes of the third harmonics in the phase E.M.F. wave forms will result in circulating currents. To prevent this, three single-phase transformers with a ratio of 3 to 1 are connected with their secondaries in series between the neutral point of the generator to be protected and the earthing bar, so that the resultant triple-frequency E.M.F. cancels that already in the circuit. Two claims, two figures.

19,210/09. **Compensated D.-C. Machines.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). A field construction suitable for high-speed turbo-generators or variable-speed motors consists of a smooth bore slotted stator with the main field and compensating windings distributed and overlapping around the periphery. This distribution is obtained with a fractional winding pitch of 50 per cent., so that short end connections are used. Each slot contains a coil of each winding, and a space is left in the slots through which air is forced axially by means of a fan. Seven claims, four figures.

20,311/09. **Arc Lamp Electrodes.** A. G. Bloxam (*Gebr. Siemens & Co.*). Electrodes for use in enclosed flame arc lamps contain a number of cores. Each core consists almost entirely of the light enhancing chemicals, and is surrounded with a thin sheath of pure carbon. The several sheaths are connected together so as to form one electrode. Slow burning of the electrode without flickering of the arc is claimed. One claim, seven figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Boult (*Voigt & Haeffner A.-G.*) 14,128/09.

Electric Ignition: Mueller [Magneto machine] 17,664/09; R. Bosch [Distributers] 18,534/09, and 20,656/09; Dier and Primeau [Igniting gas burners] 18,679/09.

Electrometallurgy and Electrochemistry: Patterson [Cell] 11,154/09; Ruthenburg [Furnace electrodes] 12,507/09; Electrolytic Alkali Co., Connor and Stubbs [Electrodes for electrolytic cells] 12,709/09.

Storage Batteries: Twaites [Cell] 6,770/09.

Switchgear, Fuses, and Fittings: Tate [Terminals] 5,302/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Switchgear] 5,418/09; Harris [Time-switch] 5,997/09; Ghadiali [Rendering broken live wires dead] 6,111/09; Ford and Bonshor [Cartridge fuse holder] 8,212/09; Von Ugrimoff [Sliding contacts] 10,175/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Protective devices] 10,594/09; British Thomson-Houston Co. and Richardson [Switchboards] 13,655/09; Raiter [Switch-stand] 22,796/09; Nordentoff [Fuses] 25,445/09; Lundberg [Plug and socket] 29,582/09.

Telephony and Telegraphy: Hughes (*Murray*) [Wireless fog-signalling] 5,685/09; May [Telephone system] 14,244/09; Fessenden [Wireless signalling] 17,450/09; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Telephone exchanges] 28,362/09.

Traction: Higgins and Sheridan [Signalling] 9,035/09; Becher [Signalling] 21,215/09; Cain [Signalling] 21,667/09.

Miscellaneous: Racine and Duc [Burglar alarm] 5,375/09; Gilbert and General Electrical Display Co. [Illuminated display apparatus] 5,545/09; Mavor & Coulson, Ltd. [Mining machinery] 6,051/09; Garry and M. P. Galloway, Ltd. [Colliery signal bell] 7,149/09; Seacombe [Massage machine] 12,844/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution, &c.: Siemens-Schuckertwerke Ges. [Polyphase transmission system] 3,117/10.

Dynamos, &c.: Farny [Machines] 4,907/10.

Electrometallurgy: Mulacek and Hatlanek [Induction smelting furnaces] 672-4/10.

Instruments: Crowell [Integrating dynamometer] 5,683/10.

Switchgear: White and Carichoff [Electrically operated switches] 4,697/10; White, 4,811/10.

Traction: Westinghouse Electric Co. [Electromagnetic brakes] 4,171/10.

Miscellaneous: Siemens & Halske A.-G. [Sound producer for submarine signalling] 4,967/10.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

7,222 of April 2nd, 1896. **Manufacture of Tubes.** A. S. Elmore (*J. O. S. Elmore, India*). An apparatus for the manufacture of tubes of small diameter by depositing the metal electrolytically; the mandrel is rotated and moved to and fro longitudinally in the tank. The latter is divided into compartments longitudinally, and these contain the anodes and the rubbing contacts alternately.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: W. S. Weedon [Electrodes of rutile] 26,921/04.

Distribution Systems, &c.: J. Jones [Manhole covers] 27,153/02; H. Chitty [Insulating conductors] 27,171/03; G. M. Hardingham (*Felten & Guilleaume Corlswerk A.-G.*) [Insulating conductors] 26,786/04.

Dynamos, &c.: Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Ventilation of D.C. machines] 27,472/02.

Electric Ignition: H. Brough [Automatic re-ignition of carriage lamps] 26,987/04.

Instruments, &c.: J. R. Dick and Reason Manufacturing Co. [Maximum demand indicators] 26,906/04.

Storage Batteries: L. Lucas [Plates] 28,511/96.

Switchgear, &c.: J. S. Stevens and C. G. Major [Automatic crane and lift motor control gear] 24,567/99; G. W. Johnson (*Electric Control & Supply Co., U.S.A.*) [Resistance units] 25,218/01, and [Motor controllers] 25,219/01; Crompton & Co. and R. C. Harris [Automatic circuit-breaker] 26,856/03; J. C. Dear [Lamp-holder] 26,799/04.

Telephony, &c.: H. H. Lake (*J. S. Stone, U.S.A.*) [Wireless telegraphy] 27,253/02; Marconi's Wireless Telegraph Co. and E. Priddle [Automatic control of telegraphic recorder] 26,748/04.

Miscellaneous: R. M. Lowne [Electric clocks] 25,374/01; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Electrically-controlled compressed-air-operated bell] 26,757/04; H. Kenzel [Electric targets] 27,064/04.

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THE NEW ELECTRIC LIGHTING ACT

THE Electric Lighting Act of 1909 comes into force to-morrow (Friday), April 1st. The object of the measure is two-fold, viz., to broaden considerably the powers of the Board of Trade in relation to electric supply, by avoiding applications to Parliament concerning many small but important matters, as has hitherto been necessary, and secondly, to generalise provisions usually inserted in local Acts dealing with electric supply, thus removing certain difficulties and anomalies which have been experienced in the working of the Electric Lighting Acts of 1882 and 1888.

In spite of the fact that the measure does not provide for all the requirements of every section of the industry, as was seen during the passage of the Bill through Parliament, nevertheless it brings the legislation relating to the electrical industry to something approaching uniformity. The Board of Trade may now, by Provisional Order, authorise many things which previously rendered necessary the promotion of a Bill in Parliament, such as the compulsory acquisition of land for generating stations, supply in bulk, the breaking up of streets, &c., outside area of supply, supply of electricity to railways, tramways and canals partly outside area of supply, and also simply "by order" to premises outside area of supply. The Board of Trade may also, with the concurrence of the Local Government Board, sanction the exercise of electric lighting powers by authorities jointly. New rules as to certification of meters, and revision of maximum prices are included in the Act, and certain provisions relating to supply, which are at present to be found only in private Acts of Parliament, are made standard, including the "Stand-by" clause, apparatus on hire to remain the property of the undertakers, notice to be given by consumers to undertakers before removing, and power to refuse to supply electrical energy in certain cases. An important provision of the new Act is the one which allows electric supply authorities to "associate" to the extent of giving supply in bulk, an action which was expressly forbidden in all previous Acts and Provisional Orders.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[*Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."*]

STEAM PLANT ACCESSORIES.—A pamphlet is to hand from Messrs. James Baldwin & Co. (Keighley, Yorkshire), describing a new type of blow-off cock, the object of which is to eliminate sticking and pipe strains due to unequal expansion. The cock is provided with a jacket through which the steam circulates, maintaining the casing and the plug at an equal temperature. The pamphlet also calls attention to the firm's safety mounts for boilers, the "Betall" renewable valve, and a tube float for boilers.

ELECTRICALLY-DRIVEN AIR-COMPRESSORS.—A leaflet has been sent us by Mr. A. Campbell Adams (52 St. Enoch Square, Glasgow), calling attention to an automatic switching apparatus for use in conjunction with electrically-driven air-compressors. Its object is to maintain automatically a pressure in the receiver between any predetermined limits without stopping the compressor. The latter is slowed down, and runs at the speed necessary to supply the average demand. Should there be no demand, the air-governor unloads the motor, which then runs slowly on no load.

TURBO-ALTERNATORS.—An illustrated pamphlet is to hand from Messrs. Bruce Peebles & Co., Ltd. (Edinburgh), giving general particulars of the firm's open and enclosed type turbo-alternators. Four- and two-pole machines are described, the former having salient pole and the latter cylindrical rotors. The stator windings are supported by gun-metal clamps held by bronze studs screwed into the end plates and insulated by blocks and tubes of moulded mica. The salient pole rotors are cast in one piece. The strip field coils are wound on and held in position by the pole tips and manganese-bronze angle pieces. The cylindrical rotors are built up of steel discs with open slots, the former wound coils being held in position by phosphor-bronze wedges and end-covers. Forced ventilation is employed in the enclosed type machines. The pamphlet includes a table of the outputs at speeds of 1,500 and 3,000 r.p.m. of the various standard sizes, and tables of weights and dimensions.

New Telephone Cable between England and France.—A misprint occurred in this article at the eleventh line from the bottom of page 179. The actual attenuation constant of the cable is 0·0140, and not 0·140. Fortunately the error is fairly evident from the context. The article appeared in our issue of March 17th.

POWER SUPPLY FROM TRAMWAY CIRCUITS

By E. P. Austin

A NUMBER of supply authorities are giving attention to the development of their load in districts which are outside the area supplied by the street mains, by connecting consumers to their traction system, where such system is supplied from one common station. When amicable arrangements can be made between the lighting and tramway departments, such a scheme is of considerable benefit to the generating station, both commercially and technically. Remunerative power loads can be obtained, and such apparatus and machinery as would cause undesirable disturbance if connected to the outskirts of a network can be satisfactorily dealt with off the traction system. As the writer has had some experience in working such a scheme, he proposes to deal, in the following lines, with some of the technical problems that have to be faced when dealing with power supply off traction cables.

Fortunately, the Board of Trade restrictions over 500-volt supply have been modified, and from the point of view of safety it is sufficient to erect all wires, cables, and fittings in accordance with the Board of Trade and Home Office requirements. When installing motors, the difficulties met with are principally due to the large variation in voltage experienced on all traction circuits, with the consequent speed irregularity; and also the possibility of the stoppage of the supply for short periods, caused by the behaviour of faulty cars or short circuits on the trolley wire. Dealing first of all with the question of voltage variation and its effect on motors. The extent to which this is prejudical depends on the class of load to be driven. It is, of course, negligible in the case of cranes, fans, mortar-mills, &c., driven by series motors, but when printing and textile machinery, or any apparatus requiring a constant speed, has to be driven, the question assumes a different aspect.

The standard form of shunt motor will not give the best results, for obvious reasons, although the varying behaviour of

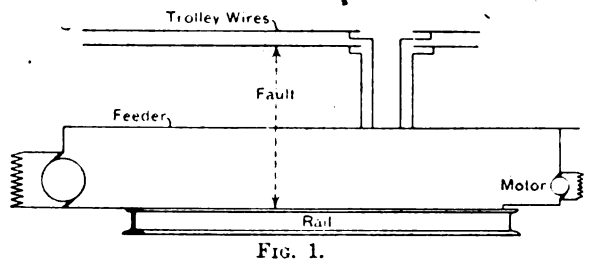


FIG. 1.

different makes of motors working under similar conditions is surprisingly marked. The armature design is chiefly responsible for this and other variations, according as the short-circuit current in the coils on commutation is great or small. The speed variation is particularly marked when the field flux-density is low, as fluctuations in the exciting current with varying voltage will produce a large variation in the flux value, and consequently in the driving torque. Compound motors cumulatively wound are out of the question for constant speed running, and there are reasons, to be detailed later, for not using a differential winding. It remains, then, to consider the commutating pole motor for running off traction circuits. Such a machine, with a high flux density in the shunt field, will, from its inherent characteristics, maintain a nearer approach to a constant speed than it is possible to obtain under these conditions.

There is a peculiarity in the behaviour of shunt-wound motors when supplied off a traction system, which is not met with under ordinary steady voltage conditions, namely, the blowing of the motor fuses when all is running well, and there is no defect in the motor or wiring. The trouble is more persistent when the sparking limit of the machines is somewhat low, and the reason of this will be apparent on considering the running conditions.

When a heavy short-circuit or other cause of excessive current occurs on the tramway system, a large drop in voltage results, which will affect any running motor that is connected to the same section in a manner depending on its position relative to the situation of the fault. For instance, in Fig. 1 a shunt motor is shown, connected to a traction feeder supplying a section on which a fault has developed. The voltage across the motor terminals will drop to the value of the potential across the fault, causing the motor to act by means of its own inertia as a shunt generator on short circuit with a resultant loss of field. Assuming the fault to be cleared rapidly by means of a feeder fuse or similar apparatus, the voltage across the motor terminals will immediately rise to its full value. The self-induction of the field will retard the rise of the exciting current, while the armature current will reach a high figure, and prob-

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ably cause a flash over the brushes, and thus blow the fuses. It sometimes happens that the starter will be released and a fresh start be all that is necessary, but, as a rule, the action of the starter is not rapid enough to open the armature circuit in time.

The effect of a fault is not so marked when one occurs beyond the point where the motor is connected, as in Fig. 2, and has

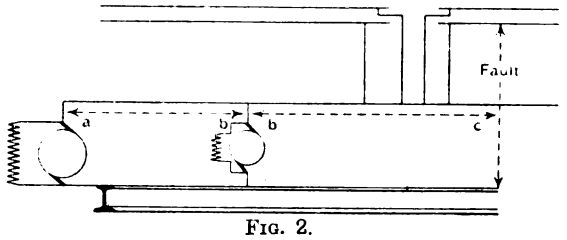


Fig. 2.

little or no effect on a motor when the distance *a—b* is small compared to the distance *b—c*, as the whole matter depends on the fall of potential along the feeder.

There are various means of overcoming the difficulties detailed in the foregoing, and making power supply off traction satisfactory. If the speed variation is not a serious drawback, then a simple remedy for the fuse-blowing trouble is to use a compound motor cumulatively wound, as such a machine will assume a field of some strength when the voltage rises across its terminals after a short on the line.

A differential winding would aggravate the trouble, on account of the larger current the machine would supply to the fault, when it would work as a series generator, also the heavy armature current that follows on the removal of the short would oppose any field due to the shunt winding, and make a flash over the brushes more certain. From these considerations, it appears that the commutating-pole machine will give the best all-round results for working under these conditions.

The efficient protection of circuits supplied from a traction system with one pole earthed is of paramount importance. To instal fuses that will work satisfactorily *in pairs* on 500 volts, is not a guarantee of protection, as any breakdown of insulation on the system, or flashing over of a motor to frame, puts only one fuse in action. It is obvious, then, that the fuse installed on the live wire of any motor circuit must be capable of satisfactorily opening the circuit on a heavy current at high voltage on one pole only. There are a large number of so-called 500-volt fuses on the market which are quite useless for such conditions, principally on account of the restricted space provided for the fuse to blow in. In making a selection, there should be ample length of break and clearance between terminals, and any part of the metal base and cover; also the cables should be brought in at the sides and not at the top or bottom, and provision should be made for efficient ventilation, and there should be ample space for the arc to break in. The safest and most reliable form of fuse for the purpose consists of an open tubular fitting to carry the fuse wire, engaging with knife contacts mounted on an insulating refractory base with back connections, the whole enclosed in an insulated cubicle of ample dimensions.

LOCAL NOTES

ABERDEEN: *Overhead Tramway Equipment.*—The Corporation have passed a resolution transferring to the general manager of the tramways the control of the maintenance and repair of the overhead equipment. Hitherto this has been under the control of the electrical engineer. The Chairman of the Tramways Committee, in moving the resolution, stated that this principle was adopted in all the large towns in Great Britain, including Leeds, Birmingham, Sheffield, London, Newcastle, Nottingham, Sunderland, Glasgow, and Bradford.

ACCRINGTON: *Tramway Through Running.*—Through running of the tramcars between Accrington, Rawtenstall, and Bacup was inaugurated on Thursday.

AYR: *Public Lighting.*—The Lighting Sub-Committee and the Electrical Engineer have for some time past been considering how the cost of public lighting could be decreased. At present the cost of each incandescent electric lamp is £3 17s. per annum, but if the carbon filament lamps now used were replaced by metal filament lamps, it would be possible, they state, to reduce the price to £2 2s. each per annum, and give twice the candle-power. This would mean a reduction of about £400 per annum, and it would cost about £50 to make the necessary alterations. The Committee have unanimously recommended that this should be done. With regard to arc lamps they recommend that the electrical engineer should be allowed to experiment with various types during next winter, and also to consider whether it will not be possible to reduce the number of arc lamps by replacing them with high candle-power metal filament lamps.

BATH: *Extension of Electric Lighting Order.*—The Board of Trade have sent the Corporation the draft provisional Order relating to the proposed extension of the Electric Lighting Order to a radius of three miles from the Guildhall. The Bath Gas Co. opposed the Order, and asked that the charge made by the Corporation for street and other public electric lighting should not exceed the price charged to private consumers, and secondly suggested that the "Northumberland" clause should be inserted, viz., that the prices to be charged during each forthcoming year should be adjusted to preclude the possibility of the revenue being less than the expenditure, the charge to be based upon the experience of the previous year. The draft Order is now under consideration by the Electric Lighting Committee.

BRISTOL: *Advertising Electricity.*—The Bristol Electricity Department have commenced the publication of an *Electrical Bulletin* with the object of bringing before the ratepayers the many useful applications of electricity. The first issue contains articles on how to wire houses cheaply, facts concerning metal filament lamps, loss of power due to counter-shafting, &c.

GOSPORT: *Street Lighting.*—The Lighting Committee recommend that a number of streets should be lighted by electricity. Tenders have been received from the local gas and electric lighting companies, and it is proposed to accept the offer of the Electric Lighting Co. to instal 120-c.p. electric lamps at £3 7s. 6d. per lamp per annum, and 300-c.p. lamps at £8 per lamp per annum. After some discussion at the last meeting of the Council the proposal was referred back to the Lighting Committee with instructions to prepare a statement showing the entire cost of electric lighting and gas for the streets in question.

HALIFAX: *Tramway Profits.*—The Finance Committee is faced with increased estimates for the coming year to the extent of £7,232, but in order to prevent too great an increase in the rates, the Tramways Committee have offered to contribute £5,500 per annum out of the tramway profits towards the deficit.

HASLINGDEN: *Electric Lighting Provisional Order.*—The Board of Trade, having deferred the revocation of the Council's Electric Lighting Provisional Order until September, the Council have again discussed the desirability of putting it into operation. At a meeting last week it was decided to work the Order, and it was referred to the Tramways Committee to report upon erecting a separate generating station, or purchasing current in bulk.

LEICESTER: *Electric Lighting Accounts.*—For the half-year to December 31st the accounts of the Electricity Department show a net profit of £1,121 after meeting capital charges.

LLANELLY: *Electric Lighting.*—The Llanelly & District Electric Light & Traction Co. have given the Council notice that within a period of nine months they propose to supply electricity for public and private lighting under the terms of the agreement

LUTON: *Electric Supply Profits.*—Acting upon the estimated profits of the electric supply undertaking for the financial year to March 31st, the Electricity and Tramways Committee recommend the transfer of £846 to the general district rate. This sum will liquidate the amount standing in the rate books to the debit of the electric lighting undertaking.

WEYMOUTH: "*Fixed Price*" *Light.*—Mr. J. H. Bolam, Borough Electrical Engineer, recommends his Electricity Committee to adopt the "fixed price" system of supplying electricity to small property. In this case it is proposed that the Council itself should undertake the scheme, and not work it through a company. According to a special article in the *Weymouth Telegram*, the Electricity Committee have powers to put the scheme into operation without special permission from the Council, and there is reason to believe that in a few days the scheme will be in full working order, but the important detail that remains to be decided is the rental per lamp.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

GRIMSBY.—A Local Government Board inquiry will shortly be held respecting a loan of £2,000 for street lighting.

HESTON AND ISLEWORTH.—The Electrical Engineer has been instructed to prepare specifications for the extension of the electricity plant at an estimated cost of £3,600, and to invite tenders.

LIVERPOOL.—The Liverpool District Lighting Co. are advised by their electrical engineer to instal a new generating set.

LONDON: *Hammersmith.*—Tenders for cable at an estimated cost of £1,212 are to be invited.

NETHERLANDS.—Tenders are invited for the installation of an electric lighting and power plant at Hertogenbosch.

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Tenders to "Heer Administrateur der Godshuizen, Gasthuisstraat 9," Hertogenbosch, by April 19th. Plans and specifications may be purchased from the same official on payment of £1.

NEW ZEALAND.—H.M. Trade Commissioner for New Zealand, says the *Board of Trade Journal*, reports that a firm who are building a theatre at Auckland, which is expected to be completed in October next, intend themselves to instal the electric lighting plant, which they will buy in London. Electrical manufacturers interested in theatre lighting, and particularly in auditorium and stage-lighting, luminous signs, &c., might communicate with the firm in question. It would be well in communicating to send a cable code, as there is little time to spare. The name and address of the firm may be obtained by British manufacturers on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

RUSSIA.—The Russian correspondent of the *Financier* mentions a number of openings for electrical goods and apparatus: A contract is being made with the engineer Laskin to light the town of Hennitchesk, in the Government of Tabriz, with electricity. A considerable extension of the electric lighting system is contemplated at Kieff. The firm A. Lyskin has offered to supply the town of Orgieff with electric for a period of 15 years on concession terms. The "Yuzhnaya Rossia" Electricity Co.'s offer to reconstruct the Rostoff, on the Don, electric station and supply current at a reduced rate is under favourable consideration by the Town Council. The "Tiflis Listok" says that it is intended to begin this spring with the construction of a great series of water-power electrical works near the village of Atazhukino. The "Dalny Okrain" says that there are only two offers for the construction of the Vladivostock Central Station; one by the firm of Varpeboldt, which offers to accept payments over a period of five years. The other is by an American engineer, Yung, who is asking for a twenty years' concession. The St. Petersburg firm of "Volt" is charged to prepare plans for a water and electric lighting system for the town of Novo Nikolaieffsk. The station will be built on the River Ob.

WALTHAMSTOW.—Tenders are invited for a feeder booster switch, switchboard, and accessories. Particulars from the Electrical Engineer, and tenders to the Town Clerk by April 22nd.

Miscellaneous

HASLINGDEN.—Messrs. Copland & Carden have presented a report to the Guardians regarding the use of electricity at the Workhouse and new Union Buildings.

RUSSIA.—The Russian correspondent of the *Financier* mentions several electric tramway projects: The Minsk Town Council is arranging to change over from horse to electric traction. The town of Simperofol is preparing the terms of a contract with Engineer Bielein for a 40-years' tramways concession. The Council of Tchernigoff has decided on establishing a telephone system for the whole of the province.

TURKEY.—The Government have decided, during the next financial year, to instal wireless telegraphy at the Constantinople Dockyard, and upon all naval vessels. The scheme also provides for wireless installations at Trebizond, Salonika, Bayreuth, and Yemen.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

N.—The L.C.C. invite tenders for the wiring and fitting of the Shelburne Road and Tarriano Avenue elementary schools. Particulars from the Chief Engineer to the Council after April 4th and April 11th respectively, and tenders to the Clerk by April 20th.

W.C.—Block of offices on site of Old Sergeant's Inn, Chancery Lane, for the Law, Union, & Rock Insurance Co., Ltd., 126 Chancery Lane.

S.W.—Electric Theatre, Garratt Lane, Springfield, S.W. Builders, L. Whitehead & Co., Ltd., University Mansions, Putney.

Electric Theatre, Upper Tooting Road, Balham, S.W. Builder, J. Watt, The Lodge, Bromley Road, S.E.

Factory, King's Road, Chelsea, S.W. E. K. Purchase, 20 Maddox Street, W.

PROVINCES.

BATH.—Manual training and domestic centre (£5,000). Secretary, Education Committee, Bath.

BEDFORD.—Bacon factory (£15,000). Local Co-operative Syndicate.

BELFAST.—Additions, Union Workhouse (£9,000). Builder, W. Dowding, Cromwell Road, Belfast.

BOURNEMOUTH.—Additions, Sanitary Hospital. F. Lacey, Borough Engineer.

CHESTERFIELD.—Alterations, Corporation Theatre (£1,000). Architects, F. Matcham & Co., Warwick Court, W.C.

DARWEN.—School (£7,000). R. W. Smith Saville, Borough Engineer, Darwen.

DONCASTER.—Variety Theatre. Major Crosby, The Palace, Grimsby.

DUNDEE.—School Board Offices. Architect, J. Langland, Dundee.

GLASGOW.—Presbyterian Church, Nicholson Street (£3,000). Architects, Miller & Black, 58 Renfield Street, Glasgow.

GOVAN.—Shops for Glasgow Engineering Co. (£3,000). Plans by firm's own staff.

KILMARNOCK.—Church (£3,000). Architect, H. E. Clifford, 225 St. Vincent Street, Glasgow.

LIVERPOOL.—School, Rawson Road (£7,000). Builders, W. Hall & Son, Ltd., Liverpool.

MANCHESTER.—Tenders are invited for the wiring of the "Ins and Outs" Homes, Cavendish Road, West Didsbury, for the Chorlton Guardians. Particulars from Messrs. Charles Clegg & Sons, Architects, 21 Spring Gardens, Manchester, and tenders to the Clerk, Union Offices, All Saints, Manchester, by April 11th.

NEW BRIGHTON.—Winter Gardens (£3,000). Architect, J. B. Preston, North John Street, Liverpool.

TENDERS RECEIVED AND ACCEPTED

AUSTRALIA.—The tender of the British Insulated & Helsby Cables, Ltd., has been accepted by the Postmaster-General's Department for the supply of 1,000 common battery wall sets at £1,975. The General Electric Co., Ltd., through their Australian agents, are supplying 200 common battery table sets at £307 10s.

CHICHESTER.—At the last meeting of the Corporation a recommendation was made that the tender of Messrs. Sandell & Co., of Worthing, be accepted for the electric lighting of the new elementary schools at a cost of £105. An amendment to refer the matter back, several members being in favour of gas, was, however, carried.

GRIMSBY.—The tender of the Jandus Arc Lamp Co., Ltd., has been accepted for flame arc lamps.

HULL.—The tender of Messrs. J. MacMillan & Co., of London, has been accepted for the supply of telephone instruments at £369.

KINGSTON-ON-THAMES.—The Council have accepted the tender of the Craigpark Cable Co. for half a mile of 0·1 square inch cable at £175 11s., and for half a mile of 0·05 square inch low-tension cable at £124 16s.

LONDON: *Camberwell.*—The Council have accepted the following tenders for the annual supply of electric lamps: British Thomson-Houston Co., Ltd., 100 volts and 200 volts, 8 and 16 c.p., 5s. 3d. per dozen; 32 c.p., 6s. 9d.; frosted, 5s. 9d. and 7s. 6d.; Pooley & Austin, Osram (carbon filament) lamps, 100 volts, 16 and 32 c.p., 26s. 5d. per dozen.

Woolwich.—The Council have accepted the tender of the Lancashire Dynamo & Motor Co. at £63 for a 20-h.p. motor. They have further placed an order with Messrs. Wellman-Seaver and Head, Ltd., at £38 10s. for switchgear.

WALTHAMSTOW.—The Council have accepted the following tenders for annual supplies to the electricity and tramway undertakings: W. T. Henley's Telegraph Works, Ltd., cables; Liverpool Electric Cable Co., Ltd., I.R. covered wires; Siemens Bros. & Co., Ltd., workshop flexible cord and braided silk, tantalum lamps, trembling bells and barrel pushes, Siemens' carbons for flame arcs; British Electrical Trade Supply & Bitumen Co., box compound, Chatterton's compound and pitch; General Electric Co., Ltd., switches, china bridge fuses and ceiling roses, counterweight sets and dust shot, wood blocks, fuse wire, staples, bell wire, Sinclair insulators, shackle rings, chimney and roof brackets, pole steps, arc lamp hooks; Chamberlain & Hookham, Ltd., ordinary and prepayment meters; Ferranti, Ltd., ordinary and prepayment meters; Electrical Co., Ltd., meters and Nernst lamps; British Westinghouse Co., Ltd., switches, lamp holders, adaptors, cut-outs, gear and pinion wheels, armature coils; Maxim Lamp Works, incandescent lamps, 8, 16, and 32 c.p., and traction lamps; Sunbeam Lamp Co., Ltd., spherical incandescent lamps, 32 c.p., wall plugs, opal shades, and enamelled iron; British Thomson-Houston Co., Ltd., traction lamps; Davis Electrical Co., steel conduit and saddles; Sloan Electrical Co., Ltd., Conradity arc lamp carbons; Ship Carbons, Ltd., carbons for enclosed arcs; J. W. Rowlands & Co., trolley heads, trolley globes; Anti-Attrition Metal Co., trolley wheels.

WIMBLEDON.—The General Electric Co., Ltd. have obtained a contract for the supply of "Osram" lamps to Wimbledon electricity department, which includes a large quantity of 200- and 300-c.p. Osram lamps for street lighting. Successful experiments have been carried out with high candle-power Osram lamps for the lighting of streets at Wimbledon, and a number of arc lamps have been superseded already.

The General Electric Co., Ltd. have also obtained a contract for the supply of Robertson lamps to the Wimbledon electricity department for the forthcoming twelve months.

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COMPANIES' MEETINGS AND REPORTS

ISLE OF WIGHT ELECTRIC LIGHT & POWER CO.—The report for 1909 shows a net profit of £11,689. After meeting debenture interest and preference dividends, the directors recommend placing £3,000 to renewal account, £1,000 to reserve, £100 to reserve for bad and doubtful debts, and carrying forward £121.

UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON.—The report for the December half-year shows a surplus of £463 after meeting interest on the 4½ per cent. bonds and 5 per cent. prior lien bonds. The net income from the operation of the Chelsea power-house was £40,241, and the net revenue from the power-house, investments, and properties was £82,359. From the income from the power-house has to be deducted interest on the 4½ per cent. and 4 per cent. power-house debentures, amounting to £19,154. The output of electrical energy during the half-year was 6,005,000 units. The meeting is on April 21st.

LIVERPOOL DISTRICT LIGHTING CO.—At the annual meeting last week, it was stated that a new generating set will have to be installed to meet the increasing demand upon the undertaking.

GUILDFORD ELECTRICITY SUPPLY CO.—For the year to December 31st, after transferring £1,000 to depreciation, there is a net revenue of £3,292. After meeting debenture interest and preference dividends and placing £500 to reserve, the directors recommend a dividend of 5 per cent. on the ordinary shares.

WILLANS & ROBINSON.—The report for the December half-year states that, after writing off the sum of £4,245 as depreciation, and paying £4,263 interest on debenture stock, there is a loss of £8,282. Deducting £1,015, the sum carried forward at June 30th, 1909, there is a loss of £7,267. It is not possible to pay any dividend on the preference shares for the half-year, or to meet the charge for interest on and redemption of the funding certificates. The total arrears of preference dividend is thus brought up to £14,999, and of interest on funding certificates to £1,562. The sum of £15,000, the cost of certain legal proceedings, is taken from reserve, and the directors propose that a further sum of £10,000, to meet certain outstanding liabilities, be also set against the reserve fund, reducing this to £42,522. The report continues that the state of trade throughout the year 1909 was bad. It has been impossible to secure a sufficient volume of work to keep the shops fully employed, and the prices obtainable have been unsatisfactory. Some of the recently adopted lines of manufactures, however, are now beginning to bring in orders. It has been decided to recommend the election of Mr. Frederic R. Davenport as an additional director. Mr. Davenport will give the whole of his time to the service of the company, and it is intended that he shall act as assistant managing director, more especially in charge of the commercial part of the business. By the appointment of Mr. Davenport the directors expect to effect a substantial improvement in the position and operations of the business, and they consider that under these altered conditions it is desirable to leave the election of a chairman in abeyance.

COALITE.—At the annual meeting on Wednesday last week Mr. J. H. Smith, who presided, referred to the value of their process in regard to the generation of electricity. Sir William Preece, at the last meeting, had stated that from the proposed station at Barking they would be able to supply electricity at a lower price than was charged anywhere in Europe. Since then, Mr. Percy Allen, chief engineer of one of the largest chemical manufacturing firms in England, and who was considered one of the foremost experts on the use of gas engines for the production of electricity, was asked to report upon the scheme at Barking to the directors of the British Coalite Company, and his report confirmed the highest hopes of the directors. He clearly demonstrated that as soon as the erection of the required number of units was completed and the gas engines provided, the company would be in a position to produce electricity at such a low cost as would yield profits of a most substantial character. This report absolutely proved that the gas from the coalite process could be utilised to great profit for generating electrical power, in which latter direction there was an unlimited field. This power scheme at Barking was to be followed by others which would be developed on a large scale in different parts of the country and outside Breat Britain.

LYNDHURST ELECTRIC LIGHT CO.—There is a net profit of £1,159 for 1909. After placing £830 to reserve and meeting the 5 per cent. preference dividend, a balance of £8 is carried forward.

SLOUGH & DATCHET ELECTRIC SUPPLY CO.—There is a net profit of £3,835 for 1909. The sum of £750 is transferred to depreciation, and a dividend of 4 per cent. declared upon the ordinary shares.

SWANSEA IMPROVEMENTS & TRAMWAYS CO.—After placing £4,000 to renewals and £1,000 to depreciation and reserve, there is an available balance of £9.060 for the December half of 1909. The directors recommend a dividend of 3½ per cent. on the ordinary shares, carrying forward £1.211.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £61 to £61 10s. per ton (last week, £61 5s. to £61 15s.).

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—A meeting of the General Electric Sign & Engineering Co., Ltd., will be held on April 25th, at 2 p.m., at 28 Basinghall Street, London, to hear the liquidator's account of the winding-up.

The first meeting of creditors in the bankruptcy of W. C. Ellis, Electrician, Applegate Street, Leicester, will be held on April 1st, at 12 noon, at the Official Receiver's Office, 1 Berridge Street, Leicester. The public examination will be held on April 8th, at 10.30 a.m., at the Castle, Leicester.

The public examination of J. W. Hunter and A. Clapham, trading as the Yorkshire Motor Car & Electrical Engineering Co., at 101 Kirkstall Road, Leeds, has been adjourned *sine die*.

W. G. Everingham, Electrician, 37 Auckland Road, Ilford, has been adjudicated bankrupt. The deficiency on the business amounts to £594, and the failure is attributed by the debtor to "want of business experience."

W. H. Durrant, Electrical Engineer, 53 Tonning Street, Lowestoft, has been adjudicated bankrupt.

CHANGE OF ADDRESS.—Electrical Installations, Ltd., of Bassishaw House, Basinghall Street, London, have removed to larger premises at 27 Martin's Lane, Cannon Street, London, E.C., where all communications should now be addressed.

APPOINTMENT

A traffic superintendent is required in the Tramways Department of the Blackpool Corporation at a salary of £200 per annum. (See an advertisement on another page.)

NEW COMPANIES

CHILIAN EASTERN CENTRAL RAILWAY CO.—Registered by Ashurst & Co., 17 Throgmorton Avenue, London. Capital £240,000. To acquire, construct, complete, equip, maintain, and work railways, tramways, telegraphs, &c., in Chili or elsewhere in S. America.

BEDFORD & CO. (CARDIFF), Frederick Street, Cardiff. Capital, £1,000. To take over the electrical engineering business now carried on by C. E. Bedford at the above address.

RUSSIAN MUNICIPAL & INDUSTRIAL CO., 3 New London Street, London, E.C. Capital, £25,000 in 22,500 preferred ordinary shares of £1 each, and 50,000 deferred ordinary shares of 1s. each. To take over a concession granted by the City Council of Oremburg, and to carry on the business of contractors, suppliers of electricity, railway and tramway constructors, &c.

"OSRAM" LAMPS SURVIVE FIREMAN'S HOSE

THE accompanying illustration depicts the scene of a fire which recently occurred on the premises of the Hertford Hardware Supply Co., Hertford. A number of "Osram" lamps were burning during the whole time the fire was in progress, and they came in for a considerable amount of rough usage,



OSRAM LAMPS AFTER A FIRE.

as they were right in the midst of the danger zone; in fact the hose pipe of the Fire Brigade was on several occasions actually played upon the lamps. Although the surroundings were badly damaged and burnt, Mr. J. M. Bowman, Resident Engineer of the Electricity Works, reports that these "Osram" lamps held out during the whole of the time, and are still burning to-day as though nothing had happened.

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ELECTRICAL ENGINEERING

No. 171 [Vol. VI., No. 14] THURSDAY, APRIL 7, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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The Engineering Journal of the Electrical Industry

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

Our monthly supplement, "Electrical Engineering in Mines," is included in this issue. It opens with a practical article by a colliery electrician, including notes on the maintenance of colliery electrical plant, and proposed modifications of the special rules. Reports are given of further discussions on Mr. W. Maurice's Paper on "Electric Shocks" at four branches of the Institution of Mining Electrical Engineers. A summary is given of mining patents which have been issued by the Patent Office during March, including one relating to a short face coal cutter by Messrs. Mavor and Coulson. The principal article is a long illustrated description of the electrical equipment of the Ashington Collieries. Reports are also given of two meetings of the Newcastle branch of the Institution of Mining Electrical Engineers, on a Paper by Mr. H. J. Fisher on causes and prevention of electrical accidents in collieries, and on a demonstration by Prof. Thornton and Mr. H. W. Clothier on electrically-caused coal dust and gas explosion. A signalling system for winding plants is also described.

We were afforded an opportunity on Thursday last of seeing the first commercial machine of the type designed by Mr Miles Walker for the purpose of improving the power factor of large induction motors. The machine in question is rated at 6-k.v.a., and is to be used in conjunction with a 900-h.p. slow-speed motor doing haulage work. Besides enabling the motor to work at unity power factor at all loads, it will be possible to make it take a leading current, and thus improve the power factor of the whole system. (Page 229.)

We give some information concerning the 1910 Convention of the Incorporated Municipal Electrical Association at Glasgow from June 14th to 17th. Among the subjects to be discussed are commercial progress; mixed pressure turbines; exhaust steam turbines; chemistry in the boiler-house; continuous records of costs and steam consumption; cheapening of cost of mains and services. (Page 230.)

A letter from Messrs. Brown, Boveri & Co., Ltd., calls attention to the fact that impulse-reaction turbines have been made on the Continent for some time, and mentions sets of exceptional size now in hand. Another letter calls attention to a special starter suitable for use with shunt motors running on tramway circuits. (Page 231.)

An incandescent lamp with a drawn tungsten filament, placed on the market by Messrs. Siemens Brothers' Dynamo Works, Ltd., is illustrated and described. (Page 231.)

The annual report of the Fire Brigade Committee of the London County Council shows that only 106 fires in 1909 could be traced to electricity, out of a total of 3,197. The number of fires due to gas was 334. (Page 231.)

Among the specifications published by the Patent Office on Thursday last was one by H. W. Twaites for

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a storage battery electrode, comprising a perforated lead tube or box filled with the active material, and plugged at both ends.—A cartridge fuse, consisting of a fibre tube with metal caps, which grip the ends of the fuse wire against flanged metal washers at each end, is described by J. Ford and and E. Bonshor.—The British Thomson-Houston Co. cover a method of equalising the pressure across aluminium cell protective devices by connecting the electrolytes together with siphonic tubes.—Means for isolating sets of 'bus-bars on H.T. switchboards are described in another specification by the same firm.—Opposition has been entered to a patent by the Saltpetersäure Industrie Ges. for an arc furnace for treating gases.—A patent by E. Wohlwill for a method of obtaining chemically pure gold by electro-deposition expires on Wednesday after a life of fourteen years. (Page 232.)

THE centrifugal drying machine used in laundries, and known as the hydro-extractor, is particularly adapted to electric drive. A self-contained machine of this pattern is exhibited at the Laundry Exhibition now open. An electrolytic bleaching plant is also exhibited. (Page 233.)

Two important lawsuits of interest to the electrical industry are down for hearing before Midsummer, viz., the B. T.-H. Co. v. Midland Railway Co., which concerns the Morecambe-Heysham single-phase railway, and W. Griffiths v. Edward Lloyd, Ltd., a libel action in reference to the G.B. surface-contact tramways in Mile End Road. An application by the Electrical Contractors' Association for an injunction against the Leicester Corporation for hiring out fittings and doing house-wiring will only come on after Midsummer. (Page 233.)

A BILL is to be introduced by the Transvaal Government under which electric power companies may only work by licence, and under certain conditions of purchase. Special provisions are inserted in respect of the Victoria Falls and Transvaal Electric Power Co., which has already been granted certain concessions. (Page 234.)

A NEW and very simple rotary pump, with no valves, gear, or vanes has been introduced. In the smaller sizes it is suitable for forcing lubricants, and in the large sizes for circulating-water plant. It has a positive suction, and is claimed to act well at low speeds. (Page 234.)

THE Dover Corporation are considering a recommendation to light their streets completely by electricity. The amalgamation of the tramways and electricity undertakings is also recommended.—The work upon the first electric tramway in Edinburgh has been started.—The Hull City and Electrical Engineers are to carry out experiments upon rail corrugation.—A proposal has been made to carry the mails by tramcar in Oldham.—The Weymouth Corporation have decided to charge 2½d. per week per lamp for the first six lamps, and 2d. per lamp afterwards, in connection with their fixed price light experiment.—The working expenses upon the Gloucester tramways for last year were as low as under 5d. per car mile.—The Birmingham Tramways Committee expect to transfer £2,500 to relief of rates from last year's profits. (Page 235.)

COOLING towers are to be installed at Edinburgh. Grimsby Corporation require a three-wire balancer and continuous-current motor meters; Manchester Corporation, rotary converter and static transformers; Littleborough Council, feeder and distributor cables, transformers and switchgear; Halifax Corporation, a 300 kw. rotary convertor, transformers, and switchboards; and Walthamstow, switchboard and gallery. Mains extensions are to be carried out at Eccles. Particulars are given of a proposed electric supply scheme in India. Shrewsbury Corporation propose installing mechanical stokers and public lighting. Loans for large electrical extensions at St. Helens have been sanctioned. (Page 236.)

A MEETING of creditors of Mr. A. H. Gibbings was held at Liverpool last week. (Page 237.)

IT is proposed to send the London Electric Supply Bill to a Select Committee of the House of Commons. The scheme for amalgamating several of the London tube railways comes before a House of Lords Committee to-day. (Page 238.)

THE report of the South Wales Electric Power Distribution Co. for 1909 states that the company is not now working any generating station, and that the position of the company has considerably improved during the year. At the half-yearly meeting of Messrs. Willans & Robinson, on Tuesday, the shareholders were asked not to be unduly discouraged by the present state of affairs. Given reasonable improvement in trade, there was every prospect of profits being made. Many of the troubles of the company had been inherited at the time of the re-organisation, which ought to have been more drastic. (Page 238.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, APRIL 7TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, Westminster, London. "The Progress of Electric Braking on the Glasgow Corporation Tramways," by A. Gerrard.

FRIDAY, APRIL 8TH.

Physical Society.

8 p.m. At Imperial College of Science, London. "An Experimental Demonstration of the Loading of Artificial Cables," by B. S. Cohen.

SATURDAY, APRIL 9TH.

Birmingham and District Electric Club.

7 p.m. At the Colonnade Hotel, New Street. "Choice of Private Generating Plant," by R. V. Brook.

TUESDAY, APRIL 12TH.

National Electrical Manufacturers' Association.

2.30 p.m. Committee Meeting at Balfour House, Finsbury Pavement, London.

Junior Institution of Engineers.

7.30 p.m. At Royal United Service Institution, Whitehall. "High Speed Steam Turbine Design and Construction," by J. M. Newton.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street. "The Progress of Electric Braking on the Glasgow Corporation Tramways," by A. Gerrard.

WEDNESDAY, APRIL 13TH.

Mining Institute of Scotland.

6 p.m. At Technical College, George Street, Glasgow. Discussion on Mr. Robert Nelson's Paper on "Electricity in Mines."

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At 92 Victoria Street, London. "The Theory and Design of Current Transformers," by A. P. Young.

Association of Engineers-in-Charge.

8 p.m. At St. Bride's Institute, Bride Lane, Fleet Street, London. "Welding and its Application," by R. J. Wallis-Jones.

THURSDAY, APRIL 14TH.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. Continuation of discussion on "The Measurement of Light and Illumination."

Rontgen Society.

8.15 p.m. At 20 Hanover Square, London. "Some Methods of Using the Alternating Current Mains for Rontgen Ray Work," by Dr. G. B. Batten.

FRIDAY, APRIL 15TH.

Institution of Mechanical Engineers.

8 p.m. At Storey's Gate, St. James's Park, London. "A Research on the Hardening of Carbon and Low-Tungsten Tool-Steels," by S. N. Brayshaw.

SATURDAY, APRIL 16TH.

Institution of Mining Electrical Engineers.

4.30 p.m. Cumberland Branch. At Grand Hotel, Whitehaven. "Direct Current Plant and the Distribution of Current to Outside Pits," by J. Glynn Williams.

Electric Traction for the Mont Cenis Tunnel.—The Italian State Railway authorities have granted the contract for the overhead equipment, transforming stations, and a part of the generating plant in connection with the Mont Cenis line electrification, to the Italian branch of Messrs. Brown, Boveri & Cie. (Tecnomasio Italiano Brown, Boveri). It appears that the authorities hope to have the line electrically equipped in time for the 1911 exhibition at Turin, as the experimental runs are to be made early in 1911.

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IMPROVING THE POWER FACTOR OF INDUCTION MOTORS

On Thursday last we had the pleasure of attending a demonstration of the uses of the "Phase-Advancer," a new auxiliary machine designed by Mr. Miles Walker, of the British Westinghouse Electric & Manufacturing Co, Ltd., and described by him last year in a Paper before the Institution of Electrical Engineers. (See Electrical Engineering, Vol. V., p. 65.) The demonstration was given in one of the large machine shops of the Westinghouse Co.'s works at Trafford Park, Manchester. The machine is illustrated in Fig. 1, and is the first of its kind to be constructed on commercial lines. It is to be used in conjunction with a 900-h.p. slow-speed induction motor doing haulage work near Newcastle.

The phase-advancer is a special form of exciter connected in circuit with the rotor winding of the induction motor, to which it supplies magnetising current generated at a low frequency and low voltage. Under these circumstances, the amount of idle power required for magnetising is only a small fraction of

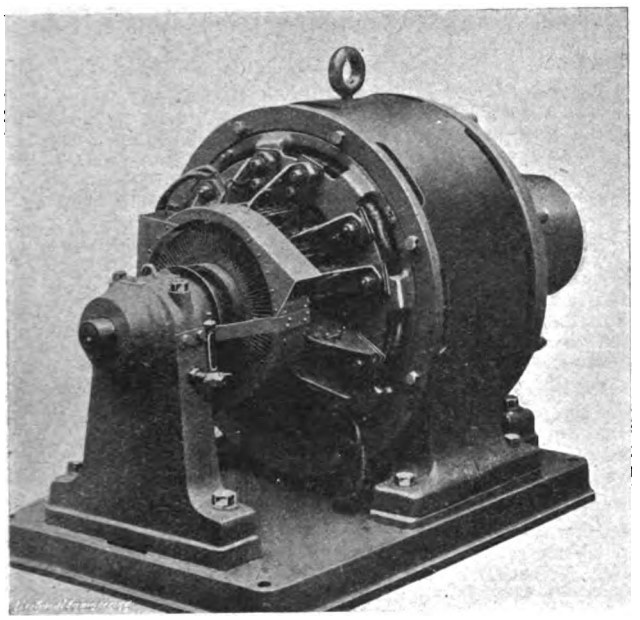


Fig. 1.—6 k.v.a. Phase-advancer.

that required when the magnetising current is supplied to the stator winding at the full frequency and full voltage. For example, a 750-b.h.p. three-phase 50-cycle 2,000-volt 590-r.p.m. motor requires in the stator 50 amperes per phase as magnetising current, or an idle power of 175-k.v.a. We understand that when fitted with a 6-k.v.a. phase-advancer, the same motor will run at unity power factor, and requires no idle power from the mains. Further, if a 12-k.v.a. phase-advancer is used, the motor can be run at a leading power factor of 0·7, when, in addition to taking its ordinary load, it will compensate for the lagging currents produced by other motors representing another 750 b.h.p. A motor with more copper in its windings would be capable of supplying magnetising current to many other motors, with the line working on unity power factor, the only extra cost being that of the 12-k.v.a. phase-advancer and the additional copper of the one motor. There would be considerable saving in generation and transmission, against which must be set off the losses in the phase-advancer and in the windings of the over-compensated motor, which, however, would amount to not more than 6-kw.

Taking, for example, the case of four 750-b.h.p. slow-speed motors, which would have a power factor as low, say, as 0·7, the saving in the capacity of the line and generators would be not less than 220 kw. In this case two phase-advancers would be used, two motors being over-compensated to provide the wattless current taken by the other two, and the losses in the phase-advancers would amount to about 12 kw.

The following is a brief explanation of the working of the machine:—

The phase-advancer may be regarded as an exciter connected in circuit with the rotor winding of an induction motor, and generating magnetising currents at the low frequency of the slip. If these magnetising currents are great enough to create the flux in the motor, the motor will run at unity power factor, as no magnetising current will have to flow into the stator winding. If they are increased, the motor will run on leading power factor. In order that the current in the rotor can exercise a magnetising effect, it must lead in phase on the E.M.F. generated by the rotor slip. The necessary leading E.M.F. is generated by means of an armature revolving in a magnetic field which is excited by a leading current obtained by using the current in one phase to produce the flux which generates E.M.F. in another phase. In the machine shown in Fig. 1 the electrical connections are equivalent to those of Fig. 2. The main difference is that the actual machine has six poles instead of three, there being two poles and two sets of brushes in parallel in each phase. The armature resembles an ordinary direct-current railway motor armature, except that the coil span is different. The inner end of each coil is connected to a star-point, and each outer end is connected to one bar of the commutator. On the commutator are three brushes which bear upon the segments connected to coils, which are for the time being passing under a pole. Each pole is provided with a compen-

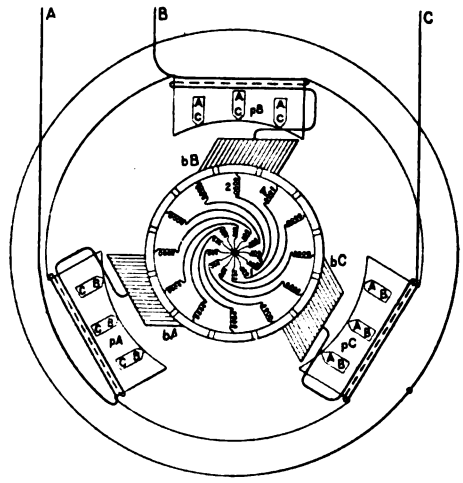


Fig. 2.—Diagram of Phase-advancer.

sating winding placed in slots in the pole-face, the winding being arranged so that the ampere-wires per inch along the pole-face are equal, or slightly greater, than the ampere-wires per inch of periphery of the armature. If we follow one of the armature circuits, commencing from the star-point along coil *1, 2*, it will pass under the pole *pC*, then under pole *pB*, and it will make as many turns in front of the poles *pC* and *pB* as are necessary to generate the required voltage. It then passes to brush *bB* and on to the series exciting coil on pole *pB*. From thence it passes to the compensating windings marked *A* in the slots *pC* and *pB*, and from these to phase *B* of the rotor of the induction motor The currents in the other phases pass through similar circuits. It will be seen that as the part of the coil *1* is under the pole *pC*, the E.M.F. generated in coil *1, 2*, will lead in phase on the current flowing to brush *bB*. Moreover, as the part of the coil *2* is under the *pole pB*, there is generated in the coil *1, 2*, an E.M.F. in phase with the current flowing to brush *bB*. This gives a boosting effect in the rotor circuit which tends to reduce the slip. By reversing the polarity of the poles or by reversing the direction of rotation, this boosting effect can be reversed so as to increase the slip.

The machine we had the pleasure of inspecting is rated at 6 k.v.a., to work in conjunction with a 900-h.p. slow-speed motor. The chief difficulty which had to be overcome in the design was the fact that 1,200 amperes have to be collected from the commutator for each phase. It is a six-pole machine, and each set of brushes deals with 600 amperes. The commutator is only 9 in. in diameter, and has a working face of

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4 in., so that most of the surface is covered by the carbon brushes. The peripheral speed of the commutator is only 2,500 ft. per min., and the wear on the brushes is very small. The commutation was excellent. The means adopted to get rid of the heat generated can be seen in the photograph of Fig. 1. The armature generates at a pressure of from 5 to 20 volts according to the requirements of the motor, and at a frequency equal to that of the slip of the motor. The machine was shown in operation with two 750-h.p. motor-generator sets destined for South Africa. The motors are three-phase 590-r.p.m., 50-cycle 2,000-volt slip-ring machines, and these were run loaded back upon each other, one motor acting as an asynchronous generator. The motor was started up on a rheostat in the usual way, and the only extra switchgear required was a three-pole knife switch for throwing in the advancer. The latter was belt-driven from a separate motor, but it can be designed for direct-driving from the motor it works with if desired.

The following readings were taken with this combination:—The sets were first run on light load without the phase-advancer, and the motor took some 32 kw. at a power factor of 40 per cent. On loading up to 287 kw., at 1,840 volts, the power factor increased to 86 per cent. The phase-advancer was then thrown in, and at the same pressure, the motor took 300 kw. at unity power factor, the current being reduced by about one-fifth. The current was then brought up to the original amount by raising the pressure to 2,200 volts, and the motor then took 375 kw. at unity power factor. The speed of the phase-advancer was then increased so that it delivered more current into the rotor of the motor By this means the motor (loaded to 375 kw.) was made to take a large leading current on a 50 per cent. power factor, the ammeter reading being nearly 50 per cent. greater than the previous reading at unity power factor. On reducing the load on the motor to only 20 kw., with the phase-advancer still running at the increased speed, the power factor remained at 50 per cent. leading. Finally, the motor was run light, taking some 20 kw., and the power factor adjusted to about 5 per cent. leading. It will be noticed that in the present case the power factor is adjusted by altering the speed of the phase-advancer. If the latter is direct-coupled to its motor, the adjustment is made by means of a diverter across the stator windings of the advancer, the current being increased to raise the power factor or to make the motor take a leading current. To increase the slip of the motor, the current in the stator windings is reduced, so that the rotor of the main motor supplies power to the advancer and drives it as a generator.

The following are some of the uses to which this new machine may be put:—Suppose a large motor with a low power factor at the end of a long feeder. By installing a phase-advancer in conjunction with the motor, the feeder would be relieved of wattless current, and new consumers might be connected to the feeder at the motor end. Another use is in connection with induction motors for winding purposes or for driving rolling mills. The large slip required is now obtained by inserting resistance in the rotor circuit. By means of the phase-advancer any drop in speed may be obtained, and the power returned to the line instead of being wasted. A further use is in connection with induction generators. These machines have the advantage that they may be run up to speed and switched on to the 'bus-bars without synchronising, but have not been much employed, because they take a large magnetising current from the line and are incapable of generating any wattless current to supply to induction motors or other apparatus requiring wattless lagging currents. By using a phase-advancer, an asynchronous generator may be made to supply its own magnetising current, as well as wattless currents to other parts of the system.

Electric Cabs in Zurich.—The *Commercial Motor* quotes a foreign correspondent to the effect that the Zurich Corporation will grant no further concessions for petrol cabs, on the ground that electric cabs can be run quite as efficiently but without the noise and nuisance attending petrol vehicles. It is stated that spring will see the first electric cab running in Zurich, and it is prophesied that petrol cabs will have been wholly tabooed by 1915.

THE I.M.E.A. GLASGOW CONVENTION

THE annual convention of the Incorporated Municipal Electrical Association will be held this year at Glasgow, from June 14th to 17th, under the Presidency of Mr. W. W. Lackie, the City Electrical Engineer.

Tuesday, June 14th.—The Convention will be opened by the Lord Provost of Glasgow, the Hon. H. A. McInnes Shaw, at 10.30 a.m. in the Large Hall of the Institute of Engineers and Shipbuilders in Scotland, Elmbank Crescent. Mr. W. W. Lackie will then deliver his Presidential Address, after which the following Paper will be read and discussed:—"Commercial Progress," by A. C. Cramb (Croydon) and H. Collings Bishop (Newport, Mon.). The Tramways and Electricity Committee will entertain the Association at luncheon at the City Chambers at 1.15 p.m., and in the afternoon visits will be paid to the Springburn Sub-station of the Electricity Department, the Pinkston Tramway Power-house, and the Port Dundas Electricity Works. At 7.30 p.m. there will be a reception and conversazione at the City Chambers by the Lord Provost.

Wednesday, June 15th.—The meeting this day will be in the Freemasons' Hall, 96 George Street, Edinburgh, at 10 a.m., when the Hon. the Lord Provost of Edinburgh will welcome the Association. The following Papers will be read and discussed:—(1) "Mixed Pressure Turbines," by Ashton Bremner (Burslem); (2) "Exhaust Steam Turbines," by F. A. Newington (Edinburgh); (3) "Chemistry in the Boiler-house," by A. R. Sillar (Colchester). The members are invited to lunch at the North British Hotel by the Edinburgh Corporation, and visits to the works of the Electricity Department will be paid in the afternoon.

Thursday, June 16th.—Meeting at 10 a.m. in the Large Hall of the Institute of Engineers and Shipbuilders, Glasgow, when discussions will take place upon the following subjects:—(a) "Advantages of Continuous Records of Costs and of Steam Consumption"; (b) "Cheapening of the Cost of Mains and Services." Visits to the following works will be paid in the afternoon:—(1) St. Andrews Cross Electricity Works; (2) Coplawhill Tramway Works; (3) Govan Corporation Electricity Works. An alternative series of visits will be:—(1) Partick Corporation Electricity Works; (2) Clyde Valley Electric Power Co.'s Yoker Power-house; (3) Messrs. Beardmore's Shipbuilding Works at Dalmuir. The annual dinner will be held in the evening at the Windsor Hotel, which will be the headquarters of the Council during the Convention.

Friday, June 17th.—Annual Business Meeting at 10 a.m. in the Large Hall of the Institute of Engineers and Shipbuilders, Glasgow. At 12 noon the members will leave Glasgow (Central Station) for a sail on the Clyde.

A special programme has been arranged for ladies.

The detailed official programme will be issued in due course, and in the meantime all communications should be addressed to the Secretary, Mr. C. McArthur Butler, Staple Inn Buildings, Holborn, London.

Wind-power Generating Plant.—Messrs. J. G. Childs & Co., Ltd., of Willesden, will shortly install a complete wind-power electric generating plant at a large farm in Somerset. The wind-wheel will be 48 ft. in diameter, and supported on a tower 100 ft. high. The controlling gear will be similar to that described in ELECTRICAL ENGINEERING, March 25th, 1909, Vol. V., p. 280. A storage battery will constitute part of the plant, and the power will be utilised to supply over 300 lamps, motor-driven agricultural machinery, and pumps.

Manchester Municipal School of Technology.—Vol. II. of the Journal of this Institution has just been published, and consists mainly of reprints of a number of Papers by members of the teaching staff read before various societies and institutions in the year 1908. Among the more important are "Fuse Phenomena," by Prof. A. Schwartz and W. H. James; "The Electric Discharge and the Production of Nitric Acid," by W. Cramp and B. Hoyle; "Electrolytic Corrosion," by W. H. Gee; Papers by C. F. Smith and W. Cramp on alternating-current problems, and various other Papers on chemical and miscellaneous subjects.

Current Transformers.—On Wednesday next, April 13th, a meeting of the Students' Section of the Institution of Electrical Engineers will be held at the Institution Library, London, when M. A. P. Young will read a Paper on the theory and design of current transformers. After describing the various uses of current transformers, the author will deal with the mathematical theory, going into the errors introduced in the case of wattmeters on account of the varying phase-displacement between the primary and secondary currents at different power-factors. The influence of frequency and secondary impedance and resistance will also be considered. Tests in connection with current transformers will be explained, and transformers of various makes will be described.

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"Electrical Engineering"
April 7, 1910.

ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203-206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

DUTIES OF A COLLIERY ELECTRICIAN

Including Notes on the Maintenance of Colliery Electrical Plant and proposed Modifications of the Special Rules

BY A COLLIERY ELECTRICIAN.

IN some cases both A.-C. and D.-C systems are used in the same group of collieries, and it is therefore essential that electrical engineers in charge of plants should be thoroughly experienced in both systems. As some plants are very isolated and are in mines where a quantity of water underground has to be dealt with, so that the generators have to be run day and night for the pumps, it is therefore necessary that the electrician shall do all his own repairs and as speedily as possible, not only to save loss of production, but also in some cases to prevent a liability of workings being flooded out. For these reasons the electrician in charge, besides having a good theoretical and practical knowledge of A.-C. and D.-C. systems, should also be able to re-wind the machines under his charge, if required. He should be able also to make insulation tests, and must, of course, be capable of making proper insulated joints on cables, and of repairing efficiently all switches, fuses, and controller fittings, &c. A thorough knowledge of ambulance work is also desirable, and last, but not least, he must be a conscientious workman. The writer regrets to say, however, that there are men in charge of plants who do not think it necessary to grind in the metal to metal contacts of a switch or fuse, who do not know that the fingers of a controller should make a full surface-rubbing contact on the plate upon the centre spindle, who think that a covering of ordinary black insulated tape is enough for a joint, and who do not recognise the necessity of stripping the outer covering back and covering the joint in V.R. cables with rubber from rubber to rubber. The joints sent you herewith are examples of what has been done within the last few years in underground work; included in the parcel are the remains of a fuse which was used on a 500-volt circuit.

[The fuse sent us is a double-pole fuse of the type that was used in the early days of electric lighting for 50- and 100-volt circuits. There is a bridge piece between the two poles, through which a screw passes to hold a cover. The wires are brought to the terminals through two holes in a very thin base, and the distance between the centres of these is less than an inch. In one of the joints sent, wires had been teed off a 500-volt paper-insulated lead-covered cable, by wrapping them roughly round the conductors of the cable for a few turns without soldering, and insulated with a wrapping of white unimpregnated tape covered with a rough layer of waterproof tape. In another specimen tappings were taken by means of ordinary shot-firing wire for connecting two lamps on series on the 500-volt circuit, and the joints in this case also were of the very roughest description.]

The mine manager should consider the electrician in charge as an official, and on engaging him should point out the responsibilities of his position, and request him to acknowledge his appointment on an agreement form similar to the following :—

——— is hereby appointed as Electrician [or Electrical Engineer] in charge of the electrical plant at ——— Colliery, and is responsible for the safe working of same in accordance with the special rules for the installation and use of electricity (1905) under the Coal Mines Regulation Act (1887), a copy of which is appended.

(Signed) ———
Manager.

I hereby accept the above appointment and acknowledge receipt of copy of rules, &c., as herein mentioned.

(Signed) ———

A diploma of competency, recognised by the Board of Trade, would be very satisfactory in enabling the mine manager to determine as to the electrician's capabilities.

In the special rules relating to electricity in mines (Section 1, Clause 6), it is stated that suitable means shall be provided for the immediate localisation of leakage. This is very often complied with only by the use of a lamp connected either permanently or temporarily between each pole and earth. In a central station plant it is essential to include a testing set in the equipment, and it is just as important in isolated plants like mining plants, which have often an even larger output than many central station plants for town supply. Another essential article is for cleaning out dust from machines, &c. This is usually done by a pair of bellows, but as a matter of fact they are practically useless for doing the work efficiently. The most suitable and effective article for this purpose is a portable hand air compressor at present on the market, which compresses air to a pressure of 10 lbs. per sq. in., and can be easily moved about underground. A pair of rubber gloves is another requisite.

It should be the duty of the electrician-in-charge to see that all cables and branches are numbered and entered in a book. He should make a weekly insulation test of all cables, enter such tests in the book, and append his signature to it. A weekly test of all motors should also be made, and by doing this and keeping a record, the electrician-in-charge will then be able to detect any cable or machine that is failing, and thus prepare himself for any breakdown which may occur. This system should be specially enforced in mines where there is much water to contend with, as the dampness of the air has a very deteriorating effect upon cables and machines. Under such conditions, in repairs to windings of machines that are done on site, the writer finds the use of a good insulating enamel far preferable to shellac varnish, which is apt to become mouldy in a humid atmosphere.

Trailing cables should be tested for insulation every day before use, and every month they should be brought out of the pit and immersed in water and tested for insulation. In touching cables at any time where there is a doubt as to leakage, this should be done with the backs of the fingers and not with the inside of the hands.

As the working of motors is frequently in the hands of unskilled persons, care should be taken to see that oil does not leak out of the bearings and so run into the windings. Manufacturers of machines should always recess the bottom of the end casings, and should provide a tap or screwed plug at the bottom of the casing for draining off any oil which may have got in.

If I may presume to offer another hint to motor manufacturers, I would suggest that when connecting pins pass through slip-rings in A.-C. machines, it would be very beneficial to let the pin-holes pass through the supporting arms of rings and to put a slot in the end of the connecting pin, so that a broken pin could be withdrawn by using a screw-driver instead of having to drill it out and tap a fresh hole. The sketch in Fig. 1 illustrates this more clearly. Another fault in some motors is the very limited space for getting at and adjusting brush gear. There is a tendency to make these cases with just a small cover on the top, whereas the cover should be large enough to expose all the brush gear when off. It also seems desirable that the end casings of motors should be so made that when cleaning out motors both ends can be opened without dismantling more than is necessary, otherwise the dust is liable to accumulate at

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the back side of motor. Several manufacturers are now making the slip-rings on induction motors of iron instead of brass. This has a serious disadvantage in damp pits. When the motors stand for the week-end the rings are liable to rust, and thus cause sparking when starting up.

Another suggestion I may offer is that every motor-starting panel be fitted with interlocking gear, which so acts that (after switch is thrown out by overload or no-volt release) it would be impossible to close switch unless starting resistance handle is in off position. Controllers should be so arranged that there is no likelihood of the handle being thrown over to the reverse side when pulled sharply from the forward running position.

As regards resistances, the writer would advocate the use of

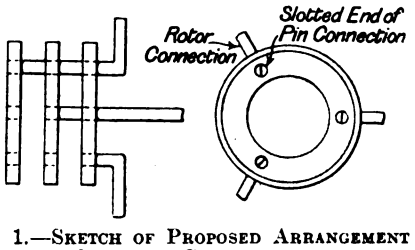


FIG. 1.—SKETCH OF PROPOSED ARRANGEMENT OF SLIP-RING CONNECTIONS.

open grid or plate types, suspended on rails across the airway passing motor house, or in motor house if motor house is closed in at front, in preference to oil-immersed resistances, which are liable to become heated and cause the oil to vapourise.

Coming back to the question of cables, the writer would point out another cause of shock from lead-covered cable. As a result of leakage, the lead has become charged, like a Leyden jar, and a person touching it has received a shock. This points to the possible advisability of lead-covered cables having a covering over the lead. In the particular case observed, the earthing of the cable was continuous, but up to a certain point inbye, iron and steel armouring was used, and beyond that lead covering. In experiments made since similar effects have been obtained, in some cases producing a spark from the lead sufficient to fire a shot. The writer would emphasise the importance of seeing that cables do not get kinked or twisted. A good arrangement for this purpose is to have a horizontal drum with centre

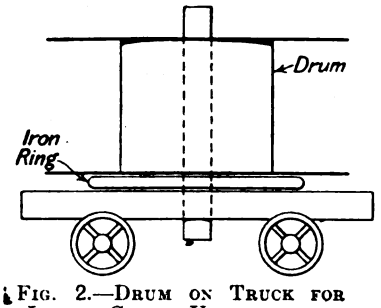


FIG. 2.—DRUM ON TRUCK FOR LAYING CABLES UNDERGROUND.

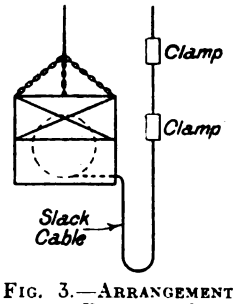


FIG. 3.—ARRANGEMENT OF DRUM IN CAGE FOR PAYING OUT CABLE IN SHAFT.

spindle on an iron ring mounted on a flat tram or bogie, as shown in Fig. 2, so that the drum can be turned round whilst the tram moves. A similar arrangement could be applied to the body of a coal-cutter, to prevent the liability of trailing cable getting under and being cut by the skids. In this case the centre spindle could be made hollow for end of cable to pass in, and the bottom of spindle fitted with contact rings. A word of caution may be issued in running wires or cables down a shaft from a drum on the cage. Always have some slack cable hanging in the shaft below the cage when descending, as shown in Fig. 3. The writer once had a very narrow escape from a serious accident through running a cable direct off a drum with iron arms. Through inattention a man in the cage allowed the cable to become fast on one of the drum arms, and as the cage descended the cable became tight and started to pull the drum out of the cage, pinning the writer between the drum and the safety chain across end of cage. It was only by shouting to the banksman to stop the cage that the pulling out of the drum and four men from the cage, and a consequent fall of 570 yards down the shaft was avoided.

In wiring fittings in motor houses underground especially, it should all be done on the loop-in system, so as to avoid joints, and not, as is often done, wired on the surface and coupled to the leads with joints.

A good system of electric flashlight and bell signals is necessary for shaft signalling. In D.-C. plants no difficulty in wiring these from the home mains is presented, and even in

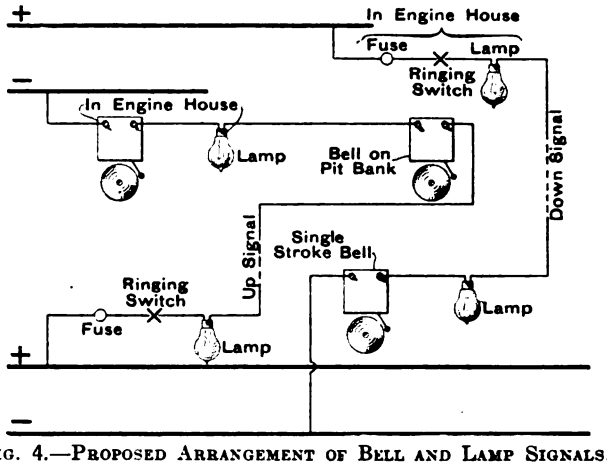


FIG. 4.—PROPOSED ARRANGEMENT OF BELL AND LAMP SIGNALS.

A.-C. plants the signal circuit can be wired off the exciter, as shown in Fig. 4.

As a standby during such time as the electric plant is stopped, a battery-bell signal could be used, wired in accordance with the diagram in Fig. 5.

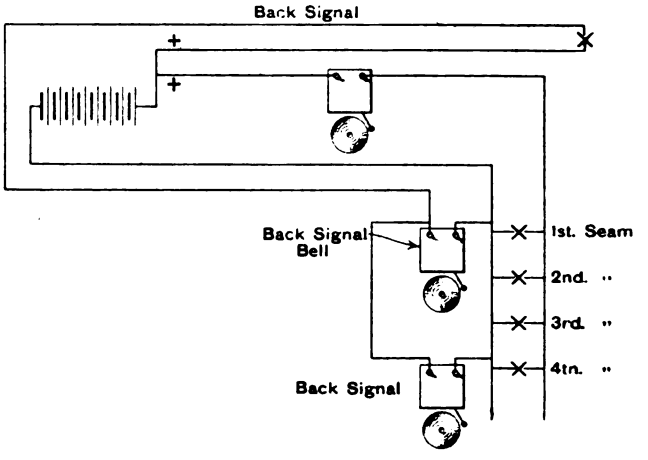


FIG. 5.—PROPOSED ARRANGEMENT OF STAND-BY BATTERY SIGNALS.

In conclusion, the writer would suggest the following alterations to the special rules for the installation and use of electricity in mines. A reduction in the number of rules would be preferable, but in the writer's opinion this will not be possible until the general standard of workmanship and suitability for mining conditions has been raised considerably.

A slight verbal alteration is suggested to Rule 3, Section I., to make it clear that the fittings, brackets, &c., in medium-pressure lighting installations are to be placed at a sufficient distance apart as well as the conductors.

To Rule 6 (which imposes a limit within which the leakage current is to be left) it is proposed to add: "A testing set, with generator of voltage not less than the current voltage in use, shall be provided for making periodical tests of cables, machines, apparatus, &c

In Rule 9, which gives three alternative methods of protection of branch circuits, it is proposed not only to omit the second method, but to prohibit the breaking of a live circuit by drawing fuses underground, and to require the use of a switch. [It is the custom to use a joint box with detachable fuses, which in a wet mine causes liability to shock.]

To Rule 11 it is proposed to add the requirement that the "competent person" appointed to take charge of electrical apparatus shall have had not less than two years' underground experience in electrical work.

To Section II., Rule 3, the following addition is proposed:—Every generator shall have its train *efficiently* earthed, and shall not rely on its foundations, nor on steam pipes, as an earth. [In this connection, attention is drawn to the liability of an attendant receiving a shock when shutting off steam if the insulation has broken down. This could be avoided by insulating the handwheel of the stop valve.]

It is proposed to add to paragraph 3 of Rule 6, Section III., the words:—Where underground cables are buried they should be cased with iron piping. [To prevent damage by picks.] It is proposed to add to Rule 7 the requirement that trailing cables should be tested for insulation every week, and tested after

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immersion in water every month. The following new rule is put forward :—"All cables, mains or sub-mains, or every circuit shall be tested for insulation at periods of not more than a month, and such tests shall be recorded by the person in charge in a book kept for the purpose.

The following additional rules are proposed to be included under Section IV. :—*Rule* 4.—Oil-immersed switches and controllers must be so constructed that conductors shall not become deteriorated through coming in contact with the oil. *Rule* 5.—The use of oil-immersed resistances, where resistance is kept in circuit for any length of time, is prohibited. [The heat generated has been known to vaporise the oil and to cause an explosion.]

The following addition to Rule 4, Section V., is suggested :—"The use of semi-enclosed motors with extended shafts and slip-rings in separate cases are prohibited in places where General Rule 8 applies." The following two new rules under this section are proposed :—"*Rule* 9."—All enclosed-type motors shall be so constructed that end casings (or part) at each end can be removed so as to allow of efficient inspection and cleaning. *Rule* 10.—All motors shall be tested for insulation at periods of not more than a month, and such tests shall be recorded by the person in charge in a book kept for the purpose.

Under Rule 2, Section VII., it is proposed to add that all fittings, brackets, &c., must be efficiently earthed, and the following new rule is proposed :—*Rule* 5.—"All wiring for lights underground should be done by looping in, or, if in series, should be done without any joints whatsoever.

The following additional rule is also proposed under Section IX. :—*Rule* 4.—Signal wires shall not be used for telephoning purposes where there is a liability of giving a false signal and causing a haulage rope to start or stop.

[It is the practice at some mines to use pocket telephones on the haulage signal wires, and this often tends to confuse the attendant on haulage engine, when the persons using telephones ring to each other.]

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during March.

March 3rd.—Supplement on "Electrical Engineering in Mines," in which, after some correspondence relating to the novelty of a recently described leakage device and on the fixing of shaft cables, an account is given of a series of experiments on electricity and coal dust explosions. The formation of a Cumberland branch of the Institution of Mining Electrical Engineers is recorded, and a new design of enclosed air-cooled mining motor is described and illustrated. Other novelties, of which particulars are given, include a new shot-firing generator, and a watertight magneto mining telephone. Discussions on "Electric Shocks" at six of the branches of the Institution of Mining Electrical Engineers are reported, and a summary is given of electrical mining patents which have been published during February.

March 10th.—A special article describing a number of novelties, including some new forms of hand-lamps, watertight fittings, and an electrically-driven air-compressor. A Paper describing the manufacture of metal filament lamps.

March 17th.—Abstracts of two Papers by Mr. Miles Walker on turbo-alternator construction, with discussion.

March 24th.—Standardisation of electrical machines; overhead line construction.

March 31st.—The rating of motors for intermittent work. Description of a new generating station. The new Willans "disc and drum" turbine.

Colliery Fatalities.—An inquiry was held at Linlithgow on March 22nd concerning the death of W. Mackenzie, a pump attendant in the Blackridge Colliery, owned by the United Collieries, Ltd. It appears that the deceased took hold of a cable where there was a fault in the insulation, and received a shock which proved fatal. The jury returned a formal verdict, as a fuller inquiry is probable. A motor attendant, J. G. Scott, of South Shields, was found dead in a motor-house at the St. Hilda Colliery on March 17th. At the inquest, evidence was given to the effect that the deceased had opened a 3,000-volt switch-box, and must have touched the live portion of the switch. He had no right to touch the box, and had been warned. According to the medical evidence, the post-mortem examination revealed no cause for death, and so the jury concluded that the man had met his death accidentally by electric shock.

The Royal Commission on Mines.—At the National Miners' Conference recently, a strong feeling was expressed that the sittings of the Royal Commission on Mines should be continued, with special reference to the dangers attending the use of electricity in mines. It was apparently the unanimous opinion of the delegates that the whole question of electricity in mines should be thoroughly investigated by an impartial body like the Royal Commission, with the assistance of the best scientific opinion.

PREVENTION OF ELECTRICAL ACCIDENTS IN MINES

THE Paper read before the Institution of Mining Electrical Engineers by Mr. W. Maurice on "Electric Shocks," which forms the introduction to the first part of that Institution's inquiry into the causes and prevention of electrical accidents in mines, has been further discussed at several branches of the Institution. Discussions at Newcastle, Cardiff, Sheffield, Nottingham, Whitehaven, and Manchester have already been reported in ELECTRICAL ENGINEERING IN MINES (February 3rd and March 3rd), but at some of these sections further discussion has taken place since the meetings then reported.

BIRMINGHAM DISCUSSION.

The discussion of the Paper by the Warwickshire and South Staffordshire Branch was resumed at a meeting in Birmingham on February 26th. After the Chairman, Mr. A. HILL, had summarised the conclusions arrived at at the last meeting, Mr. GIDWELL put forward various conditions as tending to safety, such as the wearing of rubber gloves when adjusting machinery, the provision of rubber mats near exposed live parts, and the erection of guard-rails to prevent persons from falling against them. There was some discussion as to whether such rails should be insulated or earthed, but no definite conclusion was arrived at. Another point insisted on by Mr. Gidwell was that all motors should be of such a size as to deal with 100 per cent. overload, but Mr. ENGLISH pointed out that running of motors so much below their full capacity was very uneconomical. The same speaker also dealt with the earthing of coal-cutters by an extra wire in the trailing cable, and various alternative methods of earthing suitable for different circumstances were discussed. In dealing with further questions raised by the Paper, it was agreed that the problem was largely controlled by the human element, and that the best protection was the supervision of a skilled electrical engineer of proved experience. The chairman invited written contributions giving the personal experience of members.

WHITEHAVEN DISCUSSION.

The Paper was further discussed by the Cumberland Branch of the Institution at a meeting at Whitehaven on March 19th. In dealing with Question 7 of the Paper, relating to conditions under which actual accidents have occurred, Mr. BARRACLOUGH (Workington) said that of fifty-one fatalities attributed to shock between 1903 and 1909, thirty-one had been due to defective work and eight to carelessness. Over 50 per cent. were connected with cables. He mentioned cases where coroners' juries had brought in verdicts of electric shock against the evidence of electrical experts. Mr. W. H. BORLASE (Threlkeld) suggested that in these cases the jury should be composed of men with electrical knowledge; and the President, Mr. T. P. MARTIN (Cumberland Coal Association) gave some particulars of the only fatal electrical accident which he knew of in Cumberland, where a signal wire had come in contact with a faulty cable.

Passing on to discuss the relative degree of risk with continuous and alternating current, the general opinion was that there was no marked difference, but Mr. Borlase remarked that the better class of apparatus used with the higher voltages available on alternating circuits was itself a source of safety. With regard to further questions, it was agreed that insufficient protection of cables was the chief source of trouble; and with reference to protective devices, both Mr. Borlase and Mr. J. GLYNN WILLIAMS advocated the exclusion of fuses from mines and the adoption of oil circuit-breakers. In discussing risks other than those arising from leakage, Mr. Williams contended that it was practically impossible with most existing plants to avoid exposing live parts, but thought that protection in this line might arise in new plants in the future. Dealing next with the human element, the importance of skilled supervision was emphasised, although it was to be understood that, with the most efficient engineers in charge, accidents due to bad design and installation would still be liable to occur. After a few remarks on such precautions and the more extended use of rubber gloves and avoidance of touching live parts, the subject of the status of the colliery electrician was returned to, and Mr. Borlase expressed the opinion strongly that there should be a recognised official in charge of the electrical plant, and was supported by Mr. Williams, who said that it was unfortunate that the Institution was prevented from proceeding with the creation of a diploma class of members by the delay in getting the Articles of Association of the Institution passed by the Board of Trade.

CARDIFF DISCUSSION.

The discussion at Cardiff was resumed on March 19th, when Mr. WATKINS (Bargoed) described a case of a fatal electric shock on a 3,000-volt system due to omission to open a feeder switch before working on the feeder. Another case was that of a painter who was ordered to paint the outside of a switch-box, but opened it and came in contact with live parts. He had known cases of one blade of a three-pole switch which had stuck

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when switching off, and men had obtained shocks in trying to pull it out by their fingers.

Mr. DAVIES (Abersychan) spoke of the advisability of having a visual voltage indicator such as a pilot lamp, which on A.-C. circuits might be worked by a small transformer on all controllers. Switches should have a good positive action, and ample provision to take up wear.

Mr. T. E. RICHARDS gave particulars of a successful case of resuscitation after a severe shock, and said that he favoured the Shäffer method of artificial respiration, which could be used even on a man with a broken arm. The system of earthing they adopted at their colliery was by means of two separate earth plates, one on the surface and one underground, laid in the sump. The earth wire was of copper connected to a tinned cast-iron plate in each case. With regard to cables, they use as far as practicable armoured underground, and bare overhead on the surface. He had not yet experienced any trouble resulting from breakages in the cables. Asked by the President (Mr. S. F. Walker, Bath) whether he preferred armoured cables in preference to non-armoured *but protected* cables, Mr. Richards said he would prefer armoured cables with a sound continuity throughout as regards earthing.

Mr. S. F. WALKER said that he had great objections to armouring, and he thought that if some of the money now spent in armouring were spent on insulation, a better result would be obtained. One of the great objections he had to armoured cables was that when they became damaged by a fall, they were apt to cause flashing, and were difficult to repair.

Mr. T. E. RICHARDS, continuing, related a case of an electrician who was investigating a leak in a 440-volt cable underground, and the method he adopted in finding the leak was by passing his hand along the cable, and was found some time after dead, in an upright position, with his hand on the cable.

Mr. SOARS (Swansea) thought that a very good protection for cables was by covering them in a wooden casing, well dressed with Stockholm tar.

Mr. WATKINS favoured an incombustible casing, as he believed avoiding as far as practicable anything of an inflammable nature underground. He also recommended burying the cables as much as possible.

Mr. T. E. RICHARDS mentioned a case where the cable of a pit shaft took fire, and after the fire an insulation test was taken of the cable, which showed very good results.

Mr. WALKER remarked that finely divided carbon was a good insulator, and instanced cases of the coils of arc lamps, after being burnt out, continuing to work as long as they were not disturbed.

Mr. WATKINS emphasised the necessity for periodical insulation testing, and a special specification as regards cables, switches, &c., for mines.

NOTTINGHAM DISCUSSION.

Discussion of the Paper was resumed at Nottingham at a meeting on March 19th. In calling for discussion, Mr. W. Maurice, who was in the chair, mentioned some of the directions in which he would be particularly glad to hear the experience and opinions of members.

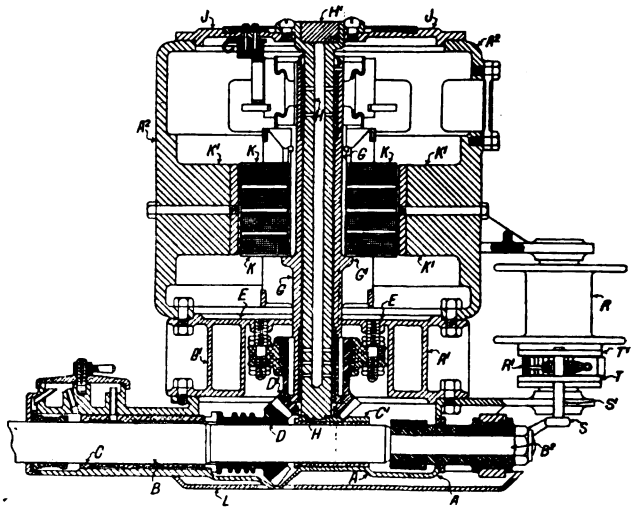
The principal speaker was Mr. F. CUSWORTH (East Kirby), who, in discussing limits of leakage, considered that if the leakage could be kept below 20 milliamperes, the leakage shock was practically harmless. The rule that it was not to exceed 1/1000 of the maximum current was no protection against leakage shock. Even with 110 volts the resistance of a man's body, especially under mining conditions, was not high enough protection, and the effects of shock were dependent on the actual current passing through the body and not upon the voltage. In speaking of danger due to defective apparatus, he mentioned a fatal case on a 600-volt A.-C. circuit, where an ammeter case which was badly earthed became live through the fibre base absorbing moisture. He suggested marble bases for such instruments, or protection with an expanded metal guard. After a few words on the protection of lamps and lamp-holders, he passed on to the subject of cables, and advocated double-wire armouring painted with bitumastic solution to avoid corrosion. The care required in their maintenance was in itself a safeguard as preventing the dangerous temporary repairs often found on unarmoured cable systems. The earth wire should not be of less capacity than the feeders, and nothing less than 7/18s. stranded wire should be used for earthing electrical apparatus. In conclusion, he emphasised the necessity for good work on the lighting systems, and recommended the use of conduit tube throughout.

Mr. MAURICE then read some communications received from members, one of whom said he had had no electrical accidents in eight years, and only two hours' stoppage, due to failure of a shunt regulator. In the pits in question certain men are made responsible for the condition of the cables in each district, and all apparatus is inspected weekly. The President also referred to a suggested appliance for automatically switching current off when the percentage of gas in the air reaches a certain figure.

Royal Commission on Mines.—Sir Henry H. Samuel Cunynghame, K.C.B., has been appointed Chairman of the Royal Commission on Mines, in succession to the late Lord Monkswell.

ELECTRICAL MINING PATENTS OF MARCH

A PATENT has been taken out by Mavor & Coulson, Ltd., S. M. Mavor, and H. A. Mavor for an improved coal-cutting machine of the bar- or chain-cutter class particularly adapted for short face workings, and especially where it is desired to make an entry cut into the face in a line with the side wall, finishing at the other end of the face also in line with the side wall. The specification, numbered 6,051 of 1909, has four figures, one of which is reproduced below. The machine itself consists of a motor geared to a rotary cutter bar projecting laterally. An independent haulage apparatus may be used, in which case there is a cable connection between the two, so that the haulage gear can be controlled from the coal-cutter. Alternatively, if the cutter bar has a reciprocatory as well as a rotary motion, a small haulage drum may be attached, as shown in the figure, to the frame of the coal cutter and driven through suitable ratchet gear by the reciprocatory motion of the cutter bar. For supporting the machine during the cutting operation, a steel sledge is fixed to the base, and for moving the machine from one place to another, wheels are provided. These can be raised above the plane of the sledge for working. The cutter bar projects from the front of the casing and radial adjustment is effected by slewing the frame. As shown in the figure, the motor axis is vertical, the cutter bar being driven through bevel gearing. The cutter-bar shaft *B* is supported by a bearing gland *C* formed in the front wall of the casing, and by a central bearing *C*. The motion of the motor shaft *H* is transmitted to the shaft *B* through bevel wheels D_1 and *D*. The wheel D_1 is formed with a boss having thrust collars embraced by a divided bearing with corresponding



SECTION OF COAL-CUTTER FOR SHORT-FACE WORKING. (MAVOR & COULSON, LTD.)

thrust recesses. The motor shaft is tubular, and has transverse passages for distributing lubricating oil fed in at the head. The shaft and armature can be withdrawn through the open head of the casing, the wheel D_1 being left in the base. The mechanism for reciprocating the cutter bar is not shown. The haulage drum *R*, with the ratchet gear operated by the bar, is included, however.

A conveyor for carrying coal along the working face and discharging it into the tubs is described in specification No. 9,817 of 1909 by D. M. Ritchie, a colliery manager of Prestwick. This consists of a long band of leather or canvas thickly studded with rivets, which lies at the bottom of a trough formed of a number of sheet metal sections fastened together. The length of the trough can be easily and quickly altered. At the delivery end the last section rests on an erection carrying a transverse roller. Beneath this are a roller and a drum. Either can be connected by means of a clutch to an electric motor; the former rolls up the leather band and thus draws the coal along to the tubs, while the drum winds up a rope which passes over a pulley at the other end of the trough and draws back the band after all the coal has been discharged.

An improved locking device for attaching to miners' safety lamps is described in specification No. 12,751 of 1909 by J. Prestwich, of Eccles. A steel stud is enclosed in a hollow metal fitting, which is attached to the base of the lamp. The pin is pressed upwards by a spring, and when the upper part of the lamp is screwed into position, the stud enters a recess in a lip attached to the upper part. The pin can only be withdrawn by means of a special electromagnetic device.

A patent by E. Witzenmann (No. 3,917 of 1909) covers a flexible metallic tubular armouring for cables consisting of a metal band of ⊓⊔ section wound helically so that the edges of adjacent coils interlock. The band is wound on tightly so that the insulation is forced up into the section in the form of a screw thread, thus preventing movement of the armouring.

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ELECTRICAL EQUIPMENT OF THE ASHINGTON COLLIERIES

THE collieries of the Ashington Coal Co., Ltd., are situated in Northumberland, some twenty miles north of Newcastle, and are the largest and most important in that district. The company owns four collieries, one at Ashington, another at Woodhorn, a third at Linton, and the fourth, on which work is just being commenced, is at Ellington. The total output of these pits amounts to some 2,000,000 tons per year. The company generates its own electric power in a steam station at Ashington.

Electric haulage, pumping, and coal-cutting have been employed for some few years in the Ashington pits, and preparations are now being made for a supply of power from Ashington to Linton, and to the new pits at Ellington, for the purposes of electric haulage and pumping. The total electrical horse-power installed in the Ashington pits is about 2,200, distributed amongst some eighty motors, over 50 of which (aggregating some 1,500 h.p.) were supplied by the General Electric Co., Ltd. There are three shafts for winding coal at the Ashington colliery, named the Bothal, Carl, and Duke shafts respectively. A fourth shaft, carrying the main water pipes, is also fitted with a small cage to ride men only. All the winding engines are steam-driven. The exhaust fans in the ventilation shafts are also steam-driven, and deal with 260,000 cubic feet of air per minute each, but are about to be replaced by electrically-driven fans. An idea as to the extent to which electrical working is employed in the Ashington pits can be obtained from Fig. 1, which is a diagrammatic plan of the cables and motors in the various seams, and represents the state of affairs a month or so ago.

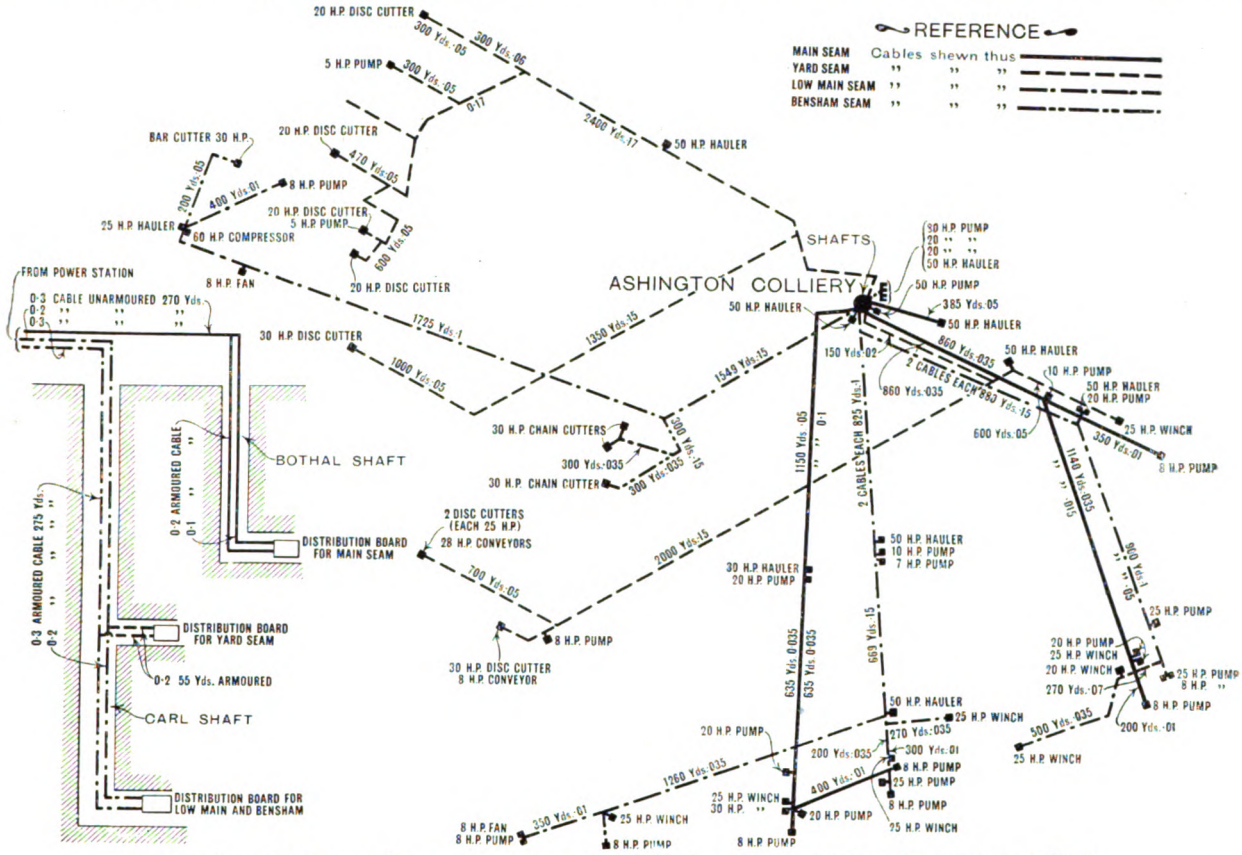


FIG. 1.—DIAGRAM OF SHAFT CABLES AND PLAN OF CABLES AND MOTORS IN ASHINGTON PITS.

From the inset diagram of the shaft cables, it will be seen that there are two feeders from the power station to the Carl pit, one 0·2 sq. in. and one 0·3 sq. in., each consisting of a set of three braided stranded cables. The distance is about 270 yards, and these cables are carried on a single wooden pole line and supported on porcelain insulators. A second pole line carries two 0·3 sq. in. feeders, each consisting of a set of three bare stranded cables, for supplying the Bothal pit and the surface plant. At the mouth of the Carl pit, the 0·2 sq. in. feeder is jointed to an armoured lead-covered cable, and the 0·3 sq. in. feeder to an armoured bitumen cable. These are supported at intervals of from 12 to 18 feet down the shaft by heavy wood cleats bolted to the shaft wall, and both go down the full depth of 275 yards. As indicated in Fig. 1, the cables enter junction boxes at the Yard seam level, from which two 0·2 sq. in. armoured cables are taken to supply that seam. The Bothal pit feeder is jointed at the pit mouth to two armoured three-core cables, 0·2 sq. in. and 0·1 sq. in. respectively, which run down to the main seam distribution board.

Near the distribution boards, the cables enter dividing boxes, from which single-core unarmoured cables protected with sheet-iron lead up to the iron-clad boards. The armoured cables from these boards are carried along the roadways to the various haulage motor rooms, gate-end switches, &c. They are hung from the wooden props struts by short lengths of rope, which would give way in the event of a fall of roof. At intervals the cable is given a deep loop, so that there shall be plenty of slack for repairs, making joints, &c. Where it was necessary to join two lengths of cable, the two ends are brought in to a joint box of the pattern which is divided into three compartments, the two outer ones being intended for filling with bitumen compound for ensuring a water-tight joint. In the present case, the centre compartment containing the joint is filled in solid with insulating compound, and the outer compartments are filled with molten lead, which makes a good electrical contact with the armouring and lead. A joint made in the manner is illustrated in Fig. 2. It will be noticed that a piece of stranded copper cable is moulded into the lead and carried outside the box. This bond is first sweated to both armouring and lead of the cable before pouring in the molten lead. A substantial clamp is also fitted to the box at each end for supporting the cable.

Three-phase current is distributed in the pits at 500 volts through armoured three-core cable. All the

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cables, excepting the trailing cables for the portable machines, are armoured, and every piece of apparatus is connected to the armouring, which is earthed. The trailing cables are four-core rubber insulated, and covered with hose-pipe, the fourth core being the earth-

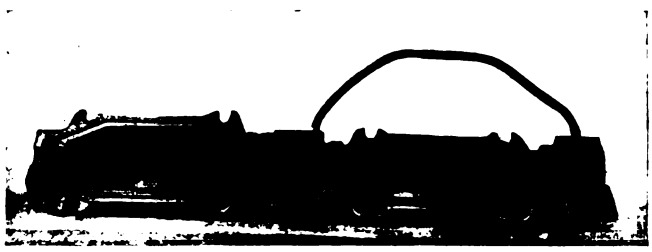


FIG. 2.—JOINT BOX OPENED TO SHOW METHOD OF BONDING.

ing wire. The armouring of the shaft cables is connected to the rising mains from the pumps, to the water-pipes and cooling-ponds at bank, to a 6 ft. hole filled with scrap-iron, and to a four-mile length of wire rope buried in a trench along a transmission line.

The system of protection now being introduced is quite unique, and is protected by a patent taken out by Mr. T. McKie, the electrical engineer to the colliery, and the Ashington Coal Co. In this system, each motor is protected individually by an automatic device

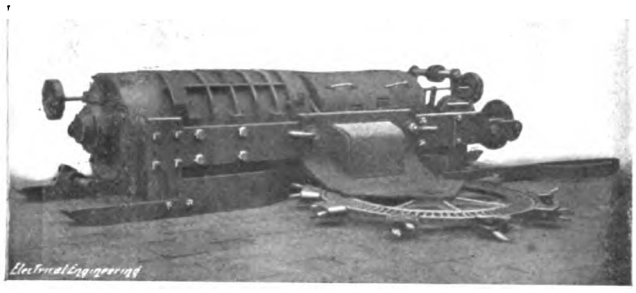


FIG. 3.—DIAMOND ELECTRIC DISC COAL-CUTTER.

on its controlling switch, and any leakage is separately indicated on each main circuit. In the case of a stationary motor, the frame, and in the case of a coal-cutter, the earth-wire of the trailing cable, is connected to the main cable armouring and the switch-box through a solenoid placed in the switch-box. Should there be any leakage in the motor, the leakage current must flow through the solenoid. Energising the solenoid causes a weight to be released, which drops on a trigger and opens the switch. This ensures that

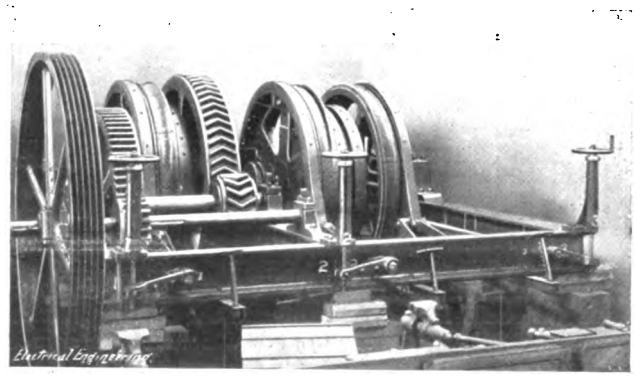


FIG. 4.—50-H.P. THREE-ROAD ENDLESS ROPE HAULAGE GEAR. (ROBEY & CO., LTD.)

the motor is cut off directly leakage occurs. This device has already been fitted on several motors in the pits with every success. At the switchboard, the armouring of each main circuit is connected to a common bar through a relay. This bar is connected to the neutral points of the generators through a choking coil, an automatic circuit-breaker, and a recording ammeter. Should there be a leakage in any part of any circuit, the leakage current flowing back through the armouring will disconnect the faulty motor as explained above, and will also actuate the relay at the switchboard. This causes a lamp to light and indicate on which circuit the leakage has occurred. The ammeter records the leak, and the attendant can write the time and circuit on the chart alongside the kink in the curve. The provision of the circuit-breaker and choking coil in the connection from the armouring of the various main circuits to the neutral point of

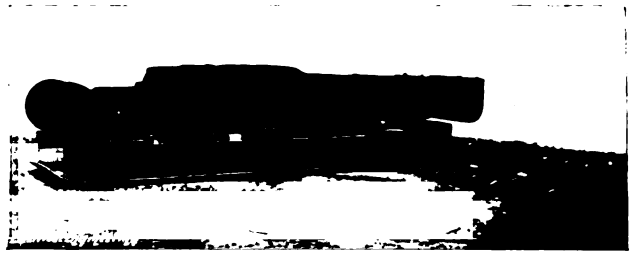


FIG. 5.—DIAMOND ELECTRIC CHAIN COAL-CUTTER.

the generators prevents any damage to the generators due to sudden rushes of current.

A set of switch-pillars on this system is being constructed by the British Westinghouse Co. for use on the 500-volt side of the 3,000 500-v. transformer at the bottom of the Linton shaft for controlling the inbye cables. The leakage trips are instantaneous, and are claimed to be more reliable than overload protection on the three phases. Each motor-switch will be fitted with a minimum leakage trip, so that the motors will not open the feeder-switches except in the case of a heavy



FIG. 6.—DIAMOND GATE-END SWITCH FOR COAL-CUTTER, SHOWING TRAILING CABLE PLUG AND SOCKET.

earth or the motor-switch not acting. As leakage trips are fitted to the branch feeders as well, a triple protection is obtained.

It will be seen from Fig. 1 that in the main seam there are seven pump motors, four 20 h.p., one 10 h.p., and two 8 h.p. capacity. Besides these, there are two 50 h.p., and one 30 h.p. hauling motors, and three winch motors, one 30 h.p. and two 25 h.p. There are no electric coal-cutters in this seam, the work being done by compressed air disc machines, which are supplied from several steam-driven compressor sets on the surface. The punching and drilling machines used in the pits are also worked by compressed air. Electric coal-cutters are employed to a considerable degree in the Yard seam. Here, there are eight disc cutters of from 20 to 30 h.p. each, shown in position. These were supplied by the Diamond Coal-Cutter Co.,

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of Wakefield. They are fitted with three-phase, 40-cycle, 30 h.p. 500-volt motors of the squirrel-cage pattern with the rotor and stator slots out of parallel to avoid dead points. The motors are provided with ball-bearings, as apart from the simpler lubrication and easier running obtained, there is so little wear that there is no danger of an earth or short-circuit occurring due to the rotor striking the stator. This has been a source of danger, as in some cases a rotor stamping has been known to have cut into the stator winding. Further, the friction may heat up the stator stampings and burn up the slot insulation.

One of the Diamond disc machines is illustrated in Fig. 3. These machines have been fitted with a new pattern of reversing controller and are switched direct on to the supply. The use of the reversing switch reduces the wear and tear of the trailing cable plugs, as these can be left in the same position.

Besides the coal-cutters there are two 50 h.p. haulers, a 50 h.p. pump, a 25 h.p. winch, three 8 h.p. conveyor motors, and two 8 h.p. pumps in the Yard seam. One of the 50 h.p. haulers is illustrated in Fig. 4. This is situated near the Carl shaft, and provides the motive power for three endless rope haulage ways in the Yard seam. The haulage gear, which was manufactured by Messrs. Robey & Co., Ltd., of Lincoln, consists of three endless rope drums, each six feet in diameter, mounted loose on the drum shaft, and fitted with friction clutches for operating the drums independently or together, as may be required. Each drum has a powerful band brake. The shaft is 8 in. in diameter, and the gun-metal bearings have sight-feed drop lubricators. The double helical gear is machine moulded, and is driven by means of a rope pulley on the first motion shaft from a 50 h.p. motor. In order to facilitate the erection below ground, the cast-iron base-plate is constructed in sections. Fig. 4 shows the gear as erected at the makers' works.

Fig. 5 illustrates a chain type Diamond machine which was supplied recently for the Bensham seam. There are three 30 h.p. chain cutters at work in this seam, which is supplied from a Low Main seam cable. In the latter seam, there are no less than fourteen electrically-driven pumps of from 8 to 80 h.p., ten hauling and winch motors of from 20 to 50 h.p., two 8 h.p. fans, one 60 h.p. compressor, and one 30 h.p. bar coal-cutter. The two large 80 h.p. pumps are of the three-throw reciprocating type, and are driven by motors with wound rotors and slip-rings, supplied by the General Electric Co.

Fig. 6 illustrates a pattern of gate-end switch-box supplied by the Diamond Coal-Cutter Co., and used in the Ashington colliery in conjunction with their coal-cutters. This comprises a gas- and water-tight cast-iron case containing a quick-break 3-pole switch and cartridge fuses. The handle is detachable. When the lid is dropped, it locks automatically, and the box can only be opened by moving the handle. It is impossible to switch on while the box is open. Closing the switch locks the trailing cable adapter and the box lid. The live terminals of the switch are protected by an insulating plate, and cannot be touched accidentally when the box is open.

The power station at Ashington contains two 750-kw. Parsons turbo-alternators. These are of the early wire-wound rotating armature type, and run at 2,400 r.p.m., delivering three-phase current at 40 cycles, 500 volts. The machines are remarkable for their large air gaps; one has a gap of 3 in., and the other a gap of 3·5 in. Four slip rings are provided, and the fourth is connected to the neutral point of the star wound armature. The field magnets are excited at 100 volts. On a recent test, one of these machines was found to take only 21 lbs. of steam per kw. hr. on three-quarter load. The working pressure is 140 lbs. per sq. in. At present it is only necessary to run one machine at a time, but when the supply is given to Linton and Ellington the load will be greater than can be dealt with by one machine, and a third unit will probably be installed. The average load on the station is some 500 kw. The main switchboard was supplied by Messrs. Siemens & Co., and comprises nine panels. Two are for the control of the main generators, and two belong to the motor-generators. There are four feeder panels, two controlling two feeders running to the Carl pit, one for the Bothal pit feeder, and one for a feeder supplying the surface plant. The remaining panel is allotted to the air and circulating pumps of the condenser plant. For changing over the load from one machine to the other, a Siemens revolving light synchroniser is used. The surface condenser plant is in duplicate. The air pumps and centrifugal water circulating pumps are electrically driven by G.E.C. and Bruce Peebles three-phase slip-ring motors of from 40 to 60 h.p. each. These are provided with liquid starters and switch-fuses.

The supply to the surface plant, which consists of various coal screening appliances, brickmaking plant, stone-breakers' winches, and general lighting and power supply to the shops, is given by means of an overhead line.

The electrical equipment at the Ashington power house in connection with the supply of power to the Linton and Ellington pits comprises two 200-kw. Westinghouse oil-cooled three-phase transformers, Reyrolle switchgear on a new panel of the main board, and lightning arresters to protect the transmission lines. The secondary pressure is 3,000 volts, and the switches on this side of the transformers are of the Reyrolle automatic oil-break pattern with overload release coils in each phase. The transmission line is in duplicate from Ashington to Linton, the two pole lines being spaced five yards apart. A single line runs from Linton to Ellington. Each line consists of three solid No. 4 S.W.G. copper wires strung on Buller insulators. The poles are 34 ft. long and 11¼ ins. in diameter five feet from the butt, excepting at angles, terminals, and crossings, when they are 37 ft. long and somewhat thicker. There are no cross arms, but the insulators are carried on three galvanised wrought iron side brackets 2 ft. apart. Shackling is effected every ¼ mile, and knuckle bosses are used at all shackling and straining poles. Earthing is effected by running an old steel winding rope in a trench for the whole distance of the line. To this every piece of ironwork on the line is connected. The rope is in turn connected to earth-plates every 200 yards, and also to the large earth-plate at the generating station. The length of the double line is approximately 2¾ miles, and the length of the single line from Linton to Ellington about 1¾ miles. The present working pressure is 3,000 volts, but the line will probably have to work at 6,600 volts later on.

Horn type arresters are fixed at Ashington, Linton, and Ellington. These are placed on the wall in the two former cases and on terminal poles at Ellington. In the latter case connection is made underground from the terminal poles to the switchroom at the pit mouth by means of three-core cables, suitable for 6,600 volts working pressure, laid solid in Howard asphalt troughing. The dielectric of these cables consists of layers of Manilla paper impregnated with diatrine, over which a vulcanised bitumen compound is applied under pressure forming a solid tube upon each conductor. The cores are then laid up together round a core of similar bitumen compound, and sheathed over all with a tube of compound ribbed internally so as to fit the interstices of the laid-up cores. The cable is then taped, jute served, and protected with wire armour, and finally jute served and compounded over all. Each cable is in a separate trough filled with Trinidad bitumen covering the cables to a depth of ½ in., and a top layer of asphaltic concrete. Between the haulage engine house and the transformer chamber at the bottom of the shaft at Ellington, a similar cable is used, excepting that it is further protected with a double layer of galvanised steel armouring wires. The cables as well as the overhead line material were supplied by Messrs. W. T. Glover & Co., Ltd. (Trafford Park, Manchester).

Besides the supply to the colliery, this station, by arrangement with the Northern Counties Supply Co., feeds the local distributing network of that company, delivering continuous current for village lighting, and a small amount of power at 240/480 volts on the three-wire system. The cables are bitumen insulated, and are laid underground in wooden troughs. A large number of metal filament lamps are on these mains for street lighting and for private houses. This load is dealt with by two motor-generator sets by the British Westinghouse Co., each consisting of a 300-h.p. three-phase asynchronous motor with squirrel-cage rotor running at 575 r.p.m., and coupled to a 200-kw. D.C. compound-wound generator delivering current at 480-530 volts. These sets are started up from the A.C. side by means of an auto-transformer, and take a starting current of from 300 to 400 amperes. The rest of the plant comprises two balancers and a switchboard. Six meters are in use, three in series on each side of the system.

In conclusion, we should like to express our thanks to Mr. Ridley Warham, General Manager to the Ashington Coal Co., Mr. E. O. Southern, Manager at Ashington, Mr. W. J. Charlton, chief engineer at Ashington, and Mr. T. McKie, electrical engineer, to all of whom we are indebted for much assistance. Our representative was afforded facilities for inspecting the plant in the pits as well as that on the surface.

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CAUSE AND PREVENTION OF ELECTRICAL BREAKDOWNS IN COLLIERIES

MR. H. J. FISHER (Electrical Engineer to the Lambton Collieries) read a Paper on March 9th on this subject before the Newcastle Branch of the Institution of Mining Electrical Engineers. Analysing a list of electrical breakdowns contributed by some of the members, he found that out of twenty-three recorded breakdowns on cables, four were caused by bad insulation, two by falls of roof, four by runaway sets, seven by water, and six by bad workmanship. With trailing cables, there were eight breakdowns due to falls of roof, and two by water. With motors, there were eighty breakdowns recorded, eleven due to bad design, three to overload, fourteen to defective insulation, one to careless operation, twelve to water, twelve to the rotor coming into contact with the stator, nine to collection of dust, eleven to oil-soaked windings, four to open circuit in field coils, and three to vermin getting inside the motor. With switchgear and controllers, there were sixty-five breakdowns. Thirty-five due to bad design, four being too small for the work; nine to careless operation, one to water, and thirteen to failure of the automatic trip gear to operate or to over-fusing. These breakdowns, which total 178, work out to the following percentages :—37·5 bad design or material, 37·5 bad work or faulty operation, 12·5 due to water, 12·5 purely accidental.

A common fault with multi-core cables lies in the jute packing used with rubber and bitumen cables becoming loaded with moisture. This can be avoided by using solid bitumen cable or rubber-insulated bitumen-covered cable. A fault sometimes found is that the armour is applied in a dry state and is acted upon immediately by water. The best practice is to compound the armour thoroughly as it is being applied, not with a brittle compound, but with one that is, and will remain, as sticky as possible.

After the cores are laid up and taped, soft compounded jute packing should be applied, and the first layer of armour applied and compounded. Another layer of soft compounded jute packing should be applied; the second armour should be applied over this and compounded, and after the final jute serving or Hessian tape, the whole should be again compounded. A cable made up in this way is absolutely waterproof, and will resist heavy falls of stone, as the jute packing will make it more resilient.

Paper-insulated and lead-sheathed cables are satisfactory, but should be double wire when suspended along main roads. Bitumen sheathing, unless it is soft and pliable, is apt to harden and crack and let in moisture. Vulcanised rubber insulated cable is more universally used than any other class, and where the rubber is of good quality is undoubtedly the best. It and vulcanised bitumen cable is perhaps best adapted for face-work. Paper cables are more liable to breakdown than the other classes, unless sufficient care is exercised in jointing and sealing ends and watching insulation resistance.

A large proportion of faults on cable systems occur at joint-boxes, and Mr. Fisher described his own design of box, of which full particulars and illustrations were given in ELECTRICAL ENGINEERING IN MINES, November 4th, 1909.

From the table of 80 breakdowns of machinery, 25 were due to defective design or insulation, and 36 to bad work or maintenance. The author has come across various instances of insufficiency of insulation on bar-wound stators and rotors.

Dampness is a frequent cause of breakdowns, but its effects could be avoided by more thorough impregnation of the windings and the use of closed tubes to carry the winding. Frequent troubles occur owing to the use of an inferior class presspahn. The author has found a special class of presspahn coming from Germany, and thoroughly impregnated with paraffin wax, which effectually prevents dampness entering the windings. Slip-ring troubles are often due to the fact that a class of insulation is used that readily absorbs oil and moisture, or that allows carbon or metallic dust to accumulate and to cause flash-overs on the rings. To prevent this, a thin slip of insulating material of larger diameter than the insulating bushes should be inserted between the rings.

There is room for a great deal of improvement in switchgear and controllers both as regards design and material, often caused by designers not being thoroughly versed in the conditions in mines. Greater accessibility is required. Cases are even known where it has been impossible to connect up switch-cases in place. The unsuitable use of wood, porcelain, and sulphur for cementing terminals are matters that require attention.

In conclusion, Mr. Fisher advocated the use of automatic cut-outs everywhere in place of fuses, and the more thorough standardisation of spare parts.

The discussion was opened Mr. H. W. CLOTHIER (Messrs. A. Reyrolle & Co.), who said that manufacturers had been in search of information of this description for many years, and that it was a difficult matter to obtain first hand from practical men details of the difficulties with which they had to contend.

Mr. G. G. L. PREECE (Messrs. W. T. Glover & Co.) said that in many cases manufacturers had already altered their designs in order to meet the requirements of practical mining engineers. It appeared to him remarkable, having regard to the poor insulation found on much of the mining machinery, that there were not more breakdowns.

Mr. WOOD (Messrs. Ernest Scott and Mountain, Ltd.) contended that the majority of breakdowns of mining plant were due to oil in the windings, particularly on direct-current machinery. He suggested that in order to cure such trouble the windings should be very thoroughly impregnated. He recommended more careful design in bearings, as in many cases the overflow to the oil-containing chamber was not sufficient. The question of circuit-breakers instead of fuses was a difficult problem in connection with portable machines.

Mr. LAYBURN wished to know whether motor breakdowns due to oil gathering between the stator and rotor were really caused by the rotor going to earth through failure of insulation properties, or to a collection of dust and oil in the air-gap causing mechanical heating. He emphasised the necessity for proper oil-throwers between the bearings and the electrical machinery. The dust problem could not be satisfactorily overcome by means of blowing, and his experience was that in order to clean mining machinery thoroughly, it was necessary to dismantle the whole of the apparatus periodically. The presence of coal-dust in such windings led to damage which was not altogether electrical. He knew of a case where mechanical friction on a short-circuit arrangement of slip-rings produced a spark which got on to the coal-dust in the windings, and would have caused serious damage if it had not been promptly noticed. With reference to the surging due to switching operations, he suggested the use of a choke coil on every machine to damp them down.

Mr. BAXTER (Messrs. Reyrolle & Co., Ltd.) agreed with Mr. Fisher as regards the insufficiency of the light cotton covering usually employed as insulation on rotor-bars. He believed that the Admiralty had substituted mica or micanite for presspahn for the purpose of insulating the slots of armatures. With reference to standardisation of colliery plant in order to keep down the number of spares, he suggested that colliery engineers limit themselves as much as possible to one make of machine, so that standardisation of one maker's plant would mean practically standardisation of the whole of the colliery equipment.

Mr. MORGAN said that he had used and approved the wax-impregnated presspahn referred to by Mr. Fisher, as it was cheaper than micanite and answered its purpose very well. Oil-throwing was greatly aggravated if the bearings were worn and if the rotor was slightly out of balance and a whip of the shaft occurred.

Mr. SHEARER suggested that where large motors ran the risk of being overloaded, it was well to mark the ammeter with a red line indicating the point of overload, so that an unskilled attendant could always tell what he was doing. With regard to the burning out of the first coils on an alternating-current motor on the instant of starting, it was the usual custom among transformer manufacturers to insulate the end coils and those near to them very much more heavily than the remainder to provide against this surging effect. It was the general practice, unfortunately, to start up the motor with its rotor open, but for a large machine it was essential to close the rotor circuit on switching in the motor. This would very largely obviate the burning out of the motor, inasmuch as at the instant of starting there was probably 100 per cent. excess voltage.

Mr. CLOTHIER said that the case of the switching in of an alternating-current machine raised a problem analogous to the switching in of high-pressure cables. It was at first thought that an ohmic resistance inserted in series and gradually cut out would overcome the difficulty, but having regard to the surges set up in a cable system by switching operations at a distance it was found that the ohmic resistance was not a sufficient remedy, and a use of choking coils and spark-gaps was therefore made. The question was one of pressure and not of current. Spark-gaps were not, of course, applicable to the present problem, inasmuch as the voltage developed in the rotor was not one between phases, but between individual turns upon each phase. With regard to the question of automatic overload arrangements for portable machinery, he said that it was quite possible to substitute these for fuses, inasmuch as a circuit-breaker could be arranged to have a heavy setting for switching-in purposes, while directly the machine got up to full speed the setting could be automatically changed over to a light one for tripping purposes on load.

Various other members contributed to the discussion, one remarking that it was extremely difficult to blow fine dust out from a motor on account of its extreme lightness; another mentioning that fibre wedges in the slots of the rotor (unless this fibre was thoroughly impregnated) led to the earthing of rotors. A third mentioned an insulation test which had been carried out upon the wax-impregnated presspahn referred to, in which it has stood a voltage of 4,000 satisfactorily. Another member wished to know the percentage of high-tension oil-immersed

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transformers which broke down in mine practice, and how often the oil in such transformers should be changed.

In his reply, Mr. FISHER said that four cases of breakdown had been reported by the members of the Newcastle branch owing to the collection of dust causing flashing across bar-wound machines. In another case a pump motor armature had burned out owing to a non-technical man having put in a 200-ampere fuse on a 5-h.p. 200-volt motor. In another case water shooting out of the glands of a pump short-circuited the slots of the stator winding, which was remedied by total enclosure. Accumulation of dust behind the armatures of direct-current machines was a frequent cause of trouble. Frequent inspection of air-gaps prevented a considerable amount of touching of stator and rotor, and consequent flashing and burning out of the coils. In some instances induction motors were earthed because the micanite stator tubes were slit along the top of the slot to allow of former winding. This could have been overcome by laying strips of mica on the top of the conductor, bending the tube over and wedging in. A frequent cause of trouble was the settlement of dust on rotor windings at the point where the bars are carried out from the slots. The usual method is to insert a sheet of presspahn between the upper and lower layers of crossing bars. Dust settles in the slots thus formed, and it is very difficult to clean out. The overload rise of temperature in a motor did not melt the wax in the presspahn to which he had referred. In his experience they had been very free of oil-immersed transformer breakdowns. In four years only two out of forty-five transformers had broken down, and then only very slightly. It would be a very great convenience if circuit-breakers could be used instead of fuses for all portable machinery, as this would eliminate the temptation to use any old bit of wire for a fuse. A circuit-breaker would have to be periodically examined, but this applied also to fuses. There were, however, types of plug-fuse on the market so constructed that it was impossible, owing to the fit of the plug and socket, to put in a fuse of excess capacity to that intended for the circuit.

ELECTRICITY AND COAL DUST EXPLOSIONS

AT a meeting of the Newcastle Section of the Institution of Mining Electrical Engineers on Wednesday, February 23rd, Prof. W. M. Thornton (Armstrong College, Newcastle) and Mr. H. W. Clothier (Messrs. A. Reyrolle & Co.) repeated their experiments made previously on explosions of coal dust and gas before the Newcastle Section of the Institution of Electrical Engineers (see ELECTRICAL ENGINEERING IN MINES, March 3rd, page 25).

In the discussion which followed, it was suggested that there was more chance of ignition when breaking the three poles of a three-phase circuit simultaneously than on a d.c. system, although there were three points over which the flame would be distributed as compared with one or two in a direct-current supply. A member stated that he was impressed rather with the difficulty than with the probability of electrical ignition of coal dust, and pointed out that it was impossible for life to exist in any mixture of coal gas and air capable of forming an explosive mixture, and in the majority of cases the contamination of the air proceeded so slowly that it was possible to withdraw the miners from the pit before danger point was reached. Referring to Mr. Clothier's experiments, he remarked that the success of the wide flange in switch-boxes pointed to the fact that the plate ventilated motor was preferable to the totally enclosed machine. Another member had tried experiments upon boxes with rubber ring joints. In order to see whether there was any breathing action in the box due to changes of temperature, he placed such a box in a sulphurous acid atmosphere. Within a week reagents inside the box showed a distinct acid reaction. In answer to a question, Dr. Thornton said time of contact between the dust and the flame influenced the probability of ignition. A flash had an average duration of about one-tenth of a second or more in inductive circuits. For this reason the magnetic blow-out for quick break switches on direct-current work was useful.

Mr. H. J. Fisher inquired as to the degree of danger of coal dust lying in the box and remaining undisturbed until the apparatus operated. Dr. Thornton replied to this by stating that he had tried experiments in an ordinary small fuse box by sifting dust on to the interior, and then replacing the cover loosely and blowing the fuse. The result had been an explosion which lifted the lid of the box and a 4½ lb. weight placed upon it. He considered that powdered shale, as obtained from some mines in Scotland, was even more dangerous than dry coal dust.

Mr. Clothier drew attention to the importance of isolating the fault on a mining cable before the arc had an opportunity of getting outside the cable cover in the case of a two- or three-core cable, and advocated a well-armoured cable for dangerous parts of the mine. Dr. Thornton's experiments showed the possibility of an arc crossing from one metal conductor to another at different tensions in the presence of metal vapour, and he had experienced trouble on high-tension fuses where an arc passed across insulation surfaces, sufficient under normal working conditions of pressure and air to stop five times the normal working pressure. He had also seen in a 6,000-volt oil break switch a flame break out of a tank of oil, starting an arc across the terminals at the top of the switch, which were considered sufficient to insulate 20,000 volts. This pointed to the necessity of completely enclosing high-tension apparatus.

Another member drew attention to a curious incident which occurred on a cable placed under a wet roof and carrying direct current. The cable burned out, and at the point where the burn-out took place where it was in contact with the roof, a white solid substance was formed, which, when placed in water, exploded violently, indicating sodium. Mr. Preece said that the same thing had been noticed in direct-current street mains on breaking down, and was due to the electrolysis of soil of an alkaline nature.

SIGNALLING SYSTEM FOR WINDING PLANT

AN ingenious apparatus for the transmission of signals from the various levels to bank, and finally from bank to the engine-house, is being supplied in this country by the Adnil Electric Co., Ltd., and we recently had the opportunity of inspecting a complete working installation at their new showrooms in Artillery Lane, London, E.C. The system has been put into use in over twenty-five pits on the Continent, and, we are informed, is giving every satisfaction.

An instrument, illustrated in Fig. 1, which serves both as transmitter and as receiver, is installed at each level and at bank, and a similar instrument, without any transmitting handle, however, is situated in the winding engine-house. At each point there is also an acoustic signalling instrument—either an electric hooter or a single-stroke bell. The transmission of signals is carried out as follows. If a winding signal has to be given, say, from the third level, the miner on that level first presses the "level indicator" button, which causes all the

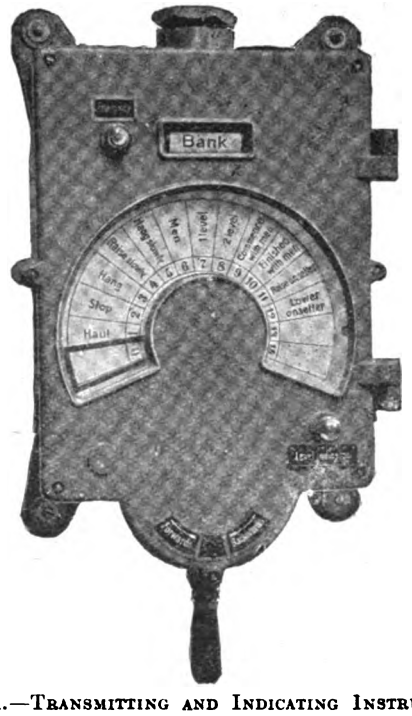


FIG. 1.—TRANSMITTING AND INDICATING INSTRUMENT.

instruments to register "third level" at the window above the dial. He then moves the lever of his instrument a certain number of times until the pointer is over the required signal. For instance, to stop the cage, he would move it twice to the left. (Should he accidentally move it three times, he immediately moves it once to the right, which causes the pointer to return one position.) This has the effect, as will be explained later, of placing the pointers of all the other instruments, with the exception of the receiving instrument in the engine-house, over position 2. Simultaneously the hooter or bell is sounded twice at each point, except in the engine-house. When the banksman considers that all is ready for the order to be carried out, he presses a "carry out" button on his instrument, and this causes the necessary signal to be transmitted to the engine-man. The level indicator in the engine-house then shows "third level," the dial pointer moves into the second position, and the hooter or bell sounds twice. At the same time the pointers on all the other instruments automatically return to the zero position unaccompanied by any audible signal. The signal remains, however, on the engine-driver's instrument until a fresh one is transmitted from bank. After any miner has set the system to his level by pressing his "level indicator" button, it is impossible to transmit any signals from any other level, and so no interference, malicious or accidental, is possible. Should it

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be necessary, however, to send a signal from a different level to that shown by the indicator, the button is pressed, and all the indicators altered. By this means both the first miner who was sending his order, and the banksman, know that a more urgent order is to be carried out first, and consequently the latter is received and passed on to the engine-house first. In case of pressing danger, an audible signal (differing in tone from the others) can be given by pressing the emergency push. This signal is sounded simultaneously at bank and in the engine-house. The chief advantages claimed for the system are the simple and rapid transmission of the signals from the levels to bank, and that by pressing his button, the banksman can transmit to the engine-driver only the signal given from below.

The device, which works the dial pointers is illustrated diagrammatically in Fig. 2. This consists of three electromagnets, M_1, M_2, and M_3, with moveable iron cores. The electromagnets are arranged in a circle at 120° from each other round a centre crank, to which the cores are coupled. To turn the crank round once in the direction of the hands of a clock, current impulses would have to be sent through the three electromagnets in succession, in the order M_3, M_1, M_2. The crank is geared by a small pinion to a large cogwheel R, on whose shaft is the pointer. By giving the desired number of impulses in the right order, the pointer can be moved to any number on the dial, and by reversing the direction of the motion of the brush L (that is by moving the lever of the instrument to the right), the pointer is caused to move in the opposite direction.

An essential and ingenious part of the system is the

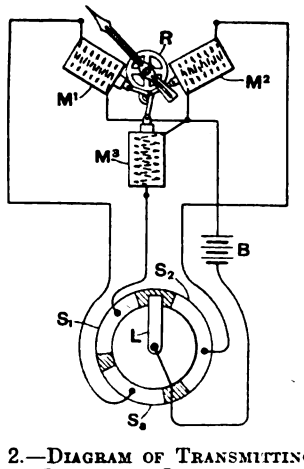


FIG. 2.—DIAGRAM OF TRANSMITTING AND INDICATING INSTRUMENT.

automatic switch, the function of which is to store up the signal given from any point and to pass it on to the engine-driver when the banksman depresses the "carry out" push. The principle on which this is done is illustrated by the diagram of Fig. 3. On this diagram the recorders on the bank and down the pit only and the corresponding bells or hooters are shown. At bank the "carry out" push only and in the pit the signalling lever only are in evidence. The apparatus inside the double dotted lines represents the automatic switch. M is a motor coupled to a shaft S, on which are fixed a pinion P and two discs D and D_1. The pinion P drives the signal storing disc SSD. A brush B bears on a piece of insulating material fixed on the edge of the disc SSD. Disc D has also a small segment of insulating material, on which a brush bears. Disc D_1 has a rim of insulating material except at one point where the brush bears on metal. Disc D_2 is stationary, so that when the shaft turns, the brush L is brought into contact with the segments S_1, S_2, S_3, and S_4 in succession.

Suppose the man in the pit wishes to give a signal corresponding to position 3 on the recorders. To do this he brings his signalling lever into contact with C three times. Each time this occurs, the following circuit is closed, and the following happens. A circuit is closed from the positive pole of the battery B through signalling lever, disc D_1, motor, armature K_1 of the relay, and back to the negative pole of the battery. The motor instantly turns the shaft and breaks the contact at disc D_1, but at the same time causes contact to be made at D, so that the current is kept flowing through wire W, shaft, disc D, K_2 of relay, and through the motor. The shaft therefore has to make a full revolution before the contact with the brush on disc D is broken again by the segment I. This one revolution of the shaft will have caused two distinct functions to have been performed :—(1) A current impulse will have been sent through the medium of brush L through each of the three coils of each recorder and through the bells or hooters. The pointers of the recorders will therefore have moved on to the next point on the dial, and the bells or hooters will have sounded once. (2) The pinion P will have turned the disc SSD round a certain distance. (The signal storing disc SSD is so geared as to make only one complete revolution when the shaft S has turned round the maximum number of times.)

The pinion P having been turned round three times through the signalling lever being brought into contact with C three times, the "carry out" push is now depressed by the banksman. A current will thus flow, which may be traced from the battery, through W_1, "carry out" push, winding W_4 of relay to battery. The armature springs K_1, K_2, and K_3 then come into contact with C_1, C_2, and C_3, and current commences flowing through winding W_3 to the motor. As the current is now sent through the motor in the opposite direction to that which flowed when the signalling lever was operated, the motor will turn back the shaft until the insulating segment on SSD comes under brush B again. That is to say, the shaft is now turned backward exactly the same number of times as it was previously turned forward, and the pointers on the recorders are also moved back to the starting point. When the current ceases flowing through the motor by virtue of disc SSD, the relay releases, and the springs K_1, K_2, and K_3 go back to their

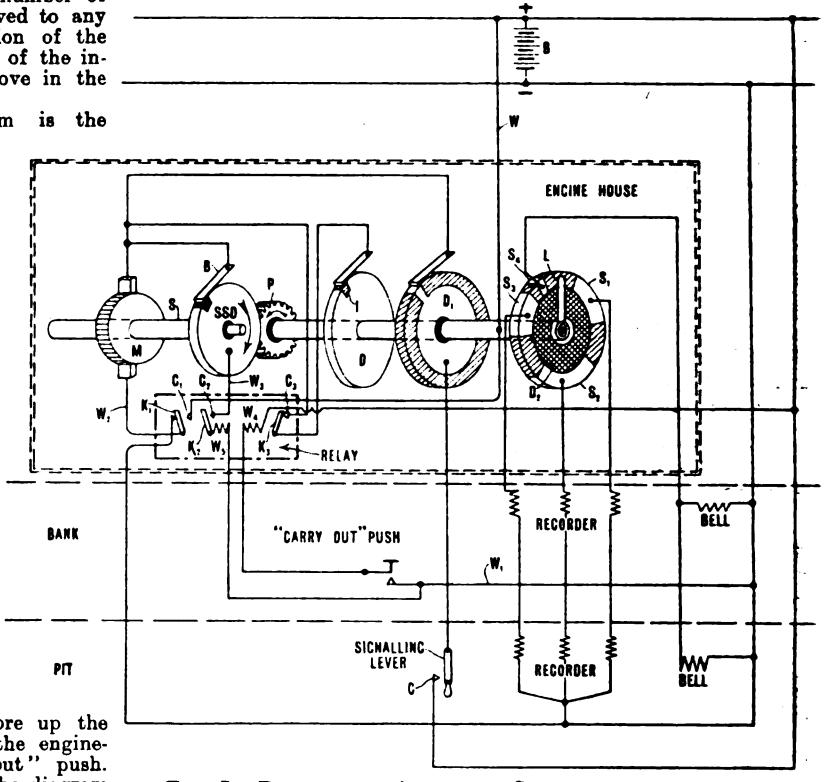


FIG. 3.—DIAGRAM OF AUTOMATIC SWITCH, SHOWING ALSO ONE LEVEL INSTRUMENT AND THE BANK INSTRUMENT CONNECTIONS.

normal positions. The instrument in the engine-room is so connected that its pointer moves forward exactly the same number of steps as the "bank" and "pit" recorders are moved backward. The only apparatus in the pit is the series of recording instruments; the more sensitive part, the automatic switch, is placed in the engine-house.

We understand from the Adnil Electric Co., Ltd., that they are willing to install this system in one mine on the understanding that it need not be paid for unless entirely satisfactory.

Nottingham Branch of the Institution of Mining Electrical Engineers.—Mr. Kirby has offered a prize of one guinea for the best Paper by a member of this branch on "The Management and Care of Electrical Plant in Mines."

Damages in Colliery Fatality.—Judgment was given in the Scottish Appeal Court last month in an action by W. Smith, a Loanend colliery engine-man, against A. Russell, Ltd., coal-masters, of Glasgow. The former claimed £500 damages in respect of the death of his son, a junior engine-man, who was killed by electric shock in December, 1907, in the Polmaise Colliery, Stirling, asserting that the electrical apparatus was not properly protected. It appears that a switch-box had become alive by leakage, and that the man had received a fatal shock. The defendants denied that the apparatus was faulty, but the court found that the box and conduit were inefficiently earthed, and that the defendants were therefore responsible for the accident. Judgment was given for £75 damages and costs.

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CORRESPONDENCE

IMPULSE-REACTION TURBINES.

To the Editor of Electrical Engineering.

Sir,—With reference to the announcements which have been recently widely made, relative to the appearance on the market of a new pattern of turbine—the so-called "Disc and Drum" type—we think that, in fairness to the work of Messrs. Brown, Boveri & Cie., of Baden, it should be more widely known that this pattern of turbine has been regularly manufactured in our Swiss, German, and French works for some time. Among the large turbines of this type which are in hand at the present time we may mention a 5,000-kw. set for Essen, a 5,000-kw. set for Nancy, and a 10,000-kw. turbine for Paris, as well as a number of 12,000-h.p. and 14,000-h.p. turbines for the German and French navies respectively.

The Paris turbine—which will be capable of developing 20,000 h.p. continuously—is the largest yet ordered for electric power purposes in Europe. Its destination is the St. Denis station (in which ten 6,000-kw. sets of our manufacture are already installed), and under the steam conditions prevailing there, its steam consumption will be less than 8·8 lbs. per brake horse-power hour.

Yours faithfully,
Brown, Boveri & Co., Ltd.

Caxton House, Westminster, S.W.
April 2nd, 1910.

POWER SUPPLY FROM TRAMWAY CIRCUITS.

To the Editor of Electrical Engineering.

Sir,—In your issue of March 31st we notice an article by Mr. E. P. Austin on the above subject. This article undoubtedly calls attention to a very interesting subject, interesting not only to station engineers, but also to manufacturers of electrical goods. The reason that attention has not been given to the subject of taking power supply from tramway circuits has been due to the fact that the standard form of shunt motor did not give good results owing to the varying voltage, but with the advent of the inter-pole motor these conditions have been very much improved. But even thus, something more has been required to deal with momentary failures of supply which were restored before the ordinary starter no-voltage release could deal with them. Particularly is this the case with printing machines and saw-mills.

We have produced a starter for use under such circumstances. On a failure of supply, or even with a serious reduction of voltage, we open the circuit of the motor on a special automatic switch; the operation of this switch is extremely quick, and is so interlocked with the starting resistance that it is impossible to again restore current to the motor without first inserting all the starting resistance in series with it.

We shall be very pleased to give any interested parties more information on this subject, which is one which we have studied with a great deal of care.

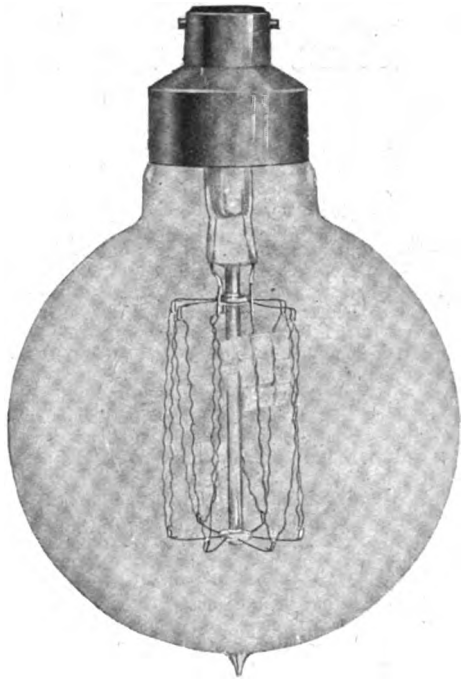
Yours, &c.,
Adams Manufacturing Co., Ltd.
(A. H. Adams, Managing Director).

London, April 1st, 1910.

THE NEW SIEMENS "ONE WATT" LAMP

A Drawn Tungsten Filament

We are now able to give some further particulars of the new lamp with a filament of drawn tungsten wire, which Messrs. Siemens Brothers Dynamo Works, Ltd., are now placing upon the market. The lamp illustrated herewith is a 100-c.p. 120-volt lamp, and, as will be seen, the filament is mounted in very much the same way as that of the tantalum lamp. It is not, like tungsten lamps with squirted filaments, made in a separate piece for every bend, although an inspection of a sample lamp reveals one joint. The efficiency is given as 1·1 watts per British candle-power (or one watt per hefner c.p.). The lamps at present are made in the 100-c.p. size for 100–130 volts and 200–250 volts, sizes particularly suited to both street and shop lighting, and will be listed at 4s. 6d. in spherical bulbs, 5 in. diameter. A range of "one-watt" battery lamps, of which an 8-volt 2-c.p. lamp is an example, will also be placed on the market very shortly. These lamps are of considerable interest, as being the first actual lamps with drawn tungsten filaments to appear on the market. It is to be anticipated that by this method of producing the filament the firm will be able to combine the high efficiency obtainable by the use of tungsten with the strength and durability that has been associated with that of the wire-drawn tantalum filament, which, of course, the company will still supply, as heretofore, in sizes up to 50 c.p.



100-c.p. 120-volt "One Watt" Lamp with Drawn Tungsten Filament.

"ELECTRICAL" FIRES IN 1909

The report of the Fire Brigade Committee of the London County Council for 1909 sets out in great detail the causes of the 3,197 fires which occurred within the County of London last year. The most serious outbreak of the year was the fatal fire at Messrs. Arding and Hobbs, Lavender Hill, Battersea, in December, where, unfortunately, eight lives were lost, due to a fire which originated in a window temporarily lighted by electricity, and dressed, for the Christmas season, with very inflammable material. The report calls attention to the danger attending the use of cotton-wool in this connection.

Looking down the summary of causes of fire in 1909, it is seen that 95 are said to be due to defective electric circuits, one to an overheated electric iron, four to "overheat of electric lamps," one to "overheat of electric light," one to an overheated electric motor, one (Messrs. Arding and Hobbs) to the bursting of an incandescent electric lamp, one to a cinematograph film coming into contact with an electric lamp, and two to spirit-vapour coming into contact with an electric spark. This makes a total of 106. Those who are familiar with the oft-repeated warnings against the dangers of electricity may be interested in the following official figures as to fires in which gas has played the leading part during the past year. The total number of fires due to gas was 334, and the fact that these are classified under no less than 24 headings is certainly strong evidence that fire risks from gas are more widespread than risks from electricity.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published March 31st, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

6,051/09. **Electric Coal-cutter.** Mavor & Coulson, Ltd., S. M. Mavor and H. A. Mavor. This machine is described under "Electrical Mining Patents of March," in the Mining Supplement.

6,770/09. **Storage Battery Plate.** H. W. Twaites. To prevent warping and disintegration with the consequent short-circuiting, the plates consist of lead boxes or tubes of circular or rectangular section. These are filled with the active materials, and are perforated all over to allow the acid to reach the material. Lead plugs or caps are inserted at top and bottom after the boxes have been filled. Three claims, five figures.

8,212/09. **Cartridge Fuse.** J. Ford and E. E. Bonshor. A tube of vulcanised fibre or other suitable material is formed with a screw thread at each end to engage with internally screwed caps with slotted lugs for sliding into the contact-blades of the fuse box. The fuse wire is threaded at each end through holes in a flanged washer which fits on the end of the tube. When the caps are screwed on, they make good contact with the turned over ends of the fuse wire, which are pressed against the washers. Soft metal washers may be placed between the wire and the caps. Being air-tight, this fuse is said to be particularly suitable for use in mines. Three claims, seven figures.

10,594/09. **Aluminium Cell Protective Devices.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). In order to equalise the voltage across a number of cells connected in series, the electrolytes of the successive cells are electrically connected by glass tubes filled with the electrolyte and placed in shunt to the aluminium electrodes. The tubes are made U-shaped, and form siphons from cell to cell. To prevent bubbles of gas from breaking the connection, each tube is provided at the top with a gas chamber. Four claims, two figures.

12,507/09. **Furnace Electrodes.** M. Ruthenburg. A high-conductivity electrode which will not contaminate the metal in the furnace consists of carbon with a core made of the same metal as that under treatment. The core is protected from the furnace gases except at the lower end where the carbon is consumed. One claim.

13,655/09. **Switchboard Construction.** British Thomson-Houston Co. and G. Richardson. In a switchboard for H.T. distribution systems, the 'bus-bars are arranged in sets one above the other, with the feeder switch terminals between. The latter are provided with throw-over isolating switches, which bridge across to 'bus-bar terminals situated above and below the feeder terminals, and connected to the upper and lower sets of bars respectively. Either set of bars can thus be completely isolated for cleaning by inserting insulating barriers between the feeder terminals and the 'bus-bar terminals. Two claims, two figures.

29,582/09. **Locking Plug and Socket Connections.** A. P., G. C., and P. A. Lundberg. In wall and floor plug connections, the socket part is provided with a hinged flap with a hole in it, and the plug has a laterally projecting pin which enters the hole in the flap when the latter is approximately at right-angles to the socket face. This prevents the plug from being pulled out accidentally. One claim, two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Heimann and Schaffer [Working arc lamps in series with incandescent lamps] 748/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Crouch and Etchells [Distributing systems] 27,242/08; Walker [Lighting plant] 6,916/09; Kemble [Insulators] 13,612/09.

Dynamos, Motors, and Transformers: British Thomson-Houston Co. (*Allgemeine Elektricitäts-Ges.*) [A.-C. machines] 694/09; Bruce Peebles & Co. (*Bragstad and La Cour*) [Motor-converters] 6,069/09; Parsons, Stoney and Law [Electric power transmission] 6,177/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Motor control] 6,564/09, 7,114/09, and 7,230/09; Hydraulic Engineering Co. and Ellington [Electric capstans] 7,408/09; Allgemeine Elektricitäts-Ges. [Electric power transmission] 11,400/09, and 13,798/09; Siemens Bros. Dynamo Works (*Siemens Schuckertwerke-Ges.*) [Rotary converter] 29,088/09; Allmänna Svenska Elektriska Aktiebolaget [Field systems] 30,176/09; Siemens Bros. Dynamo Works, and Kloss (*Siemens Schuckertwerke-Ges.*) [Cooling rotor windings] 1,404/10.

Electric Ignition: Siemens Bros. & Co., Riber and Ireland [Hand-operated magneto] 6,877/09; Braud [Magneto gear] 13,908/09.

Electrometallurgy and Electrochemistry: Reid [Furnaces] 6,820/09; Johnson (*Badische Anilin & Soda Fabrik*) [Silicon-nitrogen compounds] 15,641/09; Hay [Furnaces] 27,972/09.

Heating and Cooking: Christian [Fluid heating vessels] 18,940/09; Hearson [Incubators and bacteriological ovens] 27,909/09.

Incandescent Lamps: Saftig [Lamps for illuminated signs] 7,069/09; Kuzel [Metal filament lamp] 17,627/09.

Instruments and Meters: British Thomson-Houston Co. and D'Arcy [Meters] 6,565/09.

Switchgear, Fuses, and Fittings: Grote [Automatic switch-gear] 6,405/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Resistance units] 6,674/09; Allom [Reflectors] 6,836/09; Hawker [Switches] 9,456/09; Lundberg [Switches] 22,897/09; Morse [Switches] 25,132/09.

Telephony and Telegraphy: Huth [Oscillation generator for wireless telephony] 15,891/09; Romer [Intercommunication telephones] 17,107/09; Boult (*Maxwell*) [Telephone transmitters] 1707/10.

Traction: Thomas [Point control] 11,884/09; Bluhm [Third-rails] 12,254/09; Meranville de Sainte-Claire [Clutches for electric automobiles] 13,407/09; Houghton, Allman and Gray [Collector shoes] 15,371/09; Mitchell [Signalling] 16,542/09.

Miscellaneous: Bryant and Ivinson [Electro-medical apparatus] 7,193/09; Thomson [Coal-cutting machines] 10,334/09; Trautmann [Burglar alarm] 28,638/09; Gibbons and Rosenthal [Fan oscillator] 29,968/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: Siemens Schuckertwerke-Ges., 5,452/10.

Electric Ignition: C. Roth A.-G. [Primer for Ordnance] 4,449/10; Delage and Wood [Igniting gas burners] 6,154/10.

Storage Batteries: Marseille and Gouin [Alkaline cell plates] 3,733/10.

Switchgear, &c.: Franz Meguin & Co., 6,212/10.

Telephony, &c.: Fessenden [Wireless apparatus] 28,577/09.

Opposition to Grant of Patent

19,466/09. **Arc Furnace for Treating Gases.** Saltpetersäure Industrie-Ges. Opposition has been entered to the grant of this patent, which covers a furnace with two auxiliary electrodes for re-striking the arc should it be blown out. (*See* Electrical Engineering, February 17th, 1910, p. 128.)

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

7,783 of April 13th, 1896. **Electrodeposition of Gold.** W. P. Thompson (*E. Wohlwill, Hamburg*). Chemically pure gold is obtained by electrodeposition at high-current densities up to 2,000 amps. per sq. m. of anode surface with a hot electrolyte consisting of gold chloride containing an excess of hydrochloric acid. The impure gold is employed as the anode, which must be mechanically cleaned at intervals when it contains silver or lead.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: E. T. Greenfield [Cable armouring] 8,045/99.

Dynamos, &c.: C. Rieder [Auto-transformer for lamps] 28,071/02; A.-G. Brown, Boveri & Cie. [Ventilation of machines] 26,274/03; L. J. Hunt and Sandycroft Foundry Co. [Control of induction motors] 27,722/03; Siemens Bros. & Co. (*Siemens Schuckertwerke-Ges.*) [Driving reversible rolling mills, &c.] 27,199/04.

Electric Ignition: A. Foster [Commutator] 27,574/03.

Electrometallurgy, &c.: P. M. Justice (*C. Davis, U.S.A.*) [Electric hardening furnace] 25,671/01; E. A. Carolan (*General Electric Co. U.S.A.*) [Resistance furnace] 27,755/02.

Heating, &c.: F. W. Schindler-Jenny, 29,821/97.

Instruments, &c.: E. Wilson [Electrostatic wattmeter] 27,201/04.

Storage Batteries: H. Leitner [Frame for plates] 27,399/03; J. Y. Johnson (*Elektricitäts A.-G.*) [Starting plant in storage-battery stations] 27,736/03.

Switchgear, &c.: E. A. Carolan (*General Electric Co., U.S.A.*) [Arc-rupturing device] 27,752/02, and [Automatic voltage regulator] 27,772/02; Otis Elevator Co. (*Otis Elevator Co., U.S.A.*) [Lift control gear] 27,921/03; A. Eckstein and A. J. Krause [Water-tight tumbler-switch] 27,444/04.

Traction: W. H. Loggey and F. Hewer [Section insulators] 25,901/01.

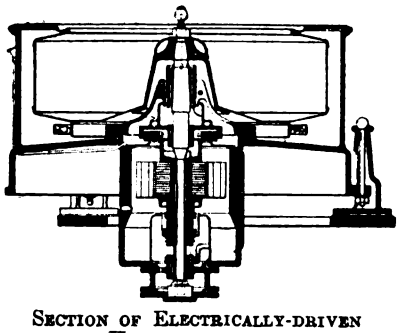
Miscellaneous: A. Smith and A. Browne [Advertising signs] 25,532/01; O. Rennert [Thermostatic indicator] 25,614/01.

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ELECTRICITY IN LAUNDRIES

THE various washing and drying machines employed in laundry-work can be readily adapted to electric drive, and laundry machinery should prove a useful addition to the day power-load of the local supply stations. The machines known as centrifugal hydro-extractors are especially suitable for individual electric drive. This machine comprises a circular "basket," in which are placed the materials to be dried. The basket has a wall of perforated metal and is rotated at a high speed, so that most of the water in the materials is thrown out by centrifugal force. A self-contained machine of this pattern, and several with belt-drive, are exhibited at the Laundry Exhibition now being held at the Agricultural Hall, and open until Saturday evening.

The self-contained hydro-extractor we refer to is exhibited by Messrs. Thomas Broadbent & Sons, Ltd. (Central Ironworks, Huddersfield). A section of the machine is given in the accompanying figure, from which it will be seen that the 48-in. perforated copper basket is mounted on a vertical spindle supported above and below in ball-bearings. The armature is built upon a sleeve surrounding the vertical spindle, and the field magnets are built into the framework of the machine. The whole is supported by four bolts with cup and ball joints, as shown in the figure; this ensures that the drum will run concentrically with the frame, and renders heavy foundations unnecessary, as any out-of-balance effects due to unequal distribution of the materials in the revolving drum merely cause the whole frame



Section of Electrically-driven Hydro-extractor.

to swing slightly. The normal speed of the drum is 900 r.p.m. To avoid the use of a heavy starter, an automatic friction clutch is interposed between the motor and the drum. The motor armature is mounted on a sleeve which can revolve round the central spindle, and leather-covered friction shoes attached to this sleeve fly out by centrifugal force and gradually grip an outer ring attached to the central spindle and the drum. The weight of the shoes is adjusted so that, at normal speed, the friction is exactly sufficient to transmit the normal power of the motor. The motor runs up to full speed almost instantly, but the drum is brought up to speed gradually. Starting up is therefore quite automatic, and the current taken by the motor can never be very excessive. The motor, which can be either for continuous or alternating current, is well protected from water. For the 48-in. extractor referred to, a 4-h.p. motor is required; various sizes, from a 26-in. drum machine with a 2½-h.p. motor to a 72-in. drum machine with an 8-h.p. motor, can be obtained. All machines are fitted with a hand brake for bringing the drum quickly to rest.

A number of electrically driven machines with belt drive between the motor and the drum are exhibited by Messrs. Watson, Laidlaw & Co., Ltd. (Glasgow). This firm also makes a machine of the self-contained pattern, but in this case the motor is arranged on the vertical spindle *above* the drum. As in the machine described above, there is a friction clutch between motor and drum to enable the drum to be brought up to speed slowly without using a heavy starter. This firm has manufactured a machine of this type with a drum 84 in. in diameter and a capacity of 90 cubic feet.

Besides the pure power applications in laundry-work, there are a few other exhibits of electrical interest. Messrs. Ernest Grether & Co. (Manchester) had on view an electrolytic bleaching apparatus suitable for use in laundries. This consists of a brine tank, an electrolyser, and a liquor tank. Common salt is dissolved in water in the first tank, and the solution is passed through the electrolyser, which consists of a series of cells with carbon electrodes. In an electrolyser suitable for dealing with 140 gallons a day, a current of 8 amps. is passed at a pressure of 110 volts. The resultant liquid, which contains a quantity of free chlorine and is therefore a powerful bleaching liquor, is passed into the liquor tank. For laundry purposes a small quantity of this liquor is mixed with the water in the washing machines. This liquor is neither acid nor alkaline, but neutral; it is said to prolong the life of the clothes and to save the launderer time, soap, and steam. As soon as the washing has dissolved the fats and grease which combine with the dirt, the latter is removed by the electrolytic liquor, together with all stains; thus rubbing or turning in the machine is reduced to the minimum, and with it the wear.

A small water-purifying plant is exhibited by the Electropura Co. of Mexico. This comprises an electrolytic cell containing aluminium electrodes, and a filter. The passage of the water through the cell is claimed to effect a precipitation of impurities, which are then left in the filter. Further, the electrolysis which goes on in the cell increases the amount of free oxygen present in the water, and gives it an agreeable taste. The process is also claimed to effect the destruction of all bacteria, and to have several beneficial properties, the exact reasons for which are not apparent.

PENDING ELECTRICAL LAW SUITS

The L.C.C. Surface-contact Tramways Again.

TWO "electrical" cases are included in the list of those which will, in the ordinary course, be heard in the Law Courts between now and midsummer. One of these will arouse a considerable amount of general interest, as it arises out of the experimental surface-contact system of electric tramways laid for the London County Council in the Mile End Road, and afterwards rejected and taken up again. The action is being brought by Mr. W. Griffiths, one of the patentees of the G.B. (Griffiths-Bedell) surface-contact system, not against the London County Council, but against Messrs. Edward Lloyd, Ltd., proprietors of the *Daily Chronicle*. Mr. Griffiths alleges that certain articles published in connection with the matter contained libellous statements. It is reasonable to anticipate that this case will revive the contention as to whether the G.B. surface-contact system as installed in the Mile End Road was suitable for the traffic conditions of a heavy urban tramway system, or whether the technical defects which appeared on its first installation, and were gradually dealt with by the contractors' engineers, were sufficiently serious to warrant its rejection.

The second case is an action by the British Thomson-Houston Co., Ltd., against the Midland Railway Co., which was first put down for hearing before Mr. Justice Warrington, and was then transferred to Mr. Justice Parker, has now been returned to Mr. Justice Warrington's court, where it will be heard with witnesses. The British Thomson-Houston Co. allege that the Midland Railway Co. have infringed their patents covering the multiple unit control system for electric traction. The equipments in question were supplied by Siemens Bros. Dynamo Works, Ltd., in connection with the conversion to electric traction on the single-phase system of the Heysham-Morecambe section of the Midland Railway Co.'s system.

In addition to these, there will be the usual number of actions against tramway and railway companies for damages for personal injuries.

There is also an action pending which is an application for an injunction brought by the Electrical Contractors' Association against the Leicester Corporation, to restrain them from selling fittings or wiring houses, &c., for electric light and power. The Leicester Corporation are working under an ordinary Provisional Order, which entitles them only to supply current, and the Electrical Contractors' Association hold that they have no power to do house wiring or sell fittings in competition with local firms. It has not been possible to advance matters sufficiently to enable the case to come on for hearing in the present sittings as has been anticipated, but it will doubtless appear in the list of cases to be heard after the Midsummer vacation.

Death from Electric Shock.—An apprentice of the Glasgow Iron & Steel Co., Ltd., Wishaw, received an electric shock on Saturday from the effects of which he died. He was working on an electrically operated furnace charger, and received the shock whilst replacing a fuse without the current having been switched off.

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ELECTRICAL POWER COMPANIES IN SOUTH AFRICA

THE draft of a Bill, regulating electric power companies in the Transvaal, has been published. According to *The Times* Pretoria correspondent, this will be one of the principal measures of the forthcoming short session of the Transvaal Government. The Bill, which has special reference to the undertaking of the Victoria Falls and Transvaal Power Company, is, it is presumed, based on the report of the Commission which sat last year to investigate the whole question of the position of electric power companies in South Africa.

Large discretionary powers are left to the Minister concerned. It provides for an advisory board composed of Government officials, upon whose recommendations, however, the Minister is not compelled to act. Every power company, existing or contemplated, can only work on licence from the Minister, who is empowered to insert such conditions as in England are usually laid down in a private Bill. The Government may give two years' notice of expropriation, after 35 years, on specified conditions which exclude any allowance for goodwill or possible future profits. In addition, the Government may expropriate on the basis of a going concern at the end of ten years, and thereafter at intervals of five years. The profits of power companies are in effect limited by a provision enabling the Minister to fix conditions regarding price and compelling the uniform treatment of consumers and the division of surplus profits.

Owing to the fact that the Victoria Falls & Transvaal Power Co. has already been granted certain concessions, provision is made for safeguarding their position. Thus, though they are compelled to come under the Bill, and the conditions of their original concessions are, consequently, varied, the period for expropriation is made long enough to cover the unexpired portion of their concession, while a special clause protects contracts already made by existing power companies.

NEW ROTARY PUMP

A NEW pattern of rotary pump for water, oil, and other liquids is being introduced by Messrs. Lacy-Hulbert & Co., Ltd. (91 Victoria Street, London, S.W.). This pump, which is manufactured at the company's works at Beddington, Surrey, has been given the name of the "Boreas" rotary pump, and is claimed to be one of the simplest on the market. As shown in the accompanying figures, the pump consists of a narrow cylindrical casing, with inlet and outlet apertures diametrically opposite. The cover (on the right of Fig. 2) has a dowel pin fixed eccentrically, and this enters a collar which has a limited movement in the metal block seen in the

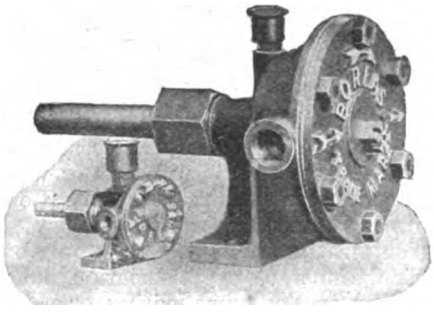


Fig. 1.—"Boreas" Pumps of 10 and 270 Gallons per hour Capacity.

centre of the pump casing. This block is held loosely between two segment-shaped pieces on the face of a disc attached to the shaft. The central block rotates with the shaft, and is also given a reciprocatory motion in a line parallel to the segment pieces on account of the restraining action of the fixed dowel pin. From each aperture there is a peripheral passage running in a direction opposite to that of the rotary motion. It will be seen that as the space between the block and the casing approaches the inlet aperture, it increases in size and sucks in liquid through the inlet passage along the periphery from the position depicted in the illustration for the next half revolution, when the parts are again in the position shown in the figure. Directly the space moves past this position, it is put in connection with the upper peripheral passage connected to the outlet aperture, and, as it decreases in volume as the shaft rotates, the liquid is forced out. These two operations are, of course, going on simultaneously.

It will be noticed that valves are entirely dispensed with, and that no gear or vanes of any kind are used. There are only two moving parts and two bearings. The standard sizes range from

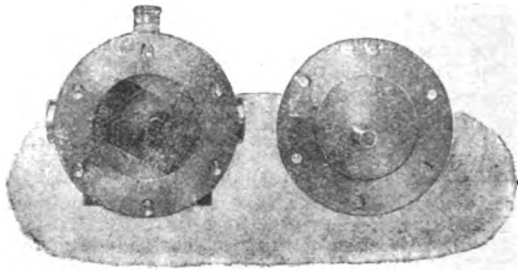


Fig. 2.—Interior of "Boreas" Rotary Pump.

a small pump with a capacity of 10 gallons per hour, and running at 500 r.p.m., up to a 1,000 gallon per hour pump running at 235 r.p.m. Larger sizes can be obtained to order. The small sizes are suitable for forcing lubricants, while the larger sizes, we are informed, are being used with considerable success as circulating pumps in condenser plant. The chief advantages of this type over the centrifugal pattern are the positive suction, the fact that the pump will work at any speed, and the high pressures attainable. The smaller sizes up to a capacity of 270 gallons per hour are constructed entirely of gunmetal, while the larger sizes have cast-iron bodies.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."]

ELECTRIC DRIVING OF MACHINERY.—A pamphlet from the Electric & Ordnance Accessories Co., Ltd. (Cheston Road, Aston, Birmingham), gives a good deal of information, illustrated by photographs of actual examples, on the subject of electric driving of machinery and its advantages over other forms of drive. The company also announce that they are prepared to supply motors on a hire-purchase system, with monthly or quarterly payments spread over one, two, or three years.

IGNITION BATTERIES, &c.—A price list of ignition cells, small accumulators, and 25-volt batteries for metal filament lamp installations has been issued by the Brockie-Pell Arc Lamp Co. (Wimbledon, S.W.).

TRAIN AND CAR LIGHTING AND HEATING, &c.—A list from Messrs. Siemens Brothers Dynamo Works, Ltd. (Caxton House, Westminster), deals with lighting and heating apparatus for electric trains and tram cars, &c. The fittings and accessories section contains numerous special designs of ceiling fittings, wall brackets, &c., for railway carriages, glass shades, testing lamps for detecting a dead lamp in a series. For this purpose, all the fittings are provided with special test contact sockets into which the plug of the testing lamp can be inserted. A water-tight form is also made, which can be used either for this purpose or as an ordinary hand lamp. Other rolling-stock fittings include canopy lamps for carriages and locomotives, signal lamps, head lamps for illuminating destination boards, &c. Car radiators, switches, and coupling cables and plugs are also dealt with, and a separate leaflet gives particulars of a cable coupling more particularly intended for electric braking connection between motor-cars and trailers on tramways.

CABLES.—A new descriptive catalogue and price list of cables for electric lighting, power, and traction purposes (mains section list, No. 4), has been issued by Messrs. W. T. Glover & Co., Ltd. (Trafford Park, Manchester). A variety of patterns of cable are listed, including the company's special "Diatrine" paper lead-covered cables and bitumen cables. The catalogue contains nearly three hundred pages, and gives full specifications of each class of cable listed, and a full telegraphic code for ordering. There are also over 50 coloured illustrations showing details of typical cables.

GENERATORS, MOTORS, AND SWITCHGEAR.—The Electric Construction Co., Ltd. (Bushbury Engineering Works, Wolverhampton), have sent us a collection of some 120 leaflets and price lists relating to D.C. generators and motors, A.C. motors, and switchgear. The leaflets are bound up loosely with an index, in a substantial cover. Among those only recently issued are a list of oil and open-type rotor-starters for induction motors, and three leaflets (dated Feb., 1910) relating to the firm's electric haulage gears for mines. Prices of single-drum, main and tail, and endless rope haulage gears of 25, 50, and 75 h.p., are given, together with some particulars and illustrations.

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LOCAL NOTES

ACCRINGTON: *Public Lighting.*—The Electricity Committee have offered to carry out public lighting in the parish of Altham at £4 per lamp per annum for a minimum period of five years. This sum is to cover the erection, maintenance, and lighting during that time. The arrangement has been agreed to.

ARDROSSAN (N.B.): *Electric Supply.*—The Hon. T. H. W. Pelham conducted a local inquiry last week into an application by Mr. G. Balfour, of London, for a provisional electric lighting order for Ardrossan and Saltcoats. There were a large number of opponents, mostly on small points. The chief objectors were the Ardrossan Council, who appeared as owners of the local gas works, but Mr. Pelham said he could not recommend the Board of Trade to refuse the order merely on the ground of competition with the gas supply.

BATH: *Electric Lighting Area.*—In connection with the proposed extension of the Council's electric lighting area, the Board of Trade have inserted several clauses at the instance of the Bath Gas Co. These include the "Northumberland" or "Bermondsey" clause, with revisions of charges every three years in order to prevent any loss falling upon the ratepayers, the first revision to take place at the end of five years; the long-period contracts should be similarly revised every three years, and that the charges for street lighting shall not be higher than the prices to consumers for similar purposes, and the like hours of supply. The Electricity Committee recommend that the Town Clerk should instruct his Parliamentary agents to submit objections to the clauses, and in any case to request the Board of Trade to omit the provision requiring special contracts to be revised every three years, and to urge that the period of five years referred to in the first clause be extended to ten years. Subject to the committee being satisfied as to the result of these representations the Council is recommended to proceed with the Provisional Order.

BELFAST: *Tramway Receipts.*—Mr. Andrew Nance, the tramway manager, reports that the tramway receipts for the year to March 31st amounted to £203,856, compared with £195,043 in the previous year. He anticipated a net profit of about £10,000 on the year's working.

BIRMINGHAM: *Trams to Harborne.*—A house-to-house canvass is being carried out in the Birmingham suburbs of Harborne and Quinton in favour of the Corporation extending the tramways to these districts. Three years ago, the Corporation promoted a Bill for the extension of the tramways to Harborne, but opposition was offered by residents along the proposed route, and also by the London & North-Western Railway, and the proposal was rejected by Parliament. Since then, however, the district of Quinton has been added to the City of Birmingham, and considerable building has taken place on the further side of Harborne and in Quinton.

Tramway Committee's Profits.—It is anticipated that the Tramways Committee will be in a position to transfer the sum of £25,000 to the relief of rates for 1909-10. The receipts for the year just ended show an increase of about £12,000, but against this has to be set the cost of reducing the hours of the employees from 60 to 54 hours per week, which is estimated at £9,000 per annum.

BRADFORD: *Tramway Accounts.*—The receipts for the year to March 31st amounted to £253,844, an increase of about £15,000 over the previous year.

DOVER: *Tramways and Electricity Undertakings.*—Messrs. Balfour, Beatty & Co., who have been retained by the Corporation to advise upon the weak spots in their tramway and electricity undertakings, have now presented their report. This is being discussed by the Corporation privately, but the local papers have evidently seen a copy. According to the *Dover Express*, a very strong advocacy is made that the town should carry out the whole of its street lighting with electricity. It is pointed out that the town spends close on £5,000 a year on gas lighting, and that if the Corporation electricity works were utilised to their full extent by doing the lighting it would be possible to reduce the cost of current, and largely increase the number of private consumers. Another recommendation that is understood to have been made is that the control and working of the tramway and electricity undertaking should be amalgamated, and by utilising one staff only large savings could be effected. It is further understood that the report criticises the cost of the tramway current, and maintains that as a result of the economies proposed that it should be reduced. A suggestion is made also that the tramway and electricity undertaking might jointly be leased, with lighting contracts for the town, to a company who would run it at a saving of about £3,000 to the town. The greatest stress, however, is laid on the fact that the whole of the town should be lit by electricity.

DUBLIN: *Workhouse Lighting.*—After a long period of negotiation and indecision, the South Dublin Board of Guardians have passed a resolution in favour of accepting the offer of the Dublin Corporation to supply electricity for the lighting of the workhouse, at 3d. per unit.

New Lighting Committee.—Some new standing orders are to be discussed under which a Lighting Committee will be constituted, with an Electricity Supply Committee as a special committee.

EDINBURGH: *New Electric Tramway.*—Messrs. Dick, Kerr & Co., the contractors for the first electric tramway in Edinburgh, have commenced the constructional work. The line, which will connect the cable lines at Ardmillan Terrace with the New Markets at Gorgie, is about 1¼ miles long, and will cost £12,000.

GLOUCESTER: *Tramway Working Expenses.*—At the last meeting of the Corporation it was stated that the working expenses per car mile on the tramway system last year were less than 5d. The Chairman of the Light Railways Committee stated there was little doubt that Gloucester would be at the head of all municipal tramway undertakings in that respect for 1909.

HARROGATE: *Street. Lighting.*—Considerable opposition seems likely to be offered to the proposal to substitute electric for gas lighting in a number of roads where mains are laid. So far a definite scheme has not been adopted, but the opponents are waiting for their opportunity at the Local Government Board's inquiry regarding the necessary loan.

HULL: *Tramway-rail Corrugation.*—In connection with the work of the Special Committee of the Municipal Tramways Asscciation to investigate the cause of corrugation on tramway rails, the City Engineer and the Electrical Engineer have been authorised to conduct experiments.

New Plant.—The contractors for the supply and fixing of pipe work, fittings, &c., in connection with the large generating set at the electricity works, Messrs. Foster Bros., failed to complete the contract to time, and were liable to penalties amounting to £444. An arrangement has been come to for settling the matter by deducting £174 from Messrs. Foster's account.

ITALY: *Supply of Electrical Goods.*—In a British Consular report on the trade and commerce of Venice for the year 1908-9, it is stated that most of the electrical equipments in use in the province are of foreign origin. An advance has recently been made in the manufacture of such apparatus in Italy, and some foreign firms have considered it advisable to establish branch offices and open workshops in Italy.

LEEDS: *Proposed Tramway Extension.*—A proposal has been made to extend the Corporation tramways from Guiseley to Otley, a distance of 3½ miles, linking up with Leeds. A conference took place recently between the Leeds Corporation and the Otley Council, and the estimated cost of the extension is put at £45,000. Otley has been asked to contribute £350 per annum for 10 years, the Leeds Corporation maintaining the track.

LLANDUDNO: *Sunday Tramways.*—A ballot of the ratepayers is to be taken on Saturday on the question of running the tramcars on Sundays.

LONDON: *Islington: Balls Pond Road Trams.*—The Borough Council are offering considerable opposition to the proposal of the L.C.C. to construct electric tramways through the Balls Pond Road without any widening of that thoroughfare. A petition has been signed by 3,000 residents in the district, supporting the action of the Borough Council.

MANCHURIA: *Mukden: Electric Light.*—An electric lighting plant has been installed by the Chinese local government. At first the plant had a capacity for dealing with total connections amounting to 5,000 8-c.p. lamps, but the demands have necessitated extensions capable of dealing with 15,000 lamps. The plant has been mostly supplied from America, and was erected under the supervision of an American electrical engineer. A system of charging at a fixed rate per lamp per month has been instituted, as an alternative to meters. The total cost of the plant amounts to about £33,000.

OLDHAM: *Mails by Tramcar.*—At the request of the Lees and Springhead Councils, the Oldham tramway manager recently approached the Postmaster-General with regard to conveying mails by special tramcar to these two districts, in order that they might be delivered earlier than at present. It was suggested that the Post Office should pay for the actual working expenses of the car, except wages, but the Postmaster-General has been unable to agree. The Oldham tramway manager is now inquiring whether the Lees and Springhead Councils will bear this cost.

WARRINGTON: *New Plant.*—The Electrical Engineer has submitted a preliminary report on the tenders received for the 1,000-kw. turbo-alternator, rotary converter and switchgear, recently advertised for. The Committee have decided to apply to the Local Government Board for sanction to borrow £7,420, the estimated cost of the above plant and the necessary buildings, foundations, &c.

Tramway Profits.—The Tramway Committee have transferred £2.000 from the tramway profits to relief of rates.

Extension of Supply Area.—Application is to be made to the Board of Trade for a provisional order for the supply of electricity within the limits of supply for gas purposes outside the borough.

WEYMOUTH: *Fixed Price Light.*—With reference to the note in our last issue to the effect that the Electricity Committee were to give a trial to the fixed price system of charging for electric supply to small houses, we now understand that the charge is to be 2½d. per week per lamp for the first six lamps, and 2d. per lamp in excess of that number. This includes the complete installation of the wiring and lamps, as well as the supply of electricity.

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TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ACCRINGTON.—The Electrical Engineer has been authorised to lay distributor cables on the easterly side of Whalley Road from the borough boundary.

ECCLES.—A high-tension feeder is to be laid in connection with supply to Messrs. Nasmyth, Wilson & Co. at an estimated cost of £1,200.

EDINBURGH.—The Electric Lighting Committee recommend the installation of cooling towers at the Dewar Place Electricity Works. By this means it is estimated that the output of the works can be increased from 3½ to 10½ million units per annum, with a reduction in the coal bill of £3,500.

GRIMSBY.—The Electricity Department invite tenders for a small three-wire balancer and a two years' supply of continuous-current motor meters. Particulars from the Borough Electrical Engineer. (See an advertisement on another page.)

HALIFAX.—The Tramways and Electricity Committee require a 300 kw. rotary convertor, transformers, and switchboards. Particulars from the Borough Electrical Engineer, and tenders to the Town Clerk by April 18th.

INDIA.—The Director-General of Commercial Intelligence at Calcutta notifies that a scheme is under consideration for deriving electrical energy from the falls of the Bari Doab canal, in the Punjab, for the following purposes:—(1) driving the machinery of the canal workshops at Amritsar; (2) working pumps for raising water from the subsoil for irrigation purposes; (3) working the pumping plant of the Amritsar water works; (4) pumping operations connected with the disposal of sewage. The names of persons interested in the scheme may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

The Ooregum Gold Mining Co. require additional electrical machinery.

JAPAN.—According to the "Japan Weekly Mail," the Odawara Electric Railway Co. propose to extend the Kozu-Yumoto line to Miyanoshita and reach Gotemba *viâ* Gora, Sengoku, and Otome-toge. The cost of construction is estimated at about £439,000.

LITTLEBOROUGH.—Tenders are invited for (1) high-tension feeder cables, low-tension distributors, &c.; (2) transformer kiosk with equipment and switchgear in substation. Particulars from Messrs. Hawtayne & Zeden, 9 Queen Street Place, London, and tenders to the Clerk to the Council by May 2nd.

MANCHESTER.—The Electricity Committee invite tenders for the supply, delivery, and erection of five 600 kw. motor converters or rotary convertors, and static transformers. (See an advertisement on another page.)

ST. HELENS.—An application is to be made for sanction to borrow £3,930 for the extension of the boiler house plant. A new 1,000 kw. turbo-generator is also to be installed at an estimated cost of £6,300.

SHREWSBURY.—The Local Government Board have sanctioned loans of £770 for mechanical stokers, £2,700 for mains, £900 for services, and £200 for public lighting. They have withheld consent to an application for a loan of £800 for an additional boiler, and £153 for mechanical stokers until they hear that the Corporation actually intend to install the plant.

WALTHAMSTOW.—The Council require tenders for a switchboard at the electricity works. Particulars from the Borough Engineer, and tenders to the Clerk by April 22nd.

WARRINGTON.—The Local Government Board have sanctioned a loan of £500 for transformers.

Miscellaneous

CANADA.—It is proposed to incorporate the Montreal Underground & Elevated Railway Co., with a capital of about £4,000,000, for the construction of underground and elevated electric railways in Montreal.

DOVER.—An electrically-operated jib crane is required by the Harbour Board. Particulars from the Harbour Board Offices, Castle Street, and tenders by April 16th.

RUSSIA.—It is announced that the Central Telephone Administration of St. Petersburg has been authorised to expend a sum of £300,000 upon extensions of the telephone system and enlarging the central exchange to serve 34,000 subscribers. It is probable that the sum authorised will be increased to £510,000, as the Administration wishes to make provision for 45,000 subscribers.

SOUTHEND.—The Council propose a small extension of their tramways in the direction of Leigh at an estimated cost of £730.

SPAIN.—An application has been lodged with the "Dirección General de Obras Públicas, Ministerio de Fomento," Madrid, by Don José Paredes Pastrana, for a concession for the construction and working of an electric tramway in Cadiz from the Plaza de Loreto to the Barrio de San Seneriano, and that a period of one month from the date of publication of the "Gaceta" is allowed for the presentation of competing offers at the "Dirección." Local representation is necessary.

TRANSVAAL.—The Agent-General for the Transvaal, 72 Victoria Street, London, invites tenders by April 18th for 119 miles of covered telegraph wire.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

PROVINCES.

ASHTON-UNDER-LYNE.—School (1,000 places). D. H. Wall, Secretary, Ashton-under-Lyne Education Committee.

BECKENHAM.—An application is to be made by the Council for a loan of £225 for the wiring and fitting of the Alexandra Schools.

CHESTER.—Alterations and additions to school, Victoria Road (£5,140). Architect, P. H. Lockwood, St. Werburgh Street, Chester.

CHISWICK.—Theatre. Architects, Meakin and Archer, 32 Nicholas Lane, London.

DONCASTER.—Additions to Infectious Diseases Hospital. Architect, F. O. Kirby, Doncaster.

DUBLIN.—A Local Government Board inquiry was held last week into an application by the South Dublin Board of Guardians for a loan of £3,000 for the wiring and fitting of the workhouse premises for electric light.

GRAVESEND.—Public baths, Gordon Recreation Grounds (£2,000). F. T. Grant, Surveyor, Gravesend Town Council.

LINCOLN.—Enlargement of Westgate School (£1,500). R. C. Mintin, Secretary, Lincoln Education Committee.

LIVERPOOL.—Extensions and alterations, St. James's Church School (£10,591); and additions. St. Augustine's School (£5,534).

LONDONDERRY. — Rebuilding, Guildhall (£24,000). Builders, H. Laverty & Son, Belfast.

MANCHESTER.—School, Chorlton-on-Medlock (£26,000). J. H. Reynolds, Secretary, Manchester Education Committee.

NUNEATON.—Factory. G. Sheppard, New Bridge Street, Nuneaton.

SHEFFIELD.—Additions to school (£7,806). Architect, Education Committee.

SPENNYMOOR.—Higher Grade School (£8,000). Builder, Mr. Hilton, Bishop Auckland.

TENDERS RECEIVED AND ACCEPTED

BELFAST.—The tender of Messrs. Willan & Robinson, at £10,172, for the supply of a 1,500-kw. c.c. turbo-dynamo and condensing plant has now been accepted by the Corporation, subject to the condition that the Corporation shall have the option of purchasing a duplicate plant within twelve months for £8,433. We referred to this plant in some detail in our issue for March 17th.

LEYTON.—The Council have provisionally accepted the tender of Messrs. S. Hammond & Co., at £115 17s. 6d., for the installation of telephones at the public offices extension.

NORTHAMPTON.—The Council have accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for two new tramcars with inter-pole traction motors, at £555 each.

SALFORD.—The Council have accepted the following tenders for two years' supply of the undermentioned articles:—Special car accessories, Tramway Supplies, Ltd.; car accessories (electrical), J. Hall, Liverpool Electric Cable Co., Manchester Armature Repair Co., British Westinghouse Co., British Thomson-Houston Co., General Electric Co., L. Andrew & Co.; overhead equipment materials, G. Hill & Co., Watlington & Co., British Insulated & Helsby Cables, Ltd., Tramway Supplies, Ltd., H. E. Buck & Co.; ears, frogs, pull-offs, &c., G. Hill & Co., Tramway Supplies, Ltd., E. Dewhurst, British Insulated & Helsby Cables, Ltd., Watlington & Co.

The following are for annual supplies:—Cable Protectors and cable bearers, Albion Clay Co., Ltd.; maximum demand indicators, Reason Manufacturing Co., Ltd.; wood troughing, casing, and capping cleats for meter boards, C. Jennings & Co.; ammeters, Eckstein, Heap & Co.; arc lamp globes, City Glass Co.; glow lamps, General Electric Co., Ltd.; carbon brushes, H. G. Mayer & Co.; arc lamp carbons, Crompton & Co., Ltd.; meter boards and blocks, starter boards and wood cable bearers, J. Wheeldon & Sons; cables, W. T. Glover & Co., Ltd.; meters, Ferranti, Ltd., Chamberlain & Hookham, Ltd., General Electric Co., Ltd., British Westinghouse Co., Ltd. (trial order); motor starters, Verity's, Ltd.

WARRINGTON.—The Council have accepted the tender of Messrs. Chamberlain & Hookham, Ltd., for keeping the tramway meters in repair at 3s. 3d. per meter per annum.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £60 10s. to £61 per ton (last week, £61 to £61 10s.).

CANADIAN AGENTS WANTED.—A London firm manufacturing electrical generators, motors, fans, switches, arc lamps, cables, fittings, accessories, bells, telephones, &c., one of the directors of which is shortly visiting Canada, wish to enter into correspondence with some first-class Canadian firms with a view to appointing a representative in the Dominion. Further particulars from the High Commissioner for Canada, 17 Victoria Street, London, S.W.

FOSTER METALLIC LAMPS.—The following reductions in the price of Foster metal filament lamps have been made. These came into force on April 1st, and are subject to exceedingly liberal discounts to the trade. A revised price list will be sent to any of our readers on application to the Foster Arc Lamp & Engineering Co., Ltd., Worple Road, Wimbledon. 100-135 volts, 16-, 25-, 32-, and 50-c.p., 2s. 9d.; 200-260 volts, 25- and 32-c.p., 4s.; 50-c.p., 3s. 9d.

WESTINGHOUSE COMPANY'S NEW PREMISES.—In consequence of the increase in business, the British Westinghouse Electric & Manufacturing Co., Ltd., have taken larger premises, and the supply department formerly carried on at 27 Chancery Lane will in future be carried on at 3 West Street, Charing Cross Road, London, W.C. At the new premises has been arranged a special showroom, in which a large and varied selection of electric light fittings and accessories, together with heating and cooking appliances, will be on view.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—A meeting of the creditors of A. H. Gibbings, electrical engineer, 17 Gambier Terrace, Liverpool, was held last week. The unsecured debts amount to £3,234, with a further partially secured debt of £500, the value of the security being estimated at £10. The debtor commenced business in North John Street as a consulting engineer in February, 1906, in partnership. This connection was dissolved in June, 1908, and a considerable part of the indebtedness consisted of moneys due to the outgoing partner. The debtor continued the business, and obtained several important engagements, including the North British Electrical Power Syndicate, and a large Yorkshire enterprise. These, however, were all cut short by the passing, last session, of the Electric Lighting Act, which terminated most of his contracts by cutting off, or largely limiting, private enterprise as opposed to municipal undertakings. It may be recalled that the former enterprise was the cause of an agitation by Scottish municipalities owning electricity works, it being proposed to lay cables alongside railway tracks, and to supply electricity to works en route without statutory powers. The agitation by the Scottish authorities led to the drafting of clause 23 of the Electric Lighting Act, 1909, which prohibits unauthorised undertakers from competing with statutory undertakers. The assets, according to the statement of affairs, consisted only of furniture, valued at £42 15s.; but some time back debtor had given a bill of sale on his furniture to a brother-in-law resident in the Transvaal for £200. The administration of the estate was left in the hands of the official receiver.

The first meeting of creditors of W. C. Ellis, electrical engineer, Applegate Street, Leicester, was held last week. The statement of accounts shows a deficiency of £190 13s. In a report, the Official Receiver states that the debtor started business in March, 1909, without any capital. The bulk of the debts are for goods supplied; a deficiency account has been lodged, but it throws very little light on the insolvency. The books are insufficient and explain nothing.

OSRAM LAMPS.—We have received from the General Electric Co. an excellent view of the interior of the Maida Vale Roller Skating Rink, which is lighted entirely by Osram lamps. An illustration and particulars of the fittings employed were given in Electrical Engineering, March 10th, page 161.

Accident on the Cascade Tunnel Line.—Further particulars are now available of the accident which occurred at the western end of the Cascade Tunnel of the Great Northern Railroad, Washington, U.S.A., on March 1st last. According to the *Electric Railway Journal*, the avalanche swept off the tracks two trains, including four electric and three steam locomotives and a steam snow plough. One of the electric locomotives was in the inspection shed, which was also carried away by the avalanche. A considerable part of the three-phase overhead equipment was also destroyed. The electric locomotives were not carried very far, and it is thought that the mechanical damage is slight. The effect of the snow on the motor windings and contactors may be serious, however, and if much of the apparatus has to be rewound, it will be some months before the electric service can be resumed, as the locomotives will in that case have to be taken to Seattle for repair. These locomotives were described in Electrical Engineering, January 20th, 1910, page 44. Each weighs 103 tons, and develops 1,900 h.p. The electrical equipment consists of four 600-volt 25-cycle 475-h.p. three-phase slip-ring motors, supplied from the 6,000-volt contact line through two transformers.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Mexican Light & Power Co., one per cent. on the ordinary shares for March quarter.

Anglo-American Telegraph Co., 15s. per cent. on the ordinary shares, and £1 10s. per cent. on the preferred stock for March quarter.

MORTGAGES AND CHARGES.—Particulars of the following have been filed:—Consolidated Electric Works & Appliances: Second mortgage-debenture, dated February 22nd, 1910, to secure £1,340, charged on the company's undertaking and property, present and future, including uncalled capital (subject to first mortgage debentures securing £2,500). Electric Landaulet Co.: Satisfaction in full of debenture dated June 2nd, 1909, securing £5,000. British Columbia Electric Railway Co., Ltd.—Issue on Feb. 22nd of £530,000 debentures, part of a series of which particulars have already been filed. Ferranti, Ltd.—Trust deeds dated Feb. 25th, 1910 (supplemental to trust deeds dated Feb. 24th, 1905, and June 13th, 1907, securing £125,000 debenture stock). Trustees: H. R. Boyce, Winchester House, Old Broad Street, E.C.; and W. Jones, Manager of Parr's Bank, Manchester.

APPOINTMENTS AND PERSONAL NOTES

Mr. C. Furness, Borough Electrical and Tramways Engineer to the Blackpool Corporation, has been appointed to the additional post of general manager of the tramways, rendered vacant by the death of Mr. John Lancaster. Mr. Furness is to have his salary increased from £600 to £700 per annum.

Accrington Electricity Committee have agreed to the following increases of salary:—J. P. Hall, outdoor mains superintendent, from 32s. 6d. to 35s. per week; G. Kirk, draughtsman, from 35s. to 37s. 6d.; H. Taylor, switchboard attendant, from 25s. to 27s. 6d., and afterwards from 27s. 6d. to 30s.; James Wilding, overhead linesman, from 50s. to 55s. (to include all overtime); S. E. Ogden, chief clerk in tramway manager's office, from 35s. to 40s. per week.

Mr. R. B. Leach, who recently resigned his position as chief electrical engineer to the Farnworth Council to engage in consulting work, was presented last week with a silver rose-bowl, which was subscribed for by the staff. Mr. A. J. Hutchinson, hitherto chief assistant, succeeds Mr. Leach.

Mr. W. H. Hall, late borough electrical engineer at Morecambe, has been presented with a kit-bag by the staff.

The St. Helens Electricity Committee recommend an increase in the salary of the Borough Electrical Engineer, Mr. E. M. Hollingsworth, from £400 to £500 per annum, by two annual increments of £50 each.

Telegraph Traffic.—Another quiet week has passed in the telegraphic world. The cable between Zante and Corfu was interrupted on the 29th ulto., but was restored on the 31st ulto. On the 31st March also, the Dakar-Conakry cable which has been down since the 19th August last, was restored to working order.—The German South American Co. is proceeding with its Brazilian cable, and the Western Telegraph Co. will shortly have completed the laying of the Ascension-Buenos Ayres cable.—The Government of Jamaica propose to reduce the inland telegraph rate from 1s. for 20 words to 6d. for 12 words. The loss of revenue in the first year is estimated at £1,100 to £1,200.

Wireless Telegraph Notes.—It is reported that an American Company is asking for a licence for the sole right to conduct a wireless telegraph business for twenty-five years, giving the Government the privilege of purchasing the business at the end of 10, 15, 20, or 25 years. They propose to instal at Hong Kong a station equal to their station in New York, which will be capable of communication with Yokohama and Shanghai on the north, and Singapore on the south.

A wireless telegraph service between Monte Video and Buenos Ayres has been inaugurated.

A *Reuter* telegram from Berlin states that the Nauen wireless telegraph station recently succeeded in maintaining wireless communication with a Woermann liner during the entire voyage from Hamburg to Kamerun. The greatest distance signalled was over 4,000 miles.

It is announced that a tender by the Australian Wireless Telegraph Co. for the construction of a wireless telegraph installation at Fremantle (W.A.) and Sydney at £8,300 has been accepted. The plant must be capable of communicating with British warships and mail and other steamers up to 1,250 miles, and it is stipulated in the contract that only British subjects may be employed upon the construction work. We gave some details from the specification in our issue for January 13th.

According to the *Standard* Paris correspondent, the Department of the French Marine is equipping the two battleships *Justice* and *Vérité* with apparatus for communication by means of wireless telephony. The system employed is the invention of Captain Colin and Lieutenant Jeance. With this system it has been possible to communicate between Toulon and Port Vendres, in the Mediterranean, a distance of more than 150 miles.

An Admiralty wireless telegraph station is to be erected at Rosyth.

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PARLIAMENTARY INTELLIGENCE

LONDON ELECTRIC SUPPLY BILL.—When this Bill, which provides for the purchase in 1931 of the West End London Electric Supply Companies, comes up for second reading in the House of Commons, Mr. Tennant, the Parliamentary Secretary to the Board of Trade, will move that it be referred to a Select Committee of five members, three to be nominated by the House, and two by the Committee of Selection. The committee will hear evidence in the ordinary way.

L.C.C. (TRAMWAYS AND IMPROVEMENTS) BILL.—The Metropolitan Railway Co. and the Paddington Borough Council have withdrawn their opposition.

NORTH & SOUTH SHIELDS ELECTRIC RAILWAY.—The second reading of this Bill in the House of Commons, which was down for Thursday last, has been postponed until to-day (Thursday).

TUBE RAILWAY AMALGAMATION BILL.—A House of Lords Committee will to-day commence consideration of a number of London electric railway Bills, the first being the scheme for amalgamating the Great Northern, Piccadilly & Brompton, the Baker Street & Waterloo, and the Charing Cross, Euston & Hampstead Railways.

CAVEHILL & WHITEWELL TRAMWAYS.—The Bill of the Belfast Corporation, in which powers are sought to purchase the undertaking of the Cavehill & Whitewell Tramways Co. on arbitration terms, has been referred to the Standing Orders Committee. The Bill has been held not to comply with Standing Orders on account of deposit after the statutory period.

PROGRESS OF ELECTRICAL BILLS.—All opposition to the Nottingham Corporation Bill has been withdrawn, and the Bill has been referred to the Unopposed Committee of the House of Lords.

The Farnham Gas and Electricity Bill, and the Mersey Railway Bill were read a second time in the House of Commons on Monday.

The second reading of the North-East London Railway, London United Tramways, and the Cavehill and Whitewell Tramways Bills has been postponed until Monday.

DEVONPORT AND DISTRICT TRAMWAYS.—A Select Committee of the House of Commons commenced consideration of this Bill yesterday, and a report will appear in our next issue. The Bill has created exceptional local interest for the reason that it proposes to modify an existing Parliamentary agreement between the company and the Corporation for the running of the tramways. The company have found that the terms of the original agreement have become too onerous to enable the tramways to be worked at a profit.

COMPANIES' MEETINGS AND REPORTS

GATESHEAD & DISTRICT TRAMWAYS CO.—At the meeting last week, the decline in receipts of £715 during 1909 was attributed to the closing down of an engineering works in Gateshead, the transfer of employés from the North-Eastern Railway Works to York, and the opening of a railway station at Dunston. The expenditure, however, had been decreased. Considering the disturbed state of trade in the Tyneside district, the directors did not regard the result of the year's trading as unsatisfactory. In accordance with their Act of last year, which postponed the purchase by the Corporation of the lines in Gateshead until 1930, a contract had been entered into for the extension of the Bensham route and the doubling of the Low Fell section.

SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.—The report for 1909 states that the arrangement for the construction, by the Treforest Electrical Consumers Co., Ltd., of a connecting cable between the generating station at Treforest and the Cwmbran area, has been duly carried out. The connection was completed in May last, and since then the supply to the Cwmbran area has been entirely taken over by the Treforest Company. This arrangement has enabled the Cwmbran generating station to be shut down, and the expense of working it as a separate unit to supply the consumers in that area has thus been saved to the South Wales Co. The Treforest Co. has made steady progress during the last twelve months, the cost of production having been materially reduced, and the output increased. Some new consumers have been connected, and negotiations are proceeding with others who are contemplating taking a supply. To meet the growing demand for current, the Treforest Co. are considering the question of providing further capital for an increase of the generating plant. On the whole the directors consider that the position of the company has appreciably improved as compared with that in 1907, when they took office. The company does not now work any power station.

BATH ELECTRIC TRAMWAYS CO.—The gross profit for 1909 amounts to £16,107, including £2,493 brought forward. Interest on mortgage debenture stock and loans amounts to £7,393, and preference dividend £3,750. After adding £1,000 to sinking fund for debentures, a balance of £3,964 is carried forward, against £2,495 in the previous year. At the annual meeting last week, Sir James Sivewright said that although there were sufficient funds to declare a dividend on the preferred ordinary shares for 1909, the directors had thought it best not to do so owing to the fact that they owed the bank £25,650. When they had wiped this debt out, either by an issue of new debentures or preference shares, there would be nothing in the way of paying dividends on this stock. For the first three months of the present year, the revenue was £1,094 in excess of that for the same period of 1909.

EVERED & CO.—The accounts for 1909 show a loss of £2,283, after allowing £2,000 for depreciation and meeting debenture interest.

TELEPHONE COMPANY OF EGYPT.—A dividend at the rate of 10 per cent. for 1909 is announced, carrying £500 to reserve for a contemplated pensions scheme, and £42,326 forward.

RHONNDA TRAMWAYS CONSTRUCTION SYNDICATE.—The net profit for 1909 was £20,044. The sum of £3,500 is placed to reserve and renewals, and a final dividend at the rate of 3 per cent. per annum is recommended.

WILLANS & ROBINSON.—At the half-yearly meeting on Tuesday, Mr. J. C. Peache, the managing director, who presided, asked the shareholders not to be discouraged by the present state of the profit and loss account. The works were better equipped than before, and the staff was certainly no less efficient. Given reasonable improvement in trade there was every expectation of profits being earned again. At present there was some evidence of improved trade, although there was no indication of improvement in the miserable and inadequate prices which had to be accepted if work was to be obtained. Until the political horizon cleared and some measure of confidence was restored to commercial enterprise, he did not think they would find a purchaser for the Queen's Ferry works. There has recently been a well-marked increase in the number of orders received. Mr. Leslie S. Robertson, in seconding the adoption of the report and accounts, thought that many of the troubles had been inherited when the reorganisation took place. He did not think this had been so drastic as it ought to have been. Mr. Frederick Davenport was elected assistant managing director at a salary of £1,500 per annum, to undertake the commercial control of the business.

Obituary.—We regret to record the death on March 29th, St. Leonards-on-Sea, of Mr. T. Musgrave Heaphy, who from 1874 till 1904 was engineer and electrical adviser to the Phœnix Fire Office. Mr. Heaphy, who was sixty-seven years old, was responsible for the first set and many subsequent revisions of the famous Phœnix Fire Office rules relating to electric lighting, which in themselves constituted almost a text-book on electrical wiring, and indicated the best practice to be followed in this class of work. Mr. Heaphy was always a strong advocate of the wood-casing system of wiring. The funeral took place on Saturday at Brookwood.

We regret to announce the death, on March 22nd, at St. Anne's-on-Sea, of Mr. A. G. Thornton, at the age of sixty-two. Mr. Thornton was the founder and managing director of the firm of Messrs. A. G. Thornton, Ltd., scientific instrument makers, Paragon Works, Manchester.

We also regret to note the death of Mr. P. Storey, who had been borough electrical engineer at Torquay since the Corporation Electricity Works were opened in 1898.





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ELECTRICAL ENGINEERING

NO. 172 [VOL. VI., NO. 15] THURSDAY, APRIL 14, 1910. [PRICE ONE PENNY.
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Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON AND WESTMINSTER BANK (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

A SPECIAL illustrated article on fans and ventilation includes particulars of some new designs of electrically driven fans and ventilating plant. A description of the "Ozonair" system of ventilation is given, and some interesting ceiling fan equipments in India are described and illustrated, in addition to several novelties in small fans. (Page 241.)

IN our monthly illustrated article on new electrical supplies and accessories, we describe a new form of tantalum lamp with improved distribution of light in a downward direction, and a new double-carbon arc lamp. Particulars are also given of an adapter for converting an ordinary lampholder into a switch holder, a combined wall plug and adapter to enable portable apparatus to be connected either to a wall socket or a lampholder, and a combination base for switches, bell pushes, and plugs specially intended for shipboard use. A new electric toaster is illustrated, and other novelties include a collapsible advertising sign and a combined paper knife and bell push. (Page 244.)

SOME new and interesting designs of automatic and other control gear are being introduced by the Adams Manufacturing Co. These include a motor starter, in which the successive resistance steps are cut out according to the rate of acceleration of the motor, a line of remote control switches for currents up to 10,000 amperes, and an ingenious starting switch suitable for motors in mines. We were enabled to inspect the works of the firm at Bedford last week, and see the apparatus in various stages of manufacture. (Page 247.)

ALUMINIUM rod for machine connections or feeder connections in switchboard work can be jointed by butt welding on site with a blow-pipe. In inaccessible places, screwed couplings are suitable. Heavy 'bus-bars are constructed of aluminium bars, clamped together with spacing pieces between the individual bars. (Page 248.)

IN a Paper read before the Institution of Electrical Engineers in London on Thursday last, Mr. A. Gerrard described some experiments made on the Glasgow tramway system with magnetic track brakes. It was found that on braking at high speeds, the motor pressure rose to twice the normal, and various methods of reducing this pressure and the heavy braking currents were tried. The method finally adopted consists in shunting the motor fields in two successive steps by means of solenoid switches, and is found to prevent abnormal pressure rise and intermittent skidding, and further to reduce the braking current very considerably. In the discussion of the Paper, Mr. E. H. Cockshott described similar tests made at Leeds, but with different results. Mr. A. W. Maley, the inventor of one of the brakes referred to in the Paper, called attention to tests on other tramway systems which had given better results from those given in the Paper. Mr. W. H. Booth also spoke, and Mr. H. M. Sayers suggested that the different condi-

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tions rendered it difficult to compare tests in different towns. (Page 249.)

A LONG Paper by Mr. W. Pollard Digby and Mr. D. B. Mellis, read on March 18th, before the Manchester Local Section of the Institution of Electrical Engineers, described a series of researches into the properties of switch and transformer oils. (Page 251.)

A BILL for amalgamating the Great Northern, Piccadilly & Brompton, Baker Street & Waterloo, and the Charing Cross, Euston & Hampstead Railway Companies, has been passed by a House of Lords Committee. A Bill by the Baker Street & Waterloo Railway Co. for the construction of a moving stairway at their Oxford Circus station has also been passed. A proposal by the Charing Cross, Euston & Hampstead Railway Co. for the construction of tunnels at Charing Cross to allow through running with the District Railway was rejected, but the Committee afterwards decided to allow the promoters an opportunity to come to an arrangement with the opponents of the scheme. (Page 252.)

A REPORT by Mr. W. W. Lackie (Chief Engineer to the Glasgow Corporation electricity department) recommending the immediate acquisition of a site for a new generating station, has been approved by the Electricity Committee. (Page 253.)

THE Lancashire Electric Power Company are applying for a Provisional Order enabling competition in Radcliffe with the Radcliffe District Council, who at present supply electricity under an ordinary Provisional Order. (Page 253.)

THE Bill of the Devonport and District Tramways Co., which proposed important modifications of an agreement with the Corporation, has been rejected by a House of Commons Committee. The proposals of the Metropolitan District Railway Co., for the extinction of the arrears of the guaranteed stock of dividends by distributing new guaranteed stock, has been passed by a House of Lords Committee. A new electric railway from Wimbledon to Sutton is under consideration. (Page 253.)

INQUIRIES are being made by the Grimsby Corporation in relation to the purchase of the local tramways.—A vote in respect to Sunday tramways has been rejected by a substantial majority at Llandudno.—Leading tradesmen in Regent Street have petitioned the Westminster Council against accepting a tender for gas lighting.—The Local Government Board have refused a new loan to meet the loss on the Pemberton power station of the Wigan Corporation.—A new tramcar shed to accommodate 49 cars has been erected at Bolton.—The Clyde Navigation Trustees have decided to instal an independent generating plant at the Rothesay Dock.—Rearrangement of the street lighting at St. Helens is to take place. (Page 254.)

COLCHESTER Corporation propose to borrow £8,000; Battersea Council, £8,900; and the Wednesbury Council, £3,000, for electrical extensions. A gas producer generating plant is contemplated by the Leith Dock Commission. Large extensions are proposed at Wolverhampton. The Nuneaton Council require a water-tube boiler; Sheffield Corporation and Dartford Council, cables; and the Whitwood Council, cables, switchboard, instruments, &c. A scheme for electrically driving some Indian railway workshops is under consideration, and a 15 miles tramway is proposed between Tokio and Yokohama. (Page 254.)

THE North Metropolitan Electric Power Supply Co. pay a dividend of 6 per cent. on the ordinary shares; the Metropolitan Electric Tramways Co., 5 per cent.; Calcutta Tramways Co., 4½ per cent.; and the Merthyr Electric Traction Co., 5 per cent. (Page 256.)

THE second annual meeting of the Electrical Trades Benevolent Institution was held last week. During the year, the funds have been increased by nearly £1,000. Five cases of relief were dealt with by the Committee last year, and all the applicants are now in work again. (Page 257.)

AT the last meeting of the Marylebone Borough Council, the appointment of a Special Committee to investigate the methods adopted in connection with the management of the Electricity Sales Department was decided against, only four members voting for it. (Page 257.)

ARRANGEMENTS are being made for installations of the Telefunken system of wireless telegraphy in the German colonies. Negotiations are being carried on by the Post Office in regard to a new wireless telegraph station on the east coast between Norfolk and Newcastle. (Page 257.)

AMONG the specifications published by the Patent Office on Thursday last was one by Bruce Peebles & Co. for the provision of special compensating windings in the pole shoes of motor-converters to improve the commutation and to alter the main field on load so as to obtain a compounding effect.—A system of electrical marine propulsion with generators and motors interwound so as to avoid high pressures is described by C. A. Parsons, G G. Stoney, and A. H. Law.—Resistance grids with means for adjusting the resistance after stamping, are patented by the British Thomson-Houston Co.—C. B. Walker describes a battery plant for country house lighting, with arrangements for starting up the generating set when the battery requires recharging.—A method of supporting metal filaments so as to prevent short-circuiting of the loops, and also to allow for the gradual contraction of the filament, is patented by H. Kuzel. (Page 258.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, APRIL 14TH.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. Continuation of discussion on "The Measurement of Light and Illumination."

Rontgen Society.

8.15 p.m. At 20 Hanover Square, London. "Some Methods of Using the Alternating Current Mains for Rontgen Ray Work," by Dr. G. B. Batten.

FRIDAY, APRIL 15TH.

Institution of Mechanical Engineers.

8 p.m. At Storey's Gate, St. James's Park, London. "A Research on the Hardening of Carbon and Low-Tungsten Tool-Steels," by S. N. Brayshaw.

SATURDAY, APRIL 16TH.

Institution of Mining Electrical Engineers.

4.30 p.m. Cumberland Branch. At Grand Hotel, Whitehaven. "Direct Current Plant and the Distribution of Current to Outside Pits," by J. Glynn Williams.

6.30 p.m. Lancashire Branch. Further discussion on the Special Electrical Mining Rules.

TUESDAY, APRIL 19TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. Annual General Meeting at Municipal School of Technology. "The Application of the Cradle Dynamometer to the Testing of Electrical Machinery," by F. Shaw and J. Davies.

WEDNESDAY, APRIL 20TH.

Institution of Electrical Engineers: Yorkshire Section.

7.15 p.m. Annual General Meeting at Leeds University.

THURSDAY, APRIL 21ST.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, Westminster. "Hydro Electric Installations of Sweden," by A. V. Clayton.

FRIDAY, APRIL 22ND.

Physical Society.

5 p.m. At Imperial College of Science. "The Magnetic Balance of Curie and Cheneveau," by C. Cheneveau and A. C. Jolley.

Royal Institution.

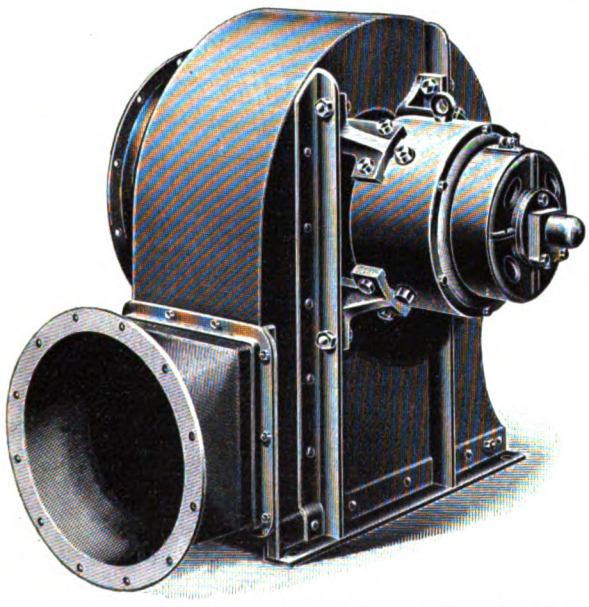
9 p.m. Evening discourse by T. Thorne Baker on "The Telegraphy of Photographs, Wireless and by Wire."

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FANS AND VENTILATION

THERE is no doubt that the comfort, as well as the hygienic importance of well-ventilated rooms is becoming appreciated by the public to an increasing extent, and it is to this, as well as to the greater complexity of modern buildings, that the rapid growth in the demand for fans and ventilating apparatus is due. In practically all large halls, shops, and steamships of recent construction, a more or less elaborate system of ventilation, with arrangements for cleaning, purifying, heating, or cooling the air, and in some cases enriching it with ozone, is installed. Apart from these larger equipments, a considerable number of desk and other small fans are in use, especially in offices, restaurants, and basements, and much ingenuity is being expended in their design. For domestic purposes and in public buildings electricity is the only convenient driving power for fans, and even in factories and other places where mechanical power is available, electric fans are more often employed than belt-driven fans. For the smaller fans, the very high speed which one is tempted to employ for the sake of cheapness is somewhat of a disadvantage, but for the larger apparatus the electric motor is certainly admirably adapted to the work, and can be designed to suit any conditions. With regard to the mechanical design of the fan itself, the shaping and arrangement of the blades to obtain the highest efficiency under any given conditions of speed, pressure, and volume, has been the subject of much research and experimental work, and a number of special designs have been evolved. The following notes give an idea of the latest steps in this direction taken by some of the leading makers.

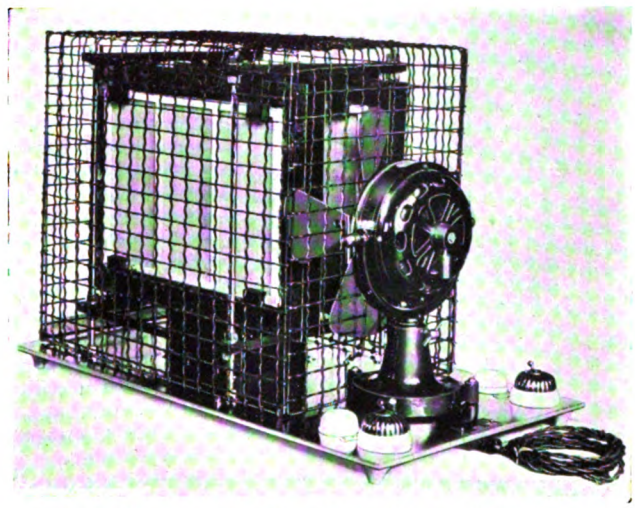
Messrs. James Keith & Blackman Co., Ltd. (27 Farringdon Avenue, London, E.C.), may be cited as one of the foremost firms engaged in the manufacture of ventilating apparatus. Besides being the makers of the famous "Blackman" open type fans which are used the world over for ventilating halls, rooms, and factories, &c., this firm is responsible for the "Keith" enclosed pressure fan. This type of fan is especially designed



New Design of Electrically-Driven "Keith" Fan. (James Keith & Blackman Co., Ltd.)

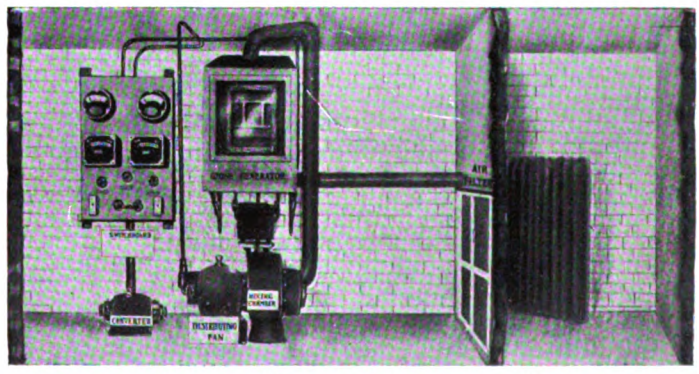
for supplying a large volume of air with a considerable pressure as is required in induced draught systems for steam-raising plant, and in ventilating equipments in which there is a length of piping or conduit on the exhaust side of the fan. The accompanying illustration shows a new design of "Keith" fan with electric drive. The motor armature is mounted on the fan spindle, and the casing is bolted up to the frame of the fan, thus giving a most compact and rigid construction. Ball-bearings are fitted to these fans except in the case of those for forced draught and similar work, which are supplied with water-cooled automatic ring oil bearings. The normal fans deliver at pressures up to 6-in. water-gauge, but the fans for mine and other special ventilating work deliver at higher pressures. Electrically-driven fans of this type are displacing all other kinds for ship ventilation on the thermo-tank system, as they can deal quickly and efficiently with a large volume of air and occupy little space. A new design of high-pressure centrifugal blower for forge and cupola work, with a motor built into the blower casing, has also just been placed on the market by this firm.

An important development in ventilating engineering is the provision of apparatus for artificially bringing up the proportion of ozone in the air to the amount present in sea or mountain air under natural conditions, viz., about one and a half parts in a million. When present in this small degree, ozone imparts to the air a most agreeable and refreshing odour, and, as it is a most powerful sterilising agent, its presence is highly desirable



New Type of Self-Contained Ozone Generator. (Ozonair, Ltd.)

A most convenient method of producing ozone (that is, causing oxygen molecules to take up a third atom of oxygen) is by means of the electric discharge. It is highly important, however, that the air should not be overheated, as injurious nitrogen compounds are then formed, and an apparatus which has been proved to generate ozone without the slightest trace of these nitrogen compounds is that designed and supplied by Ozonair, Ltd. (96 Victoria Street, Westminster, S.W.). This consists of



Complete "Ozonair" Ventilating Plant.

a series of generating units, each comprising a thin plate of insulating material with a sheet of metallic gauze on either side. The gauze sheets are connected across the secondary of a transformer delivering current at about 5,000 volts, and an innumerable number of minute discharges occur all over the opposing surfaces of the plates. The efficiency of the apparatus is dependent upon the concentration, and it is better to produce a small percentage of ozone in a large quantity of air

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than it is to produce a strong mixture and then add that to the main volume of air. In large equipments, however, such as that in Messrs. D. H. Evans & Co.'s new premises in Oxford-street (*see* ELECTRICAL ENGINEERING, Feb. 10th, 1910, p. 95), it is more convenient to produce a comparatively strong mixture, which is conveyed to the main ventilating fan, and there diluted by the main supply. Thus, in the equipment referred to, the main fan passes some three million cubic feet of air per hour. To preserve the proper proportion, the generator has to supply about 4½ cubic feet, or 250 gms. of ozone per hour. This it does with a total expenditure of 500 watts. The latest design of self-contained generator for use in halls, factories, schools, &c., is illustrated herewith. The fan produces a continuous current of air between the plates, and its armature is supplied with slip-rings from which is fed the transformer (visible under the plates). The whole apparatus is constructed of metal, principally aluminium, and has a wire cover. Other forms of self-contained apparatus, including some in handsome cabinets for domestic use, can also be obtained. The figure below illustrates a complete "Ozonair" ventilating plant for a large building. On the extreme right is the inlet chamber for the fresh air, which may be either heated or cooled. From this chamber it is drawn through a felt filter kept moist, which cleans it of all suspended matter and absorbs such deleterious gases as ammonia and sulphurous acid. From the second chamber it passes to the mixing chamber, through which it is drawn, together with a quantity of treated air from the ozone generator, by the distributing fan. Where only a D.-C. supply is available, a small converter is employed to feed the transformer. The proportion of ozone and the volume of air circulated can be regulated from the switchboard. The treated air is distributed to the various rooms in the building by means of ducts. Where the climate is hot and damp, as in India, refrigerating and drying apparatus is added. It may be mentioned that the recent installations by Messrs. Ozonair, Ltd., include equipments at His Majesty's Theatre and at the Law Courts, London.

Messrs. CROMPTON & Co., LTD. (Salisbury House, London Wall, London, E.C.), make a speciality of low-speed ceiling fans, of which they have supplied large numbers for use in Government and other buildings in India. The accompanying illustrations show an equipment of sixty-four Crompton ceiling fans as installed in St. Thomas' Cathedral, Bombay, and a group of fans combined with electroliers in the Connemara



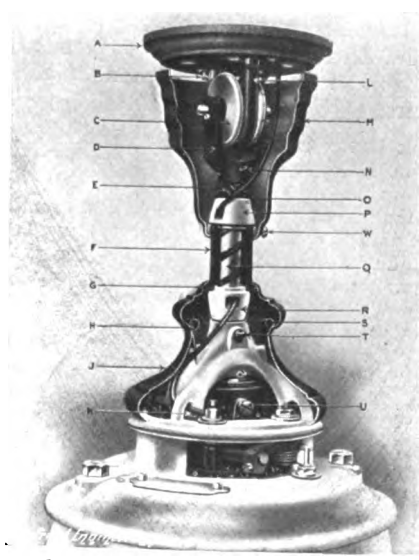
CEILING FANS AT ST. THOMAS'S CATHEDRAL, BOMBAY. (CROMPTON & CO., LTD.)

Hotel, Madras. Ceiling fans are largely displacing punkahs in India and other countries with hot climates for keeping the air in a continual state of motion, and though the fans may have a curious appearance in a cathedral, they are a distinct improvement on the punkahs originally used, which darkened and obscured the interior. Further, the design of the fans and their brackets is such as to bring them into harmony with the surroundings. Each fan has a sweep of sixty inches, and the aluminium blades are curved after a pattern adopted after an exhaustive series of experiments, as affording silent running and high efficiency. The speed is about 140 r.p.m. The Cathedral fans are run off a 230-volt D.-C. supply, and each consumes some 85 watts. Dust-proof, self-lubricating ball-bearings are used. The suspension consists of a ½-in. steel rod covered by a polished brass tube 4 ft. long. The aluminium or wood blades may be two, three, or four in number, and are fastened to the carrier by means of screws working in slots. The blade angle is easily adjusted, but it is impossible for the blades to fly off. The



ELECTROLIER CEILING FANS IN THE CONNEMARA HOTEL, MADRAS. (CROMPTON & CO., LTD.)

standard suspension, illustrated herewith, consists of the steel rod *Q* and brass tube *F* referred to above, a suspension shackle *D* hanging from the porcelain insulator *C*, a spring washer *E* and leather washers *O* and *S*, porcelain insulators *P* and *R*.



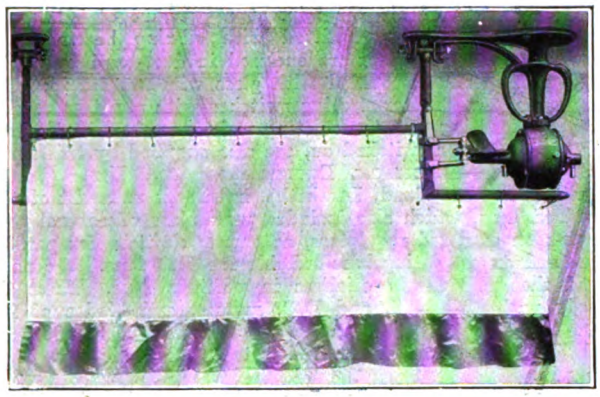
CEILING FAN SUSPENSION DETAILS. (CROMPTON & CO., LTD.)

The connecting leads come up from the motor casing at *K* and are wound two or three times round the rod *Q*. The rubber ring *G* ensures a good dust-proof joint between the tube *F* and the lower spinning *J*.

Electrically-driven punkah fans are preferred by some to ceiling propeller fans, and the GENERAL ELECTRIC CO., LTD. (71 Queen Victoria Street, London, E.C.), include in their lists the well-known "Bandy" patent electric punkah to supply this demand. It is stated that the varying air-displacement is more agreeable than the constant flow of air produced by a fan. The latter also lacks the peculiar flick at the end of the stroke which is said to have a pleasant cooling effect. The "Bandy" apparatus, illustrated herewith, consists of a rigidly suspended motor, with conical pulley on the under side and a swinging frame to which the curtain is loosely strung. Attached to the upper side of the frame is a quadrant, pivoted on a substantial bearing-pin and controlled by springs. This quadrant is pressed to one side or the other of the coned pulley on the motor with which it engages. When the pulley revolves, the quadrant is carried out of the vertical, and a sufficiently strong pull is given to the quadrant to shoot it some distance. On the return stroke the quadrant will strike the pulley on the upper side, and the punkah will be swung in the opposite direction. The "flick"

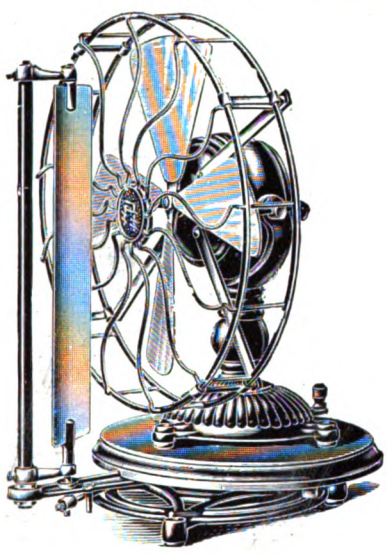
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is of equal strength in both directions, unlike the hand-pulled punkah, which only gives the "flick" in one direction. The General Electric Co. have a large assortment of propeller fans



Electrically Operated Punkah.
(General Electric Co., Ltd.)

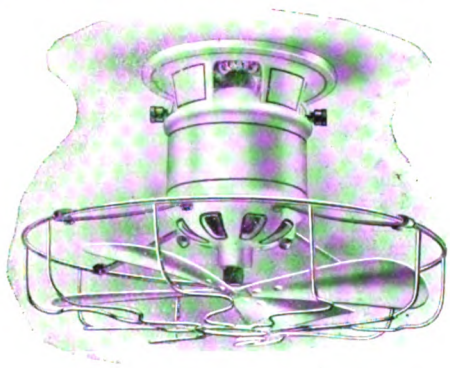
to suit various requirements. Among the novelties are a compact little desk fan, called the "Liteweight" type, weighing only 10 lbs. complete. The accompanying illustration shows a



Fan on Oscillating Base.
(General Electric Co., Ltd.)

fan on an oscillating base for spreading the draught of air over a wide area. This can be used with any make of fan and works automatically.

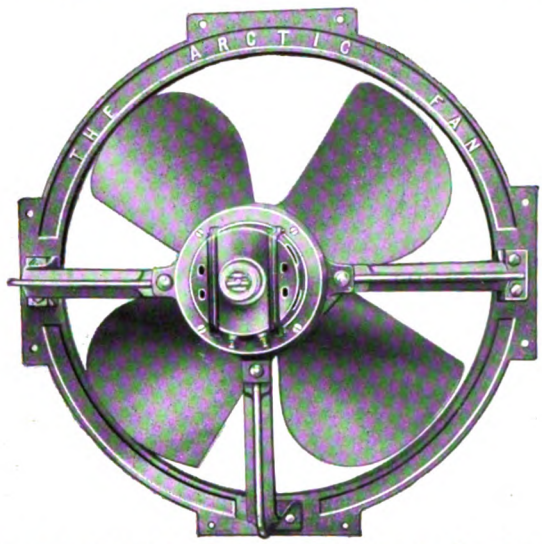
Messrs. Simplex Conduits, Ltd. (Garrison Lane, Birmingham), have just introduced a new type of ceiling fan for use on board ship. It is especially designed for ships' cabins, but will



Ceiling Fan for Ships' Cabins.
(Simplex Conduits, Ltd.)

also be found useful in restaurant work. The overall diameter is 12 in. The blades are of nickelled steel or brass as required, and the standard finish is white enamel relieved with gold lines. This fan consumes only 45 watts, and is capable of moving over 700 cubic feet of air per minute when running at the full speed of 1,500 r.p.m. It is very light, weighing only 6 lbs. complete. In the smaller Simplex fans, automatic grease lubrication is provided, but in the large fans ring lubrication is adopted. In all patterns, except porthole and ceiling fans, regulators are provided in the base. The range of fans listed by this firm includes desk fans of various patterns, bracket fans adjustable so as to direct the air current in any direction, small porthole fans for ventilating ordinary sized rooms, and large porthole fans for public buildings. These fans can be fitted with ordinary or box type blades as required.

The next figure illustrates one of the "Arctic" porthole fans of the Wilson-Wolf Engineering Co., Ltd. (Thornton Road, Bradford). No alterations have been made of late in the design of these fans. They are provided with a combined thrust and journal ball-bearing which enables them to be fixed in any position. Owing to the special design of the blades, the tips do not baffle the air by being curved in upon themselves, and the outputs at standard speeds are claimed to be 50 per



Porthole Fan (Wilson-Wolf Engineering Co., Ltd.).

cent. above those of fans with ordinary box-type blades. The motors are former wound and made quite impervious to moisture, so that they are particularly suitable for use in damp places. Special patterns are supplied for working in positions where acid fumes are present. A line of A.-C. fans of the induction-motor type with squirrel-cage rotors has just been introduced by this firm.

The Davis Electrical Co., Ltd. (17 Moor Street, London, W.), have a large assortment of electric fans, and, besides the



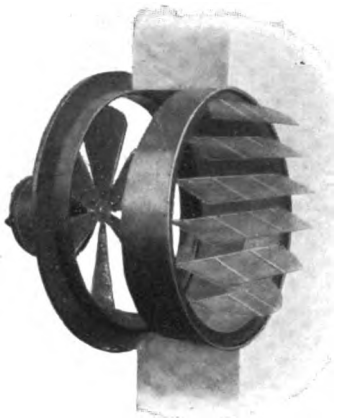
Universal Fan with Gymbal Support.
(Davis Electrical Co., Ltd.)

more usual designs, are pushing a few novel patterns. The accompanying illustration shows a so-called "Polar" fan by

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this firm. This fan has a gymbal support similar to that of a gyroscope, except that the supports can be fixed, thus holding the fan at any desired angle. The illustration shows the fan in use as a ceiling fan, but it is equally suitable for use as a desk, trunnion, or bracket fan. The firm also supplies a variety of porthole fans for insertion in walls, windows, or ceilings, and several patterns of ceiling fans for both A.C. and D.C. circuits. Battery desk fans and miniature lamp-holder fans for fitting direct into lamp-holders without plug or cord, can also be obtained.

The next figure illustrates an automatic shutter for fans of the ring and porthole type by the British Central Electrical Co. (17 Hatton Garden, London, E.C.). The aluminium shutters fall back automatically when the fan stops, and thus prevent any back draught. In a modified form of this arrangement



Automatic Shutter for Porthole Fan.
(British Central Electric Co.)

the shutters are made adjustable, by means of a cord passing over pulleys to the interior of the room. This firm lists a large selection of fans of all types, including a useful bracket fan with universal joint and three-speed regulator, and a neat design of cabin-fan.

Among the firms specialising in ventilating is that of Messrs. John Gibbs & Sons (72 Duke Street, Liverpool), who have evolved a number of special designs of blowers and fans, direct-driven by totally enclosed motors. A blower of this firm's make and driven by a 1¾-h.p. motor was found on test to discharge 2,600 cubic feet of air per min. at a pressure of 1½in. water gauge. The machine was fitted with oil-ring bearings. The motors of this firm's fans are enclosed in dust- and water-tight sheet metal casings provided with glass windows for inspecting the brush gear. Motor-starting switches with a patent arrangement for ensuring that the starting resistance shall be in circuit when the motor is switched on, are also supplied by this firm.

The Brush Electrical Engineering Co., Ltd. (Victoria Works, Belvedere Road, Lambeth), have sent us a list of their standard fans, which also includes particulars of several accessories such as speed regulators, automatic shutters for port-hole fans, and an oscillating base suitable for desk fans. We understand that this firm specialises in porthole fans. These they supply with both A.C. and D.C. motors, and blades of from 9 in. to 16 in. diameter. They consume from 20 to 100 watts, and drive a volume of some 400 to 1,000 cubic feet of air per min.

Messrs. Davidson & Co., Ltd. (Sirocco Engineering Works, Belfast), the makers of the well-known "Sirocco" fans, have called our attention to a catalogue they have just issued on dust removal, a subject closely allied to ventilation. After referring to the importance of removing dust in factories, and particularly in the case of paint and accumulator works where the dust is of a poisonous nature, the pamphlet describes the use of the centrifugal fan for this purpose in conjunction with a system of hoods and piping. Several photographs of equipments in textile mills, paper mills, and engineering works are given, and a plant installed in the works of the Tudor Accumulator Co., Ltd., at Dukinfield, to remove dust from a mixing machine and barrels handling salts of lead, is also described.

Messrs. G. N. Haden & Sons (Lincoln House, Kingsway, London, W.C.) inform us that they are at present equipping St. Paul's Cathedral, London, with a ventilating plant. This consists of two large electrically driven centrifugal blowers installed in specially constructed rooms built underground adjacent to the crypt at the extreme corners of the building. The air is drawn through horse-hair filters kept moist by a stream of water, and is further charged with moisture by a special form of atomiser. Two large heating batteries are provided. The large blowers are supplemented by a number of propeller fans situated in various parts of the Cathedral.

NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Incandescent Lamps.

The accompanying illustration represents a new design of tantalum lamp, which Messrs. Siemens Brothers Dynamo Works, Ltd., are putting on the market with a view to overcoming the drawback which many metal filaments have of weak "end-on" candle power as compared with that in a horizontal direction. The new pattern will be known as the tantalum focus-



Tantalum "Focussing" Lamp.

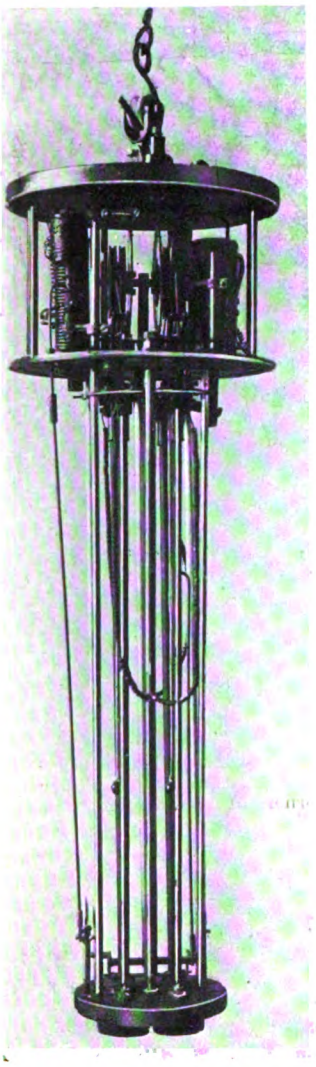
sing lamp, and has an entirely new arrangement of filament by which a much increased end-on candle power is obtained. The spider on which the filament is wound is constructed in a conical shape, with the apex pointing downwards. The light is distributed very evenly except towards the cap of the lamp, where it is not required. These lamps are now being supplied for 100-130-volt circuits in 25 c.p. sizes, in spherical bulbs of approximately 75 mm. diameter. They are especially suited for places where it is desired to obtain a strong and even light without the aid of special reflectors, and should prove useful for stage lighting, ceiling lighting, and decorative purposes. They are listed at the price of 3s. each, and are of the same efficiency as the ordinary standard type of tantalum lamp, which they resemble in every particular except in the arrangement of the filament. A revised price-list of tantalum lamps, including these as well as the ordinary standard spherical and candle tantalum lamps, has been issued.

Arc Lamps.

A new double-carbon flame arc lamp with long burning hours is being introduced by the Abbey Electric Co. (17 Victoria Street, London, S.W.), whose latest design in single-carbon lamps was described in Electrical Engineering, February 10th, 1910, page 92. The new lamp, as will be seen from the accompanying illustration, has two pairs of carbons, each pair being supported by copper cords passing over a drum. The feeding mechanism is the same as in the single-carbon Abbey lamp, each drum being attached to a large ratchet wheel with a double-toothed pawl controlled by the solenoids. The two pawls, which are rocked by means of a single pin, are so arranged that when the lamp first commences to feed, only the pawl of the mechanism controlling the first pair of carbons is affected, and consequently these carbons are fed down until the holders reach the stops at the bottom. The lengthening of the arc after the last feed causes the shunt solenoid to lift the rocking lever further than before, with the result that the pawl of the second mechanism is brought into action. This causes the second pair of carbons to descend and the arc is transferred to them. Feeding then proceeds as before. Though the shunt solenoid plunger is evidently working in a slightly

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different part of its travel when controlling the second mechanism, the voltage at which the arc burns is not different, owing to the fact that the friction against which the plunger has to work is different. In order that the tips of the second pair of carbons shall not be covered with ash while the first pair are burning, the cast-iron economiser is constructed with two separate furnaces. The nature of the feed, which causes the carbons to drop suddenly together and not to approach gradually as in lamps with clockwork mechanism, also ensures the second pair of carbons striking an arc in spite of a small deposit of insulating ash on their tips.

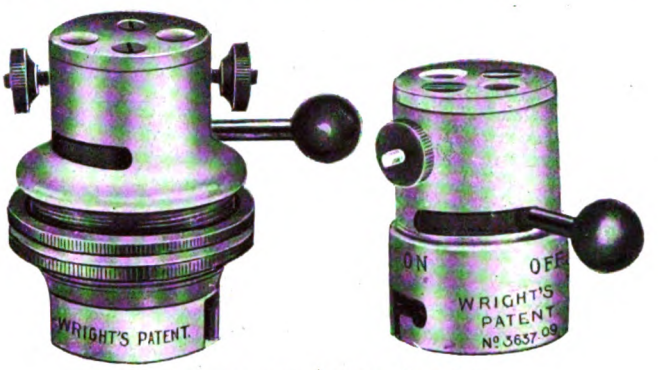


Abbey Double-Carbon Lamp.

A lamp of this pattern, measuring 37 in. overall with the globe, and taking 16 in. 9 and 10 mm. carbons, gives over 25 burning hours on one trim, or just double the burning hours of the corresponding single-carbon lamp. A second size, measuring 48 in. overall, and burning 24 in. carbons, gives from 40 to 45 burning hours on one trim. The lamps can be obtained for either alternating or direct-current circuits. The arc is said to be maintained right through the run without going out, even when the change over from one pair of carbons to the other occurs. Should the second pair of carbons be touching when the lamp is switched on, the arc will commence across them, but as the arc lengthens, the feeding mechanism of the first pair only will be operated, so that the arc will be transferred to the first pair automatically shortly after the lamp is switched on. As in the case of the former patterns of Abbey lamp, an auxiliary device is fitted to ensure that the feeding will continue until the arc is struck in the case of a badly trimmed lamp. This device also cuts out the shunt coil when both pairs of carbons have been consumed. For a full description of this device, the reader is referred to the previous article mentioned above. A recent improvement in the construction of these lamps consists in substituting two rotatable brackets or catches on the bottom plate in place of the usual chains for supporting the outer cover while trimming. It was found that the chain tended to rub the enamel off the cover when the lamp was swinging in the wind.

Fittings, Switches, and Accessories.

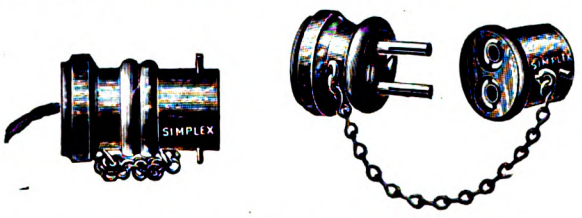
The General Brass Fittings Co., Ltd. (Holbeck Road, Leeds) are placing on the market a device for converting an ordinary lamp-holder into a switch holder without altering the wiring or detracting from the neat appearance of the fitting. This device, called a switch-adapter, is the invention of Mr. E. B. Wright, and consists of a tube or barrel having a plug portion with pins for insertion into the bayonet socket of the lamp-holder, and a bayonet socket to take the lamp. Within the plug portion is arranged to rotate a porcelain cylinder. This has spring contact plungers within the socket communicating with depressed contact studs, which engage with the spring plungers of the lamp-holder. A handle projecting through slots in the barrel permits of rotation of the porcelain cylinder through 90°, thus breaking the circuit at four points. In the "on" position the switch is lightly held by the contact plungers being pressed into the depressed contact plates, while in the "off" position this is effected by providing blind depressions in the porcelain cylinder. The accompanying illustrations show the adapter in two forms, with and without shade carrier respectively. It should be useful for isolating lamps which have been connected to wall brackets, electroliers, or cluster fittings, the wiring of which is arranged so that more than



Lamp-holder Switch Adapter.

one lamp is controlled by one switch. The plain adapter increases the length of the lamp-holder by about half an inch only. Standard lamps which have not switch-holders may be fitted with this adapter, thus avoiding the bad practice of pulling out the wall plug or adapter connecting it to the fitting, to turn out the light.

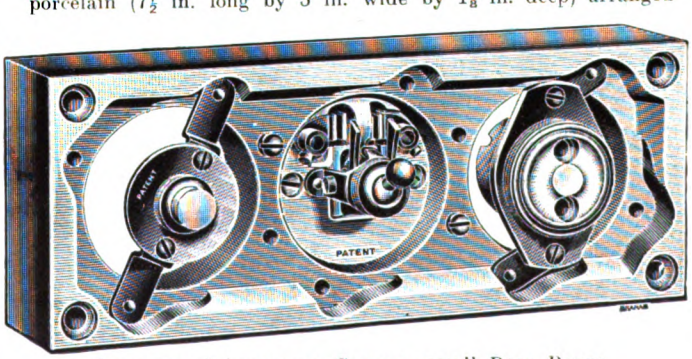
Simplex Conduits, Ltd., have introduced a novel form of combined wall plug and adapter suitable for use in connection with electric table standards, floor standards, kettles, irons, and so on, which should solve the difficulty experienced by contractors in the sale of the afore-mentioned by uncertainty as to whether the client requires a two-pin wall plug or a lamp-holder adapter. By means of the simple appliance illustrated



Simplex Combined Wall Plug and Adapter.

herewith, connection to either can be arranged. The type so far put on the market is suitable either for the 3-amp. wall socket or for a lamp-holder as desired. A further type suitable for 5-amp. wall sockets is at present in course of development. The apparatus is made in two halves, the two parts being attached together by means of a stout brass chain, so that there is no possibility of that portion which is not in use being lost.

It is often convenient, especially on board ship, to be able to group switches, bell pushes, wall sockets, &c., together; but the lack of uniformity of such apparatus generally makes this difficult. Messrs. A. P. Lundberg & Sons (477 Liverpool Road, N.) have introduced for this purpose the "adaptable combination" base illustrated here. This consists of a block of glazed porcelain (7½ in. long by 3 in. wide by 1⅝ in. deep) arranged



Lundberg "Adaptable Combination" Base Block.

with three suitable recesses to take the firm's well-known standard types of switches, wall connections, bell pushes, &c. Fronts of various materials can be fitted, and the arrangement can be adapted either to surface or flush work, the only difference being that in the latter type the covering plate is

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necessarily of slightly larger dimensions. Metal straps of suitable shapes have been standardised, and these support the various accessories in a substantial manner, the fronts being screwed on in the usual way by threaded rings.

The Sun Electrical Co. (118-120 Charing Cross Road) have brought out a new list of reflectors for concealed lighting, which contains several additions to the various forms of reflector for lines of tubular and other lamps, which they have had on the market for some time under the names of "Sunlite" and "Sunline" reflectors. These are arranged in a variety of forms and sizes in both straight and curved strips suitable for for every conceivable situation. A convenient design intended for Osram "Olive" or full-size lamps is made, in which the lamp-carriers are arranged to be swung out for cleaning the reflector. Another variety has a curved strip reflector which can be tilted to any required angle after the lamp-holders are fixed. Numerous other shop-window lighting fittings, signs, &c., are included, as well as a range of ornamental picture-lighting reflectors.

Heating and Cooking Apparatus.

Several new electric heating and cooking appliances have been put on the market by the General Electric Co. (71 Queen Victoria Street, E.C.). One of these is the electric toaster illustrated here, by which four slices of bread can be toasted at the same time in two or three minutes, with a consumption of only 500 watts. The side doors swing outward



Electric Toaster.
(General Electric Co., Ltd.)

and downward to allow of bread being put in and taken out without risk of burning the hands, and when closed retain the heat. The low price (32s. 6d.) of this simple piece of apparatus should make it a popular method of obtaining really hot toast. Other novelties consist of an electric hat pad and a large-sized electrically heated pad for use as a bed-warmer; a new pattern 800-watt combined electric grill, hot plate, and toaster, and two new patterns of water boiler.

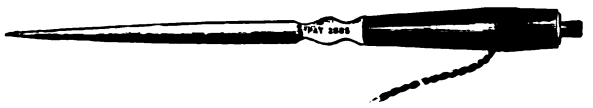
Miscellaneous.

The accompanying illustration shows a simply arranged folding sign, complete with thermal flasher, which the Sun Electrical Co. are introducing. The extreme portability of this inexpensive device should render it extremely useful for shop window and other advertising purposes.



"Sun" Collapsible Sign.

A useful article has just been put on the market by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), in the shape of the combined paper knife and bell push shown in the accompanying illustration. The combination of the two,



Combined Paper Knife and Bell Push.
(*General Electric Co.*)

besides providing a convenient bell push ready to hand, effectively cures the wandering tendency of most loose paper knives. The handles can be obtained of red, blue, white, or green non-inflammable material, or in sterling silver.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."]

HOLOPHANE REFLECTORS.—A new catalogue from the Holophane Co. (12 Carteret Street, Westminster) contains particulars of a number of designs of cluster fittings for use with these well-known ribbed glass reflectors. By using a group of lamps in this way, very even distribution of light is obtained with a better decorative effect, and less glare than with some fittings for single powerful lamps. A useful feature of the list is a series of rules for the spacing of these fittings to obtain the best effect in various circumstances.

CLIPS FOR WIRING.—The various forms of the "Buckle Clip" originally introduced by the Sun Electrical Co. (118-120 Charing Cross Road) for fixing "Kalkos" and other conduit tubes are described in a new leaflet. These well-known clips can, of course, also be used for the fixing of almost every kind of tube, cable, or wiring, and they are now made in six sizes.

WIRES AND CABLES.—Two new supplements to the cable and wire catalogues of Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster), deal respectively with bell wires, including single and twin cotton-covered wires and silk-covered twin flexible cord, and high- and low-tension motor-car ignition leads. The latter contains revised prices on account of the present high price of rubber.

TRAMCAR TRUCKS.—A comprehensive catalogue of tramcar and other trucks on the Peckham "new system" is being issued by the Peckham Truck Co. (Queen Anne's Chambers, Westminster), and contains full information as to the latest types of the pendulum and radial arrangements which the company have developed during the last few years. Among the special features are the pendulating radial gear for long wheel base trucks capable of adjusting itself to a 30-ft. radius curve, and applicable also to various other forms of trucks. This method of suspension gives remarkably easy riding, owing to the way it protects the car body from all sudden shocks by reason of the freedom for sideways movement between the axles and the truck itself. A number of designs of the Peckham patent radial truck are also dealt with, and it is clearly shown by means of diagrams how, owing to the absence of a fixed pivotal point connecting the sub-truck with the cross members of the main truck, the former are free to follow the movements of the wheels on curves, and to enable them to take up their correct position. Considerable ingenuity has also been exercised in the arrangement of the brake mechanism to ensure that it does not interfere in any way with the radial movement. Reports from various well-known tramway engineers are given which confirm the advantages claimed for these methods of tramcar truck construction.

DRY CELLS.—Messrs. Siemens Bros. & Co., Ltd. (Caxton House, Westminster), have just issued a new dry-cell catalogue to supersede that published in August last. Full particulars of the Siemens-Obach, Hellesen, Dura, and Transport cells are given, and ignition coils specially suitable for use with the Siemens-Obach dry cells are now included. An adjustable resistance for use with dry cells in ignition equipments for motor-cars, &c., is also described.

TIME SWITCH.—A new illustrated pamphlet describing the "Venner" time switch for combined arc and incandescent lamp street-lighting has been issued by Messrs. Venner & Co. (6 Old Queen Street, Westminster, London, S.W.). The types described are those for changing over circuits carrying up to 15 amps. on the first, and 5 amps. on the second circuit, at 250 volts. Some have "off" positions, while others are merely change-over switches. A selective attachment for rendering the switch inoperative on any day or days during the week, and another for varying the hour at which the switch works, can be provided if required. The devices are fitted with either 45- or 14-day clocks.

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MOTOR CONTROL GEAR

A Visit to the Works of the Adams Manufacturing Co.

ON Friday last we paid a visit to the works of the Adams Manufacturing Co., Ltd., at Bedford, and were enabled to see the well-known "Igranic" automatic and other control gear supplied by this firm in the successive stages of manufacture. Several new pieces of apparatus were also on view, and these are briefly described below.

The works are of the most modern construction, and are divided into two portions, the electrical and automobile shops respectively. The former have a floor space of over 22,000 sup.

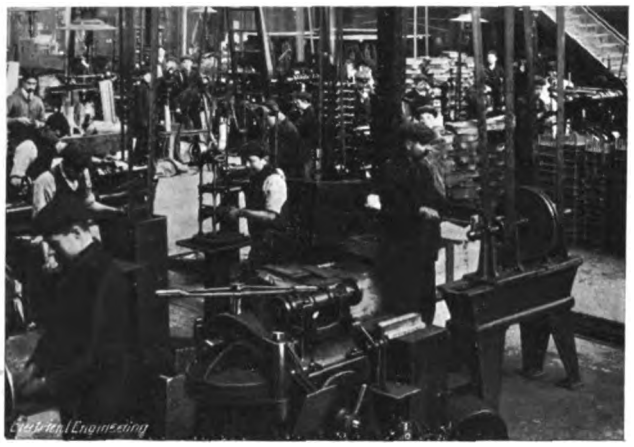


Fig. 1.—View of Portion of Electrical Shop.

feet, of which 4,000 sup. feet is provided by a gallery. Fig. 1 shows a portion of the electrical shop with grinding and drilling machinery in the foreground. The raw materials are issued as required on stock orders, and return after machining to the "finished part" stores. These finished parts, when required for assembling, are taken to the assembling shop, which occupies the gallery, and is divided into two sections, one devoted to the fronts or switch-parts of the rheostats, and the other to the resistances. The former, after being assembled, inspected, and

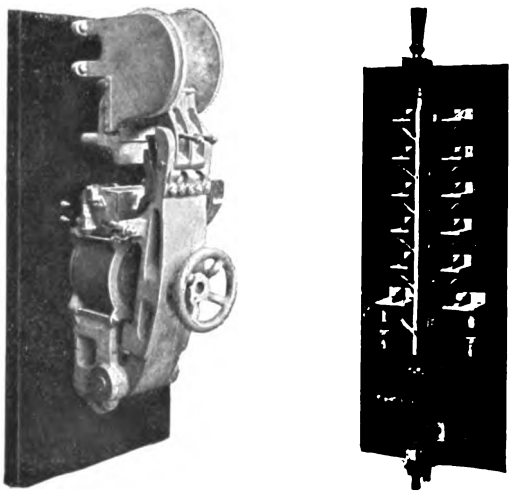


Fig. 2.—Contactor Type Remote Control Switch and Straight-line Multiple Switch Starter.

tested, are returned to the "finished part" stores, and there remain till required. The rheostats, when completed, pass over an inspection bench, where mechanical details are carefully examined, and thence to a test-room in the same gallery, where each is tested before going into the warehouse as finished stock. The number of complete rheostats in stock seldom falls below 1,000. This refers only to small size standard starters, varying from ¼ to 50 h.p. Large apparatus, such as automatic starters, of large h.p., lift controllers, printing press controllers, switchboard panels, &c., is not handled on the gallery, but on the main floor of the shops. This is divided into several sections devoted to Admiralty apparatus, automatic controllers, drum or tramway type controllers, large switchboard panels, &c., respectively. The completed apparatus passes into the ground floor test room—which is equipped with A.-C. and D.-C. supply—and thence to the packing department. The whole of the works is driven by a single gas engine running on producer gas. Over one hundred and thirty men are employed in the electrical shops alone, and an average of some fifty pieces of apparatus are dispatched from the works per day.

A feature of the company's work has been the consistent adoption of standardisation in the manufacture of motor starters and other rheostats, all the various types and sizes of which are

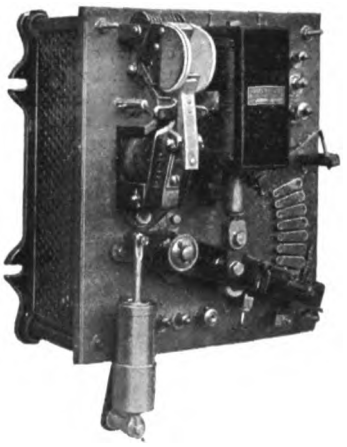


Fig. 3.—Combined Auto-Starter and Main Switch.

built up of a number of units common to all. Thus the rheostat portions of small shunt regulators and the series resistances for solenoids are made up of a number of units, each consisting of a length of bare resistance wire wound on a porcelain former, the whole being pasted over with cement and baked, to protect the wire. For the smallest sizes, the bare wire is wound on mica strips, and these are insulated with mica and enclosed in cast-iron pockets ribbed to assist cooling. The rheostat portions

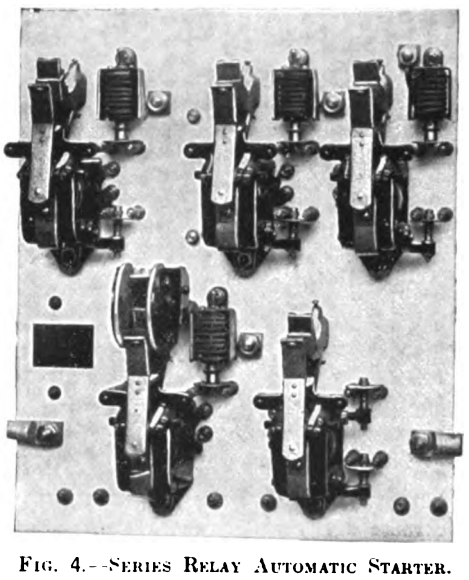


Fig. 4.—Series Relay Automatic Starter.

of motor starters up to those of 50 h.p. capacity consist of a set of units, each comprising a length of bare resistance wire wound on a tube of asbestos millboard from one to two feet long. The wire is fastened by means of eyelets at each end of the tube, and the ends are taken into the tube and through porcelain caps. The units are connected in series by passing the two wires into a short copper tube, which is then pinched by means of a special pair of pliers. This ensures a good electrical contact while avoiding the use of soldered connections. The units are arranged vertically side by side, so that they are cooled by the rising air, and threaded through a perforated

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metal sheet at each end. No insulated wires are used, and the connections are easily got at. For ordinary work panels of treated slate are employed, but several examples of a special pattern to withstand shock, such as that of gun-fire on warships, were shown us. The panels in this case are of sheet iron, faced and backed with micanite; all the bolts, studs, &c., are bushed with micanite also. For very large motor starters, a new type of resistance unit is used. This consists of a strip of resistance metal wound zig-zag over the arms of two star-shaped supports at the extreme ends of a metal rod. One support is pressed out by a spring, thus keeping the strip in tension.

Among the new apparatus on view was a 1,500 ampere remote control switch of the pattern illustrated in Fig. 2. A series of switches of this type have been designed for circuits carrying currents of from 5 to 10,000 amperes on pressures up to 600 volts. The current is carried by laminated copper brushes, and the make and break is taken on copper and carbon arcing tips, easily renewable and under the influence of a powerful magnetic blow-out. The other switch illustrated in Fig. 2 is known as a straight-line multiple-switch starter, and has been designed for enclosing in dust and watertight covers, oil immersing, &c. The switch contacts are closed in succession by means of an up-and-down motion of the handle shown at the top. The first or bottom switch is held in by a no-volt release magnet, and is provided with carbon break and magnetic blow-out. When desired, this switch is fitted with an overload circuit breaker, interlocked with the first switch, and this protects the motor against heavy overloads during starting. Fig. 3 illustrates a combined automatic starter and electrically operated main switch especially suitable for the automatic operation of pumps, air compressors, accumulators, lifts, &c.

The automatic starter illustrated in Fig. 4 has been designed for use with motors, the starting duty of which is heavy, such as pumps, air compressors, machine tools, lifts, &c. The salient feature is, that the starting current controls the rate of acceleration of the motor. The timing of the acceleration depends upon current relays in the armature circuit, which operate in such a manner that they prevent the further cutting out of the starting resistance until the motor has accelerated properly. The current relays can be so adjusted that the starting current may be limited to a certain value, and the time of acceleration predetermined. The starting resistance is cut out step by step by the adjacent switches, controlled by current relays. A main clapper switch, with carbon break and magnetic blow-out, is provided for making and breaking the motor circuit, this switch being interlocked with the resistance cut-out switches, so that the motor circuit cannot be closed unless all starting resistance is in the armature circuit.

Before being conducted round the works, we were shown a number of photographs of heavy electrical control gear installed by the Adams Manufacturing Co. and by the allied firm in America, the Cutler-Hammer Manufacturing Co. These included two 350-h.p. crane motor controllers in the Sheffield works of Messrs. Cammell, Laird & Co., and a controller for a 6,000-h.p. motor driving a rolling mill in Indiana Steel Works, Gary, U.S.A. Photographs were also shown of the totally enclosed water-tight electro-magnets made by the Cutler-Hammer Co. for the purpose of recovering sunken iron and steel cargoes.

JOINTING ALUMINIUM

Much has been published regarding the use of aluminium for overhead transmission lines, but in consequence of the limited experience in handling the metal, reliable information in connection with its use for other purposes is scarce. The following practical suggestions with regard to methods of jointing aluminium 'bus-bars, machine and feeder connections, which have just been issued in pamphlet form by the British Aluminium Co., Ltd. (109 Queen Victoria Street, London, E.C.), are therefore of considerable interest.

Aluminium round rod, such as has already been employed for feeder bars in switchboard work, may be readily butt-welded on site. The rods to be joined should be held firmly a few millimetres apart in the flame of a powerful blow lamp, con-

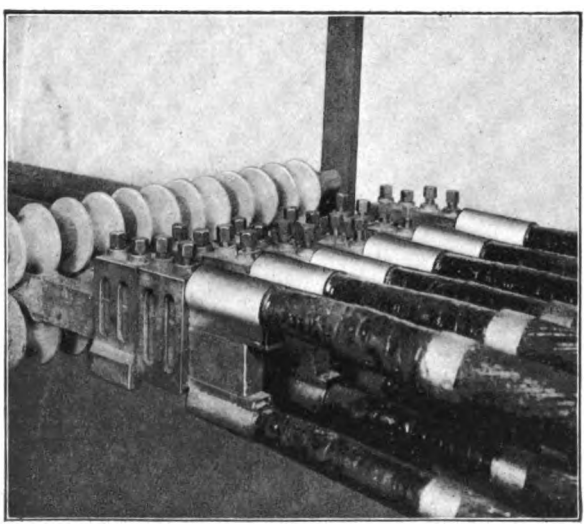


Fig. 1. Coupling between Aluminium Bars and Insulated Copper Feeders.

centrating the flame on the ends to be jointed by the use of two or three fire-bricks or an asbestos shield, until the metal begins to run, when end pressure should be exerted. The lamp should not be removed until the metal flows all round, and the pressure should be maintained until the joint has set; the extruded metal can then be trimmed off if desired. Much depends upon the rods being held firmly in line, and upon even pressure being exerted in bringing them together. In all cases it is advisable to use guides. In welding rods of over $\frac{1}{2}$ in. diameter, suitable clamps for keeping the rod in alignment and for exerting the end pressure are necessary. For jointing rod in inaccessible positions where butt welding would not be convenient, screw couplings having right- and left-handed threads are frequently employed. For a simple sleeve coupling, the ends of the rods should be cut off squarely and screwed right home until they butt rigidly together. No lubricant should be used, but the threads should be an easy fit. For connecting copper feeders to aluminium bars or rods, a special clamp of phosphor-bronze or copper with thimbles cast on, is

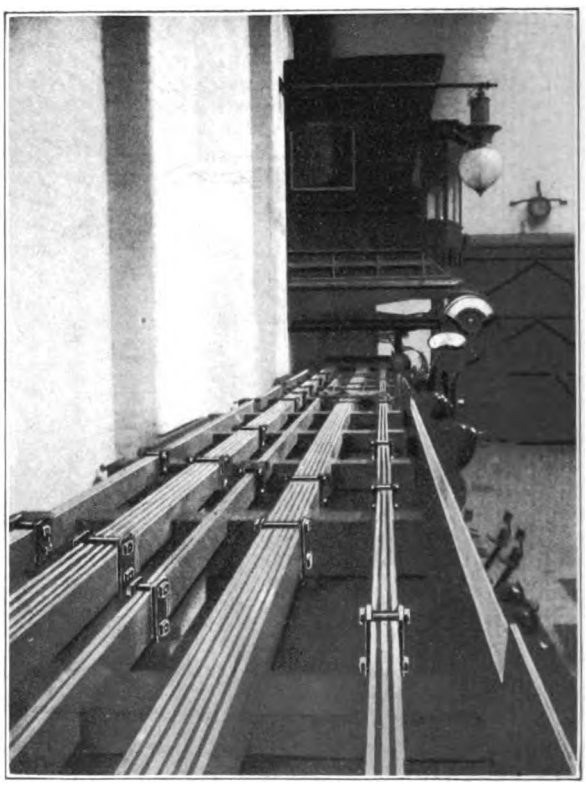


Fig. 2.—Laminated Aluminium 'Bus-bars at Birmingham.

used. The cable ends are sweated into the thimbles in the ordinary way as shown in Fig. 1.

When flat bars are to be jointed, it has been found in practice that clamps and other common forms of mechanical joints used in the erection of copper 'bus-bars and switchboard connections, are equally suitable when aluminium is employed. For heavy currents such bars are usually built up in laminated form

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and clamped together with aluminium spacing pieces between the individual bars to increase the cooling surface, as shown in Fig. 2. A fine example of such work is to be seen at the Manchester Dickinson Street station, where the 'bus-bars of the switchboard erected in connection with the new 12,000 ampere-hour storage battery are of aluminium. The contact surfaces at joints in such bars should be liberally proportioned, and must be perfectly flat and free from grit or other foreign matter. Before clamping up, the surfaces should be rough filed in opposite directions; the smallest trace of vaseline improves the contact. When bending bars of ¼ in. thickness and upwards, it is advisable to heat the bar at the bend with a blow lamp, care being taken not to overheat the metal. If the clamps and bolts are of metal other than aluminium, it is desirable, especially in damp atmospheres, to paint both clamps and joints with an acid-resisting compound or paint, so as to exclude moisture.

Insulated aluminium cable is now being employed with considerable success by various undertakings, and several special methods for jointing and tapping have been devised. In the case of standard joint boxes in which it is usual with copper cables to employ mechanical clamps, it is found that similar aluminium clamps can be used with equal success for aluminium cables. It is important, however, that the clamps should be screwed up rather firmer than usual. This offers no difficulties in single-core cable, but in concentric cable it is advisable to place a thin aluminium sleeve between the inner layer of insulation and the outer layer of conductors in order that the latter shall not cut into the insulation when tightening up the clamp. We understand that some joints made in this manner actually gave a lower resistance than the equivalent copper joint.

In jointing bare annealed stranded aluminium cable, and even insulated cable where the insulation can be stripped several inches, a cast joint will be found most satisfactory. This joint is made by melting pure aluminium in a crucible, and pouring it into a sheet or cast-iron mould, into which the ends of the cables are inserted. The mould and cable ends should be heated so that the metal may not be chilled on entering. To connect to a copper cable, an aluminium lug is cast on the aluminium cable and bolted to standard copper connections. In all cases where there is a junction between aluminium and copper, care should be taken to exclude moisture by painting over the joint with an acid-resisting compound.

For overhead lines, the following is a type of joint which has been adopted on many important copper and aluminium lines now in operation. The two ends of the cable are straightened out and passed in opposite directions through a pure aluminium sleeve of ∞ section until each protrudes a few inches on either side, care being taken that the cables and sleeve are clean and free from grease or dirt. Hard wood clamps, cut to fit the sleeve, are securely bolted together over each end of the sleeve so as to prevent any movement between cables and sleeve. The clamps are then rotated by hand in opposite directions until the joint contains four to six complete turns, according to the diameter of the cable. To keep the cable ends and sleeve in alignment during twisting, it is advisable, especially with heavy cable, to place them in a wooden trough or guide. It is advisable to bevel off the inside edge of the clamps where they come up against the first twist in the finished joint, in order to prevent damage to the sleeve, and with cables of large diameter the entering angle of the clamp should be shaped to the contour of the commencing twist. The sleeve increases the stiffness of the joint, excludes moisture, adds to the cross-section, reduces any tendency to untwist, and renders unnecessary the application of heat which would soften the hard-drawn metal.

The pamphlets from which the above information is taken contain also a list of standard aluminium 'bus-bar sections, with resistances and weight per foot, and a list of hard-drawn aluminium cables with similar particulars, including the nearest corresponding standard hard-drawn copper cables.

ELECTRIC BRAKING

A PAPER dealing with the progress of electric braking on the Glasgow Corporation tramway system by Mr. A. Gerrard was discussed by the Institution of Electrical Engineers at last Thursday's London meeting, and also by the Glasgow Local Section on Tuesday. In outlining the history of electric braking at Glasgow, the author referred to early experiences in 1898 with rheostatic and disc electric brakes, and passed on to a description of the Westinghouse magnetic rail brake designed by Mr. F. C. Newell in 1899. As is well known, this is provided with magnets suspended by springs from the truck just clear of the rail, which, when energised by current from the moving motor acting as generator, tend to adhere to the rail and drag, falling behind their normal or central position on the truck. This backward motion or lag is utilised to apply the wheel-shoes through the medium of connecting rods and levers. The magnets lag behind their normal position until all the slack motion has been taken up, and the wheel-shoes are tightly pressed against the wheels. The leverage exerted on the shoes of the leading wheels is more than that on the shoes of the trailing wheels, to compensate for the unequal distribution of weight between the leading and trailing wheels when a fast stop is being made, or even when stopping slowly on an incline. Brakes of this kind were fitted to some of the Glasgow tramcars in 1901, and, after satisfactory trials, adopted on the whole system. It was, however, realised after a while that their action put undue strain upon the motor armatures, and when the matter was gone into it was found that when running at 18 to 20 miles per hour with 10 ohms in the brake circuit, the voltage was as high as 1,000 to 1,200. It was also found that at about this speed intermittent skidding took place. Both from a braking point of view, therefore, as well as from a desire to protect the equipment, it was decided to weaken the field by introducing a resistance in parallel with it. A permanent shunt resistance was first experimented with, but it was found that when a low resistance, such as 0·25 ohm, was inserted in the shunt circuit, the motors would not excite, while on the value of the shunt resistance being increased to 0·5 ohm, the braking effect was improved and the voltage kept low, but the machines would not excite quickly enough for an emergency stop. The next move was to introduce the shunt automatically, as required, by means of a solenoid operated switch. After some further experimenting, the double-barrelled form of solenoid switch shown in Fig. 1. was evolved.

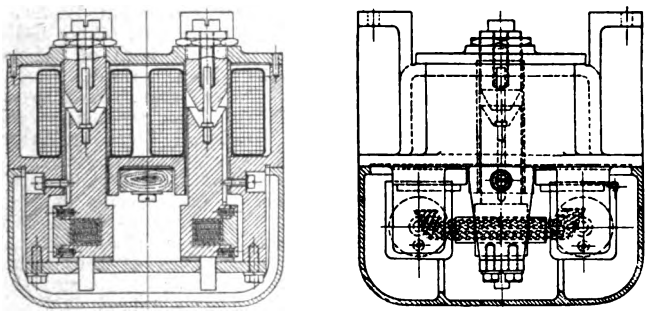


Fig. 1.—Solenoid Switch for Preventing Abnormal Voltage and Skidding with Westinghouse Magnetic Brake.

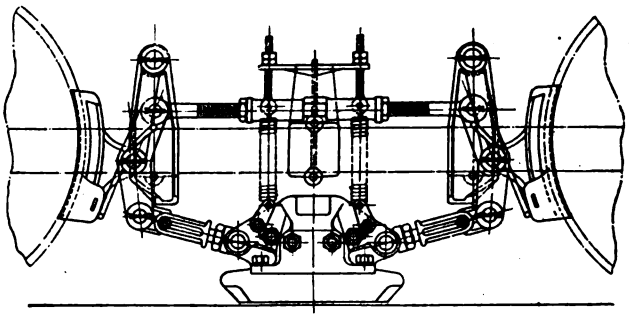


Fig. 2.—Westinghouse Magnetic Brake on Brill Single Truck (with 26c Magnet).

The low-speed solenoid operated at 30 amperes, bringing in a shunt resistance of 0·2 ohm, and the high-speed solenoid at 80 amperes, bringing in another shunt resistance of 0·2 ohm in parallel with the first. In the event of a motorman running his car at, say, 18 miles per hour, and, through excitement or carelessness, passing over the first on to the second brake-point of his controller, both solenoids will operate, and thereby bring a shunt resistance of 0·1 ohm in parallel with the fields. This gave excellent results without skidding, and without the voltage ever rising above 600 at any speed.

In order that the very best braking results might be obtained

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in conjunction with solenoid control, two sets of more powerful track magnets were tested. These new magnets are quite different in design from the old Newell magnet, on which the poles follow each other in series on the rail. On the new type the poles are placed side by side and parallel to each other. The magnets (known as the Westinghouse 26c and 25b magnets) were not only found to give a far greater maximum pull, but their effect with a current of 5 amperes is greater than that of the old magnet with 50 amperes. The arrangement of the ordinary Westinghouse brake with 26c magnet is shown in Fig. 2.

Another type of brake adopted in 1908 is shown in Fig. 3

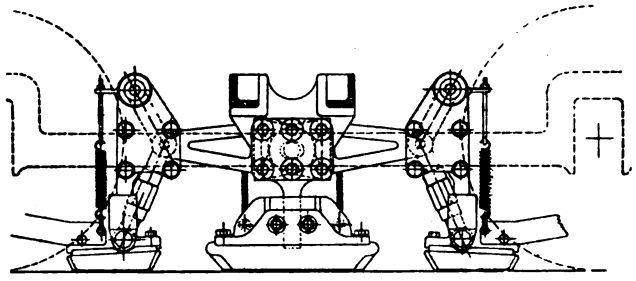


Fig. 3.—"1908" Brake with Westinghouse 25b Magnet.

The chief feature is that the motion obtained from the movement of the magnets was utilised in pressing auxiliary track-shoes down on the rail, instead of applying auxiliary wheel-shoes. The idea of substituting auxiliary track-shoes in place of wheel-shoes was to relieve the wheels of the braking effort of the auxiliary wheel-shoes, and thereby reduce the risk of skidding when making fast stops.

The remainder of the Paper gives the result of a lengthy series of tests with all these types of brake in considerable detail, from which and from the general experience in practice the following conclusions are drawn:

(*a*) Rheostatic braking is destructive in its action on motors, due to the added heating effect from the high braking currents, and to the excessive voltage generated by the motors acting as generators during service and emergency stops at high speeds. This high voltage causes flashing at the brushes and insulation breakdowns. Rheostatic braking permits smooth coasting, but the current is high, and skidding occurs when braking at high speeds. The retardation is much lower than with the magnetic brake.

(*b*) The Newell brake with the old type of magnet is greatly superior to the rheostatic brake, both in retarding power and in the current consumption, but the current is still high; the voltage generated by the motors during high-speed braking is excessive, and skidding occurs unless the controller is handled with great care. While much easier on the motors than the rheostatic brake, it is severe enough under the best conditions, and when not carefully handled is responsible for a large part of the trouble with motors and controllers.

(*c*) The 1908 brake, with auxiliary rail blocks and parallel shoe magnets, is a powerful one, and requires comparatively little current from the motors, but the voltage rise is excessive, and the skidding serious when braking at high speeds, while the surging during coasting is prohibitive. The retardation obtainable is very high but very uneven, probably due to the tendency of the track blocks to grip the rails. The excessive voltage rise might be reduced by means of the solenoid control, but it seems doubtful whether skidding and uneven retardation would be prevented.

(*d*) The Newell brake with parallel shoe-magnets requires little current from the motors, gives good results when coasting, and high retardation under ordinary braking conditions, but the voltage generated by the motors when braking at high speed is excessive, and with emergency stops from high speed, skidding may occur if the controller is not properly handled. This brake is much easier on the motors than the Newell with the old type of magnet, on account of the decreased current required, and for the same reason it is better than the 1908 brake. It would be quite satisfactory were it not for the high voltage and the skidding at high speeds.

(*e*) The Newell brake with parallel shoe-magnets and solenoid controlled shunts to the motor fields possesses all the advantages of the brake described under (*d*), while the possibility of obtaining high voltage on the motors is eliminated and there is no longer any necessity for careful manipulation of the controller to prevent skidding. Exhaustive tests have shown the brake to be skid-proof and the motors to be free from any excessive voltage rise, and it is hoped that actual experience at Glasgow will entirely confirm these tests.

The Glasgow Corporation Tramways Department is at present engaged in fitting to each car an automatic sanding apparatus, the component parts of which are a solenoid and a continuous flow sand valve. The coil of the solenoid is inserted in the main braking circuit, and its armature is connected to the continuous flow sand valve, so that, when the solenoid operates, the sand valve is opened, and a copious supply of sand is projected on the rail without any effort from the motorman. A spiral spring is attached to the valve in such a way as to work against the action of the solenoid, and adjusted so that if the electric brake is applied for an ordinary service stop, or for coasting, the solenoid is prevented from opening the valve and serving out sand when it is not required; but in the event of the motorman making an emergency stop, the current flowing through the circuit is sufficient to operate the solenoid and automatically to supply sand at a most opportune moment.

Discussion in London.

Mr. J. S. Peck (British Westinghouse Electric and Mfg. Co.) urged that greater attention should be paid to the effect of the braking apparatus upon the rest of the equipment. The author had succeeded in diminishing very considerably the heavy current taken during the braking period. This current must have added materially to the heating of the motor, and consequently to the deterioration of the insulation. But the Glasgow tests also revealed another circumstance, viz., that when braking at very high speeds or on emergency, the voltage across the armature terminals was at least twice the normal. Probably it was even higher than this owing to the voltmeter not being rapid enough to measure the instantaneous rise which appeared to take place. The shunted field device appeared to have eliminated this entirely. It was far better to instal thoroughly efficient apparatus in order to avoid accidents, than to do so under compulsion after an accident had taken place.

Mr. E. H. Cockshott (Leeds Corporation Tramway Department) said that experiments had been made in Leeds both with the Newell brake and the Maley brake, and his results did not agree with the author's. He had found that without the solenoid device the Westinghouse brake was liable to skid, and had known this to take place for a distance of 130 yards on a gradient of 1 in 11. He agreed that the solenoid device would reduce this tendency and also the voltage, but he failed to see why the same effect should not be produced with the 1908 brake referred to by the author, viz., the Maley brake. With regard to the voltage and current required on braking as compared with the Westinghouse brake, the real test was to separately excite the magnets from the trolley-line and then draw the car along through some kind of spring balance, and thus arrive at exactly the force required to move the car when the brake was fully applied, and without any retarding torque due to the motors acting as generators. They had tried this in Leeds with both types of brake, and the drag was practically the same in the two cases. If anything, there was a bigger drag with the Maley than with the Westinghouse brake. He thought it would have been useful if the author had given results of trials with the Westinghouse brake and solenoid device at speeds exceeding 20 miles per hour. He had made a large number of experiments with the Maley brake up to 28 miles per hour, and had never exceeded a voltage of 890 volts on any occasion. The highest speed given in the Paper was only 20 miles per hour. He had not noticed the surging effect, referred to in the Paper, on the Leeds cars, in connection with which some thirty Maley brakes were used. Indeed, in the Brakes Report of the Tramways and Light Railways Association, the uniform effect of braking with the Maley brake was commented upon. These brakes had now been in use for three years, and no surging effects had been noticed.

Mr. A. W. Maley, inventor of the Maley brake, failed to see any reason why the Paper should have been written at all, seeing the Committees of both the Municipal Tramways Association and the Tramways & Light Railways Association were still continuing their investigations into brakes. The main object of the Paper seemed to be to institute comparisons between the Westinghouse brake and his own; but he had not been consulted in the matter, neither had he even heard that the tests were being carried out. The conclusions of the author seemed to be mostly unfavourable to the Maley brake, and this was in very strange contrast to the results obtained at Leeds and Birmingham, where his brake was in daily operation. He felt he was suffering under an injustice in this matter, for the author had carefully suppressed the name of the Maley brake, whilst giving prominence to the name of the Westinghouse Co. Reading the Paper, he could not help feeling that the author's tests were very rough ones; it was surely necessary that the recording instruments should be of the most exact character for a really exhaustive series of tests.

The President interrupted Mr. Maley and asked him to refrain from discussing the personal side, and to confine himself to the technical side of the Paper.

Mr. Maley, continuing, made further complaints as to the manner in which the tests on his brake had been carried out by the author, and went on to give details of the tests made at Leeds (Electrical Engineering, November 28th, 1907, Vol. II., p. 851), where on greasy rails, a retardation of 8¼ ft. per second per second were obtained, thus establishing his claim that the working of his brake was independent of the condition of the rails.

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The President eventually stopped Mr. Maley, and asked him to communicate some criticisms of the technical points raised in the Paper, for publication in the *Journal*.

Mr. W. H. Booth said it was generally admitted that electric brakes caused a good deal of injury to the car equipment, and it was also admitted by many engineers that it was desirable to put in some mechanical stand-by to an electric brake. In this connection he showed diagrams of a brake with a toggle arrangement for transferring the whole weight of the car on to the track blocks, which had been tried upon the Yorkshire (Woollen District) tramways. He suggested the use of a brake working off the trolley-wire, and capable also of being worked mechanically.

Mr. H. M. Sayers said that no mechanical brake could give anything approaching the 8 ft. to 10 ft. per second per second retardation obtainable with the magnetic track brake. The Newell brake was a good instance of the development of a crude and destructive device into an economical and practical piece of apparatus, for when it first made its appearance he would have nothing to do with it. The author was the first to publish actual figures of the voltages obtained when braking at high speeds with the magnetic type brake. When it was seen that they were subjected to 1,000 or 1,200 volts, it was not surprising that tramway motors flashed over occasionally. Personally, he thought it was a very proper Paper to bring before the Institution, and speaking as a member of the Council of the Tramways & Light Railways Association, he would have welcomed it before that Association. The difference between the tests made with the Maley brake at Leeds and Glasgow showed that there must have been some difference in the conditions which was not revealed by the data given in the Paper. He was present at the Leeds tests, and could vouch for them. At Glasgow the brake was tried under unstable conditions, while the relationship between the motors, the brake windings, and the resistances in the circuit were such that surging was set up in a sort of resonant fashion. At Leeds the motors were of a different type, and there were slight differences in the circuit which gave better retardation. He did not think Mr. Maley's invention was to be judged by the Glasgow results; at the same time, he did not think Mr. Gerrard had wilfully acted unfairly in any way. He thought the result of the investigations showed that the magnetic type brake with solenoid control was the best under conditions of frequent stops and heavy traffic, both passenger and vehicular; in fact, it was as nearly perfect as they could hope to get. At the same time, it was very complicated. On urban services with few stops, and even those with steep gradients, he thought a mechanical track brake was the best and most useful; and it was a great deal cheaper than a magnetic brake. If, however, a magnetic track brake were used, there should be means of applying it mechanically.

Mr. Gerrard, replying briefly, said the paper was written to show the advantage of the solenoid control. He did not think, however, that this device would prevent skidding with the Maley brake, as this was designed to transfer a portion of the weight of the car on to the brake blocks. The electrical load in the armatures was still retained, whilst the mechanical load was removed from the wheels. Consequently there must be skidding. He had not been able to make tests at higher speeds than 20 miles per hour, for the reason that he had no hill to enable him to do so, but he understood that speeds of 36 miles an hour had been attained in London with the solenoid control with perfectly satisfactory results. With regard to Mr. Maley's remark, he had been requested to write the Paper by the Glasgow Local Section after the tests had been made. He had no intention of publishing them at the time, and the tests were necessarily roughly made. At the same time, he claimed that the results were quite conclusive. He had not mentioned the name of the Maley brake, because the results were unfavourable to it.

A hearty vote of thanks was accorded the author at the conclusion of the discussion.

SWITCH AND TRANSFORMER OILS

A LONG Paper on the physical properties of switch and transformer oils containing results of tests of a variety of qualities of oil, by Mr. W. Pollard Digby and Mr. D. B. Mellis, was read before the Manchester Local Section of the Institution of Electrical Engineers on Tuesday, March 22nd. The authors point out the great influence of very small amounts of impurities in oils on their electrical properties, and the need for greater care in testing. The following properties are regarded as requisite for a transformer oil :—Absence of moisture; good dielectric strength; a low viscosity to facilitate the heat transfer from the core and windings to the case; a flash-point expressed by a figure which is two to three times the designed temperature limit of the transformers in degrees C.; an absolutely neutral reaction; complete absence of vegetable oils or resinoid material; and freedom from metallic salts. The requirements of switch oil are similar, except that the flash-point might be put at six times the expected engine-room temperature in degrees C.

The grading of oils according to their specific resistance gives a fair indication of their purity. For the determination of specific resistance, the authors have employed a pair of metal disc electrodes, the distance between which could be regulated by a micrometer screw making the measurements by a "Megger" or other form of ohmmeter. The specific resistance is found in all cases to vary with the applied voltage according to a parabolic law. For a series of six typical oils tested, it was found to vary from about 600,000 to 6·5 million ohms per cubic centimetre.

Tests for dielectric strength were carried out by immersing two electrodes at a known distance apart and applying a gradually rising voltage till arcing took place. The distance between the electrodes was varied, and a limiting voltage found for a variety of distances. As might be expected from a consideration of the distribution of the electrostatic lines of force, the shape of the electrodes has a considerable influence on the results. In making comparative tests with different samples of oil, it is advisable to choose the terminals which give the lowest possible puncturing voltage, over a given distance, and the most consistent set of results with any one oil. After a considerable amount of experiment, it was found that a point and disc arrangement answers these requirements best. At each puncture a certain amount of oil is decomposed, and carbon is thrown down, but even when the amount of carbon produced by repeated punctures renders the oil as black as ink, the dielectric strength is not appreciably affected; in fact, as a rule, after a few punctures, the dielectric strength improves.

Another point to be investigated was the influence of baking at a temperature of 240° F. for 24 hours. The effect of this, as revealed by subsequent tests, may be summarised as follows :—An increase in the disruptive voltage where this was less than 10,000 volts over the test distance. No increase in specific resistance for oils of high specific resistance, but an increase of specific resistance in those cases where decreases in specific gravity indicate the expulsion of moisture. Increase in specific gravity and viscosity, and a raising of the flash-point, due to the evaporation of the more volatile constituents. Darkening of the oil. A tendency to emphasise the indications of any traces of alkali. Irregular behaviour in regard to the indications of the presence of resinoid matter.

Other physical properties to be examined are specific gravity, viscosity, and flash-point. A special balance, known as the Westphal balance, is recommended for the first determination in place of a hydrometer, and the importance of attention to temperature is emphasised. A description is given of the Redwood viscosimeter, in which the flow of oil through an orifice is timed, and the Martin-Pensky apparatus is recommended for the determination of flash-point.

Passing on to chemical examination, the authors remark that the oil should be pure mineral oil, free from moisture or any notable proportion of oils of low boiling-point, alkali, acid, sulphur and its compounds, resin, fatty oils, tarry matter, and metallic soaps, and methods of detecting the presence of all these impurities are described.

The fact of the variation of specific resistance with temperature suggested to the authors the advisability of studying the relation between temperature and dielectric strength, and tests were made of the point and disc method on samples of the same series oils as used in the previous experiment.

It was seen from these tests that for all oils the dielectric strength increases with increasing temperature, but that consistent readings on the ascending and descending temperature curves are only obtained by oils of high specific resistances, *i.e.*, pure oils. This fact of increase of dielectric strength with temperature throws a grave doubt on the soundness of the general practice of nearly all makers of oil-cooled transformers, who apply lower test pressures to the transformer when heated at the end of a test run, than when it has been allowed to cool down.

The test of viscosity shows that all oils become "thinner" the higher the temperature, but to a varying extent with different oils. Also, as a rule, the viscosity of Russian mineral oils is greater than that of American mineral oils of the same specific gravity.

The viscosity of transformer oil should be low enough to ensure free convection with a moderate rise of temperature, above 60° F.; nevertheless, an allowance for the lowering of the viscosity when the oil becomes warm may be made in deciding on the suitability of an oil for use in transformers.

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The viscosity at 60° F. should be regarded as the index. Taking 130° F. as the temperature, which is frequently attained in a transformer under average conditions in the English climate, it is manifest that an oil which would not quite afford free play to convection currents below 100° F. might be as satisfactory as one possessing the requisite degree of mobility at 70° or 80° F. Of course, the heating of transformers varies with the working conditions, and it is therefore difficult to fix the maximum viscosity permissible. As a rule, however, a viscosity higher than 70 or 75 is undesirable unless atmospheric temperature, load, and duration of running are such that high temperatures are inevitable. Where such conditions do not arise, a viscosity not exceeding 45 to 50 is to be preferred. Given equality in other respects, oils having the lowest viscosity should be selected for transformers.

For switches, too, the use of an oil having a viscosity sufficiently high to prevent or seriously to impede the subsidence of suspended matter is to be avoided. Considered electrically, the authors have not yet satisfied themselves as to whether—other factors being equal—thin or thick oils are to be preferred. So far as temperature is concerned in well-designed switchgear with no local heating and infrequent opening, the temperature of the switchboard gallery alone calls for consideration. The function which the oil has to serve is either that of preventing the formation of or of quenching the arc when struck. In effecting this the decomposition of the oil should be as small as possible. From the theoretical point of view, a heavy oil should hinder the formation of an arc owing to its molecular tenacity, while a thin oil with a more rapid rate of flow would probably be quicker in extinguishing the arc.

A series of tests were made to investigate the changes in physical and chemical properties of oil in the tank of a switch which was opened under a known current and voltage 200 times in succession, but the results were quantitatively inconclusive, although they showed that with good oil, and protection from the ingress of dust or moisture, such a switch might be tripped a great many times before the physical properties of the oil fell below those of a number of the inferior oils only too often used. Determinations of the amount of carbon liberated by prolonged arcing under the oil were also made, and further experiments were carried out upon the effect of temperature upon specific resistance, which was found to vary a good deal with the grade of the oil. It is suggested, however, that specific resistance measurements might be used to ascertain (by comparison of a series of heating and cooling curves, with a progressive increase in temperature), the point at which a certain molecular regrouping of the hydro-carbon constituents appears to take place, a matter of interest in the selection of oils for engines using superheated steam.

Discussion.

The discussion was opened by Mr. C. J. Beaver, who said that his own experience was that alkaline, acid, and resinoid substances were not the most usual impurities met with in mineral oils, but that moisture was by far the most predominant source of variation in electric properties. It could be eliminated by filtration through beds of calcium chloride. He also pointed out the difference in the behaviour between solid dielectrics and oil as regards the influence of temperature, and, contrary to the authors' view, advised lower test pressures for transformers when hot than cold.

Mr. J. S. Peck (British Westinghouse Co.) said that freedom from deposit under working conditions was almost as important as a high fire test or high dielectric strength, and it was difficult to obtain oils which did not throw down a deposit when worked at a high temperature. Great precautions were necessary to prevent absorption of moisture by the oil during shipment.

Mr. J. E. Southcombe said it was a rare thing to find alkaline impurities in oils. In his opinion it was in not chemical impurities but minute traces of moisture difficult to detect chemically, which explained most discrepancies in dielectric strength. Success had attended drying the oil by electrical resistances immersed in the oil, but it would appear to be a better investment to pay an experienced oil manufacturer an increased price and demand from him an anhydrous oil.

Mr. J. Lustgarten (Manchester Municipal School of Technology) referred to various causes of variation in the sparking voltage under oil, and favoured Dr. Russell's way of expressing the dielectric strength of an insulating material by the maximum potential gradient at breakdown. He had dried oil for experimental purposes by the means of sodium.

The authors replied briefly.

Institution Students' Section.—The annual general meeting of the students' section of the Institution of Electrical Engineers will be held at 92 Victoria Street, S.W., on May 4th, at 7.45 p.m. Nominations of extra-collegiate students to fill three vacancies on the students' committee should be sent to the Hon. Assist. Sec. of the Students' Section on or before April 24th.

LONDON UNDERGROUND RAILWAYS

Amalgamation Scheme and Through Running at Charing Cross.

Moving Stairway at Oxford Circus

THE scheme for the amalgamation of the Great Northern, Piccadilly & Brompton Railway Co., Baker Street & Waterloo Railway Co., and Charing Cross, Euston & Hampstead Railway Co. was passed by a Committee of the House of Lords on Thursday, there being no opposition.

The general case for the amalgamation of these three companies rests upon the advantages arising from unity of interest and unity of management, and on the advantages to shareholders from a consolidation of their stocks. So far as possible, unity of administration is maintained in the conduct of the business of the three railways at the present time. There is, however, a good deal of complication, especially in the accounting, owing to there being three boards of directors with individual rights and obligations, which necessarily impairs efficiency and involves considerable expenditure which will be saved by the amalgamation. Another important factor in the scheme is the important growth of exchange traffic between the three lines in question (and, also, with the other tube railways), and it is felt that the amalgamation will give facilities for this expansion, which is looked to as the main development in the future.

The financial proposals of the scheme, of course, form its chief characteristic, and these are set out below :—

(1) To consolidate the debenture stocks (£3,791,106) issued by the three separate companies into one stock of the amalgamated company of the same nominal amount, adding thereto a sum of £408,894 required for the purposes of the amalgamated company.

(2) To exchange the 4 per cent. preference shares of the Piccadilly and Baker Street companies for 4 per cent. preference stock of the amalgamated company at par, and to exchange the £298,030 ordinary shares of the Baker Street company held by the public for 4 per cent. preference stock of the amalgamated company in the ratio of £75 of new stock for £100 of existing shares, thus absorbing £1,240,563 out of a total issue of £3,150,000 new 4 per cent. preference stock.

(3) To exchange the £10,837,380 ordinary shares of the three companies, held by the Underground Electric Railways Company of London (of which £1,442,960 consists of ordinary shares of the Piccadilly company, convertible into preference shares of that company), into £1,909,437 4 per cent. preference stock and £8,927,943 ordinary stock of the amalgamated company, making together £10,837,380 as above.

The company proposes to carry out certain improvements in the Baker Street & Waterloo Railway and the Charing Cross, Euston & Hampstead Railway as provided for in separate Bills promoted by these companies, and for which the additional £408,894 debentures mentioned in paragraph 1 above is required. For the first completed year of the amalgamated company it is estimated that after meeting the debenture interest and preference dividends there will be a sum of £89,500 available for ordinary dividend and reserves.

The Committee next considered the Bill of the Baker Street & Waterloo Railway Co., the main proposal in which is to construct a passenger subway from the Oxford Circus station into Oxford Street. In this subway, which will have a diameter of 17 feet, will be fitted a moving stairway or "escalator," divided into two parts, one going up and the other down. These will be worked electrically, and each will have a carrying capacity of 150 passengers. The estimated cost is put at £17,000. There was some opposition from landowners, but the preamble of the Bill was found proved.

A Bill by the Charing Cross, Euston & Hampstead Railway Co., which was also considered by the same Committee, proposes to make physical connection with the District Railway at Charing Cross for the purpose of running through trains. Opposition was offered by the Gordon Hotels, Ltd., who alleged that the tunnelling works proposed would endanger the safety of the Hotel Metropole. It was asked that the promoters should be put under an obligation to have 10 ft. of London clay between the top of their new tunnels and the foundations of the hotel. On Monday, the Committee, after hearing the case against the proposed connection at Charing Cross, decided that it was not expedient that the Bill should proceed. On an application by counsel for the promoters, however, the Chairman agreed to restrict this decision to the line at Charing Cross, leaving the remaining portion of the Bill, which is unopposed, to go forward. Later on, the Committee, on a further application by the promoters, agreed to withhold their report on the Bill, in order to see if, by a re-arrangement of the new line, an agreement could be come to with the Gordon Hotels, Ltd.

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PROPOSED NEW GENERATING STATION AT GLASGOW

AN important report on the capacity of the two principal generating stations of the Glasgow Corporation electricity supply department, has been submitted to the Electricity Committee by Mr. W. W. Lackie, chief engineer to the department.

Mr. Lackie points out that the maximum load during the last winter amcunted to 21,650 kw., whereas the plant at the Port Dundas and St. Andrew's Cross stations, neither of which have space for extensions, can only deal safely with a maximum load of 23,600 kw., so that in view of the increasing demand, which before the advent of the metal filament lamp was rising at the rate of 3,000 kw. per annum, further plant capacity is urgently required. He first discusses the possibility of replacing one or two small generating sets at Port Dundas by larger ones, but dismisses the idea of plant extensions at this station on account of the unsatisfactory supply of water from the canal for condensing purposes, and the high price which has to be paid for coal delivered there, amounting to about 10d. per ton more than at St. Andrew's Cross, owing to lack of railway siding accommodation. Nor would this expedient be more than a temporary measure, as it would not meet the demand five or ten years hence. A similar objection as regards condensing water stands in the way of additional plant at the Pinxton station. Mr. Lackie, therefore, recommends the acquisition as soon as possible of a site for a new works, and reports that the most favourable site of any he has examined is an area of 53,314 sq. yards on the west side of Dalmarnock Road, with a river frontage of 250 yards, and a branch of the Caledonian Railway running along its western boundary. This site is also within 300 yards of an existing sub-station, to which it could be connected up inexpensively. The chairman announced that an offer from the proprietors of the piece of ground mentioned had been received, to sell the whole site at a rate of 8s. per sq. yard, and at other rates for a portion of the site. The Committee agree generally with the report, and suggest the acceptance of the offer for the whole or part of the site after further examination of the suitability of the land for the purpose.

MUNICIPAL v. COMPANY SUPPLY AT RADCLIFFE

Proposed Competition by Lancashire Power Co.

AN inquiry of considerable importance to electric power companies and municipal electricity undertakings was opened at Radcliffe last week, in connection with an application to the Board of Trade by the Lancashire Electric Power Co. for a provisional order, authorising them to supply electricity in the Borough of Radcliffe. The Radcliffe District Council is at present supplying under a provisional order, and the company is prohibited by its Act from supplying in Radcliffe, but it appears that several applications have been made to the company by Radcliffe firms for a supply, in preference to taking a supply from the Council, presumably on the question of price. The company contend that there is a large demand for electric power in Radcliffe, which the Council is quite unable to meet, and their proposal is to allow the company to come into the district and compete with the Council for consumers above 50 h.p. They also agree not to canvass the present customers of the Council. It was alleged that a "Development Committee" had at one time been formed to bring industries into the town, but that in consequence of this Committee holding views in favour of allowing the Power Company to enter the district, the Council had disbanded it. Representatives from a number of large works in Radcliffe were called in support of the application, the view they expressed being that to allow competition in Radcliffe would be to the interest of power users and the ratepayers generally. Mr. C. D. Taite, the Engineer and General Manager of the Power Company, referred to the fact that the company is supplying firms in Bolton and Prestwich with the consent of the local authorities, and that at Farnworth the District Council had found it advantageous to scrap their plant and take all their supply from the company.

For the Council, it was stated that the undertaking was making a profit of £600 per annum after setting aside sufficient for depreciation, which latter it was contended the Power Company did not do. Mr. F. E. Lacey gave evidence against the proposal of the Power Company, and Mr. S. J. Watson, Borough Electrical Engineer at Bury, pointed out that when the new works of his Corporation were completed, the Radcliffe Council would be able to obtain a supply in bulk at very cheap rates. The inquiry is proceeding.

PARLIAMENTARY INTELLIGENCE

HANDSWORTH TRAMWAYS.—The tramway clauses in the Omnibus Bill of the Handsworth Urban District Council were passed by a Committee of the House of Lords on Thursday. Next year the whole of the tramways in Handsworth will fall into the hands of the Council, and consequently it is sought to borrow the sum of £203,875 in this connection, which includes the cost of certain new lines to accommodate the large population in the Birchfield Road district. As there is a question of Handsworth being incorporated with Birmingham, the latter Corporation asked that a decision on the tramways should be postponed until the question of incorporation has been settled, but the Committee refused to adopt this proposition.

PROPOSED NEW LONDON ELECTRIC RAILWAY.—The consideration of a Bill authorising the construction of an electric railway between Wimbledon and Sutton was commenced by a House of Lords Committee on Friday. The line will be worked by the Metropolitan District Railway Co. as an extension of their line to Wimbledon, although no definite arrangement has yet been come to with the company promoting the new railway as to the running of through trains over the two lines. The capital of the new company is £350,000, and the engineers' estimate for carrying out the works is £511,554. Opposition is offered by the London, Brighton & South Coast Railway Co. and the London & South-Western Railway Co. on the ground of competition, but only two landowners appear against the Bill. The local authorities concerned are strongly in favour of the new line. The engineers to the Metropolitan District Railway Co. support the estimates of the engineers to the Bill.

METROPOLITAN DISTRICT RAILWAY.—A House of Lords Committee passed this Bill on Monday. The main proposal of a constructive nature was the laying of an additional pair of tracks between Hammersmith and Twickenham Green Junction. To this the opposition was not of a serious nature, relating merely to the taking of land for the purposes of the new line. The financial proposals of the bill were unopposed. The company will raise £187,500 additional 4 per cent. guaranteed stock. The Bill also provides for the extinction of the arrears of guaranteed stock dividends by distributing new guaranteed stock to the extent of £184,375.

PROGRESS OF ELECTRICAL BILLS.—The Belfast Corporation Bill, which seeks to purchase the Cavehill & Whitewell Tramway Co.'s undertaking, has been allowed to proceed by the Standing Orders Committee, and was read a second time in the House of Commons on Friday.

The Reading & District Electric Supply Bill is now unopposed, and has been referred to the Unopposed Committee of the House of Lords.

The Bishop's Stortford, Harlow & Epping Gas Bill was read a second time in the House of Commons on Tuesday.

PERSONS IN CHARGE OF MACHINERY.—A private member's Bill has been presented by Mr. J. Haslam, providing for the granting of certificates to persons in charge of steam and motor engines, boilers, and steam and motor cranes. It will be read a second time in the House of Commons on April 22nd.

DEVONPORT & DISTRICT TRAMWAYS BILL.—This Bill came before a House of Commons Committee, presided over by Sir J. Compton Rickett, on Wednesday last week, and its consideration was continued until Friday, when the committee rejected it, without calling upon the Corporation to state their case in opposition. As stated in our last issue, the Bill has created exceptional local interest, for the reason that it proposed to modify an existing Parliamentary agreement between the company and the Corporation for the running of the tramways in Devonport. The company have found that the terms of the original agreement have become too onerous to enable the tramways to be worked at a profit. Among the modifications proposed was that, instead of the fixed annual rents provided for by the agreement under the Act of 1898 in respect of the lines leased from the Corporation, the company suggest that the Corporation should be paid the net revenue from these lines. It was also proposed that the price for electrical energy paid to the Corporation should be cost price (this to be determined by arbitration) plus 5 per cent. Further, that the period for working the lines, which is stipulated in the Act of 1898 as for twenty-one years from that date, should be extended to twenty-eight years. There were also a number of provisions relating to the conduct of the service, &c. An effort to arrive at a compromise during the committee proceedings failed.

LONDON UNDERGROUND RAILWAYS.—We report the proceedings in connection with these Bills on page 252.

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LOCAL NOTES

ALDEBURGH: *Electric Supply.*—Mr. G. A. Bruce, Borough Electrical Engineer at Lowestoft, has reported in favour of a proposal by the Rural Electricity Supply Co., Ltd., the prospectus of which is referred to in our City Notes. In this case the Council are advised to apply for an electric lighting provisional order and to enter into an agreement with the company for working it.

ASTON: *New Electricity Charges.*—The recommendations by the Electricity Committee to change the present rates of charge for electricity supply have been adopted. The maximum charge for lighting is to be 3d. per unit instead of 3⅛d. for consumptions under 1,000 units per quarter, varying to 2½d. per unit with larger consumptions; for heating and cooking the charge is to be 1d. per unit instead of 1½d., with a charge for meter rent if the consumption is less than 5s. per quarter. The maximum charge for power purposes is to be 1½d. per unit instead of 2d., varying down to ¾d. per unit according to the consumption.

BIRKENHEAD: *Tramway Depreciation.*—It was stated at the last meeting of the Corporation that £10,000 had been drawn from the tramway profits for relief of rates. The Chairman of the Tramways Committee stated that the undertaking had not been in existence sufficiently long to estimate the amount of depreciation, but when it had to be met it would come out of the rates.

BIRMINGHAM: *Proposed Tramways to Harborne.*—Petitions in favour of extending the tramways to Harborne and Quinton were placed before the Corporation at its meeting last week, 13,026 votes being in favour of the tramways, and only 802 against.

BOLTON: *New Tramway Shed.*—A new tramway shed was opened last week. The feature of the building, which provides accommodation for 49 cars, and is 208 feet long by 85 feet wide, is that it is in one span without columns. The structure has cost about £10,000 to erect.

BRADFORD: *Tramway Receipts.*—The tramway receipts for the year to March 31st were £259,728, an increase of £15,493 over the previous year. The number of passengers carried was 50,518,816, an increase of 2,858,805.

CARMARTHEN: *Electric Lighting.*—A scheme is in hand for forming a company to instal an electric supply undertaking in the district.

COLINTON (N.B.): *Tramway Scheme.*—The work of constructing the Colinton electric tramways has been commenced. The consulting engineers are Messrs. Leslie & Reid, of Edinburgh, and the estimated cost of the line is about £4,000.

COOKSTOWN (IRELAND): *Electric Lighting.*—At the last meeting of the Council a proposal that the Council should promote an electric supply scheme was defeated.

DARWEN: *Proposed Tramway Purchase.*—The recent offer by a company to purchase the municipal tramways was discussed at the last meeting of the Corporation. Several members were in favour of proceeding with the negotiations, seeing that the undertaking had sustained losses amounting to £29,000 in three years, and that there was a probability of a further loss of £7,000 for the year to March 31st. A vote was taken on the question, with the result that the recent decision not to proceed with the negotiations was confirmed.

DOWLAIS: *Street Lighting.*—A Board of Trade inquiry was recently held concerning a scheme by the Merthyr Electric Traction Co. to light the streets of this district, using overhead wires. The Dowlais Chamber of Trade strongly opposed the proposition, and the company have now agreed to light all narrow areas and thoroughfares by underground cables, and not to use overhead wires in any street less than 22 feet wide.

FINCHLEY: *Electric Supply.*—During the year to March 31st, 12,079 8-c.p. lamps have been added to the connections of the Electricity Department, and 120 new public lamps have been erected. The total indebtedness of the undertaking is at present £93,259.

GRIMSBY: *Proposed Tramway Purchase.*—There has been considerable discussion in Grimsby recently concerning the desirability of purchasing the undertaking of the local tramway company. The Town Clerk and Borough Engineer have now been instructed to obtain information from other towns where a similar position has existed or at present exists.

HULL: *Underground Telegraph Cables.*—The Postmaster-General has informed the Hull Chamber of Commerce that provision will be made in the estimates of 1910-11 to lay an underground telegraph cable between Leeds and Hull.

KIRKINTILLOCH: *Tramway Extension.*—A proposal has been made to the Glasgow Corporation for the extension of their tramways to Kirkintilloch.

LLANDUDNO: *Sunday Tramcars.*—The poll taken by the Llandudno & Colwyn Bay Electric Railway Co. to ascertain the views of the ratepayers on the question of running tramcars on Sundays has resulted in a majority of 403 against.

LONDON: *London County Council: King's Cross Tramways.*—A commencement is shortly to be made with the construction of a bridge across the Metropolitan Railway at King's Cross, in order to connect the tramways in Gray's Inn Road with those in Pentonville Road serving Finsbury Park and Highgate. Without such a bridge a circuitous route would be involved. The agreements in connection with the matter provide for a 60-ft. roadway, the works being executed by the railway company, who will also undertake the maintenance of it, being reimbursed by the County Council. The Council will also make the company a payment of £33,000.

Westminster: Street Lighting.—A number of leading tradespeople in Regent Street have petitioned the Westminster City Council to postpone accepting a tender for the gas lighting of Regent Street, Pall Mall and Piccadilly until the matter has been more fully considered by the ratepayers in these districts.

NEWCASTLE: *Tramway Receipts.*—The receipts from the tramways for the year to March 31st, 1910, were £209,678, an increase of £138 over those of the previous year.

ROTHESAY: *Dock Equipment.*—After considering reports by the Dock Engineer upon the cost of generating electricity by additional plant, and the cost of taking electrical energy from the Clyde Valley Electric Power Co., the Clyde Navigation Trustees have decided in favour of the former. In our "Tenders Received" column it will be noticed that Messrs. Siemens Bros. & Co. have the contract.

WIGAN: *Electric Light Extensions.*—With reference to the recent Local Government Board inquiry into the Corporation's application for further borrowing powers, the Inspector has expressed the opinion that the Local Government Board will not give their sanction to further borrowing powers in regard to an item of £4,472, loss on the Pemberton station, until that amount had been wiped out of the capital account. Consequently, the accountant has been instructed to transfer this sum, at present charged against electric light capital account, to profit and loss account, so that it can be liquidated during the current year.

ST. HELENS: *Street Lighting.*—In consequence of complaints as to the inefficient lighting of the main streets in the centre of the town, the Electricity Committee have decided on a scheme of electric lighting.

SHEFFIELD: *Electricity Supply in Tinsley.*—The Corporation and the Yorkshire Electric Power Co. have come to an arrangement whereby the former is to be allowed to supply electricity to certain premises in Tinsley on the understanding that the consumer will be transferred to the company when the latter is in a position to give the necessary supply itself. The terms of the transfer of the supply are to be agreed, or, failing agreement, are to be determined by the Board of Trade.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

COLCHESTER.—A Local Government Board inquiry will shortly be held concerning a loan of £8,000 for electrical purposes.

DARTFORD.—The Council invite tenders by April 20th for paper-insulated and lead-covered cable, and an arc feeder pillar. Particulars from the Borough Electrical Engineer.

HONDURAS.—Concessions have been granted to J. W. Grace and to Manuel E. Lardizabel for the supply, to the towns of Puerto Cortez and Baracoa and of San Pedro-Sula respectively, of electrical energy for lighting and other purposes. Companies have been formed, under the names of the "Puerto Cortez and Baracoa Electric Company," and the "Empresa de Luz Electrica de San Pedro-Sula," to make use of these concessions.

LEITH.—The Leith Dock Commission are considering the desirability of installing an electric generating plant, or of taking a supply in bulk. It is probable that if the Commission decide to generate for themselves they will use gas-producer plant.

LONDON: *Battersea.*—The Committee reports that the scheme for supplying the Nine Elms district should be put in hand. The cost with auxiliary works will be £8,895. A 0·5 square inch concentric feeder cable is also to be provided at an estimated cost of £650.

NUNEATON.—The Electricity Committee require a water-tube boiler and accessories, and a boiler feed pump, &c. Particulars from the Borough Electrical Engineer, and tenders by April 25th.

WEDNESBURY.—An application is to be made to the Local Government Board for a loan of £2,925.

WHITWOOD.—The Council invite tenders for cables, service connectors, meters, fuses, switchboard, instruments, switches, steel poles, wooden poles, supports, arms, insulators, &c. Particulars from Mr. H. Marsden, Electricity Works, Honley, nr. Huddersfield, and tenders to the Town Clerk by April 28th.

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WOLVERHAMPTON.—An important report has been submitted by Mr. C. E. C. Shawfield, the Borough Electrical Engineer, in which he recommends additional plant being installed at an estimated cost of £23,000. The new plant will include a 2,000-kw. alternator, a 500-kw. rotary converter, and a 500-kw. mixed-pressure turbo-alternator.

Miscellaneous

AUSTRALIA.—Tenders are invited by June 8th by the Deputy Postmaster-General, Brisbane, for the supply of common battery telephones and small switchboards and protectors. Forms of tender, &c., may be obtained at the offices of the High Commissioner for the Commonwealth of Australia, 72 Victoria Street, London. Local representation is necessary.

BERMUDA.—The Bermuda Electric Light, Power & Traction Co. are considering the question of putting their traction powers into force. A traction expert was recently in the colony in this connection.

INDIA.—It is stated that the Indian Railway Board have approved schemes for the conversion to electric traction of the Ranchrapara and Saidpor workshops of the Eastern Bengal State Railway. Detailed estimates, however, have yet to be prepared.

JAPAN.—It is reported that a company has been formed to construct an electric tramway between Tokio and Yokohama. The line is to have a length of about 15 miles, and a branch line nearly four miles long is to be built to Kamata. The line will be double track, and its gauge will be 3 ft. 6 in. The cost of construction is estimated at about £357,300. The name and address of the president of the promoters of the company may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

PERTH.—The Borough Surveyor has submitted estimates of the cost of certain proposed extensions of the tramways amounting to £8,759.

RUSSIA.—It is stated that the Perm Town Council have decided to grant to a group of English capitalists the concession for the construction of tramways. The total expenditure is estimated at £318,750. Mr. Pavolvsky is the local representative.

SHEFFIELD.—Mains extensions are to be carried out for supplying certain firms at Tinsley at an estimated cost of £990.

TORQUAY.—The public lighting is to be reorganised.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

PROVINCES.

ABERDEEN.—Tinplate factory, Roslin Place (£2,000). J. Rush, 224 Union Street, Aberdeen.

Catholic church (£4,000). C. J. Menart, 241 West George Street, Glasgow.

AYR.—School, Green Street (£8,000). D. Cowie, Alloway Chambers, Ayr.

DAWLISH.—Public hall (£1,800). Architect, S. Dabell, Queen Street, Exeter.

DURHAM.—School, Byers Green (£3,000). Architect, W. Rushworth, Durham.

GLASGOW.—Additions, W. White & Sons, engineers' premises (£2,000). White & Galloway, 121 Bath Street, Glasgow.

Extensions of Messrs. Carson's chocolate factory, Bridgeton (£2,750). Architects, Duncan & Copeland, 146 West Regent Street, Glasgow.

Workshop buildings, for John McDonald, builders (£2,000). R. C. Douglas, 121 Greenhead Street, Glasgow.

Shop and warehouse buildings, High Street and Bell Street (£28,000). A B. McDonald, city engineer, Glasgow.

HALIFAX.—Electric theatre (£2,200). Architects, R. Horsfall & Sons, 22a Commercial Street, Halifax.

HOVE.—Ward block at sanatorium (£2,546). H. H. Scott, borough surveyor.

LEICESTER.—Extensions and alterations at Museum and Art Gallery (£6,901). James Chapman, builder, Rutland Avenue, Leicester.

SHEFFIELD.—Infants' school, Earl Marshall Road, for the Corporation.

TUNSTALL.—St. Mary's Church Schools and new infants' school (£4,000). Architect, H. Dain, Tunstall.

Osram Lamps on Board Ship.—One of the White Star liners, upon which Osram lamps are fitted throughout, has just returned to port after a five months' cruise, and the engineers' report states that only one lamp has failed throughout the whole period of absence, although the average life of the lamps in question is already over 700 hours. As we go to press we learn that this liner is again leaving for another cruise with identically the same lamps, and are taking only half the usual number of spares on account of the satisfactory results of the previous voyage. The economy and long life of these lamps render them particularly suitable for ship lighting.

TENDERS RECEIVED AND ACCEPTED

CARLISLE.—The Corporation have accepted the following tenders: Boiler, economiser, and pumps, Stirling Boiler Co., £3,359; condensing plant, Korting Bros., £398; engine, dynamo, &c. Browett, Lindley & Co. £4,460.

CLYDE NAVIGATION.—The tender of Messrs. Siemens Bros. & Co., Ltd., has been accepted at £6,442 for additional generating plant at the Rothesay Dock.

COLCHESTER.—The tender of the Standard Cable Co., Ltd., at £242 has been accepted for cables for the Parsons Heath and Port Lane districts.

GRIMSBY.—The Council have accepted the tender of the Jandus Arc Lamp & Electrical Co., Ltd., for 80 flame arc lamps with spares, &c., for £360 13s. 4d., provided that the company will give a two years' guarantee as to the working of the lamps.

LONDON: *Battersea.*—The Council have accepted the tender of the General Electric Co. for the annual supply of carbons for lamps, and of Callender's Cable & Construction Co., Ltd., for the annual supply of cables.

Marylebone.—The Council have accepted the following tenders for annual supplies:—Lucy & Co., cut-outs (the firm whose tender was previously accepted having withdrawn); Le Carbone, Ltd., carbon brushes; British Electric Trade Supply & Bitumen Co., bitumen, £14 per ton. The Council have further accepted the tender of Messrs. Babcock & Wilcox for two internal superheaters at £500.

Shoreditch.—The Council have accepted the tender of Evered & Co., at £207, for the supply and erection of an additional feeder panel.

Among the recent orders received by the D.P. Battery Co., Ltd., are a large storage battery for the Guildford Electricity Supply Co., which will be maintained for 10 years, and storage batteries for the Leek District Council and Letchworth Garden City.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Oriental Telephone & Electric Co., Ltd., announce a dividend at the rate of 6 per cent. per annum on the preference shares for the half-year ended December 31st, less tax, and a final dividend of 5 per cent. on the ordinary shares, free of tax, making a total of 8 per cent. for the year.

Babcock & Wilcox, final dividend on the ordinary shares, making a total of 24 per cent for 1909. Rio Janeiro Tramway, Light & Power Co., 1 per cent. for the March quarter.

MORTGAGES AND CHARGES.—Particulars of the following have been filed:—Metropolitan Electric Tramways: Particulars of debentures amounting to £100,000, ranking *pari passu* with £200,000 second debenture stock already issued. Property charged—the company's undertaking and property, present and future, including uncalled capital. Trustees, Metropolitan Trust Co., Ltd., 8 Crosby Square, E.C. Holsworthy Gas & Electric Supply Co.: Debenture, dated March 11th, 1910, to secure £1,000, and mortgage of even date as collateral security thereto, charged on the company's undertaking and assets, including any uncalled capital, and land and buildings at Holsworthy, Devon. Holder, W. Harris, Ratherton, Holsworthy.

RURAL ELECTRICITY SUPPLY CO.—An issue is being made of 9,500 participating preferred shares of £1 each. The company has been formed for the purpose of establishing electric light and power undertakings in country towns and the larger villages in the rural districts of England. In order to minimise expense, the company propose to dispense with Parliamentary powers, and substitute arrangements with the various local authorities. It is stated in the prospectus that several local authorities have given their sanction to undertakings on these lines.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—Associate Members: A. Angers, R. Bruce, W. S. Burge, C. F. Button, J. P. Chisholm, J. Crane, W. Cruickshank, H. C. Eagar, A. J. Eames, G. Gollicz, W. R. Groom, H. S. Hohne, E. J. Morrell, S. T. Pemberton, C. H. Phillips, A. R. Powell, H. Skelton, W. H. Starkey, J. P. Thomas, A. E. White.

Electrical Section of the London Chamber of Commerce.—At the annual meeting of the London Chamber of Commerce on April 7th, the Electrical Trades Section presented their report, which stated that in regard to electricity in mines the Section considered the advisability of arranging for a witness to give evidence before the Committee as to the working of the existing special rules, but a representative has not yet been appointed. The Council of the Chamber was requested to urge his Majesty's Government to introduce a Bill requiring that all such passenger ships should be fitted with wireless telegraph apparatus. It was reported to the Section that the Council had appointed a Special Committee in connection with the question of misrepresentation in trade, and would be willing to receive suggestions as to any points affecting electrical manufacturers. Mr. Leon Gaster was appointed to give evidence on behalf of the Section before the Special Committee.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £60 to £60 10s. per ton (last week, £60 10s. to £61).

CANADIAN AGENTS WANTED.—A London firm of designers and manufacturers of electric light fittings wish to get into communication with architects and decorators in Canada.

A Montreal firm desires to get into touch with British manufacturers of insulators for electrical purposes. Further particulars from the High Commissioner for Canada, 17 Victoria Street, London, S.W.

SIEMENS BROS. SUPPLIES DEPARTMENT.—Owing to increased business in the Supplies Department at 39 Upper Thames Street, London, E.C., Messrs. Siemens Bros. Dynamo Works, Ltd., have found it necessary to provide additional telephone facilities. There are now four lines, the telephone number being London Wall 8,270.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—Mr. H. K. Barham, Electrical Engineer, 60 Fratton Road, Portsmouth, has been adjudicated bankrupt.

Mr. G. E. Corfield, Balfour House, Finsbury Pavement, London, E.C., has been appointed trustee in the bankruptcy of J. A. Bauer, trading as Electrical & General Engineering Co., 17 Gracechurch Street, London, E.C.

A meeting of creditors of W. H. Durrant, Electrical Engineer, 53 Tolling Street, Lowestoft, was held last week. The deficiency is £72 6s., and the failure is attributed to excessive competition, want of capital, and ill-health. The matter was left in the hands of the Official Receiver.

The public examination of A. McAlpine, Electrical Engineer, Cank Street, Leicester, took place last week. The liabilities amount to £2,067, there being a deficiency of £804. The debtor, who had carried on a general electrical engineering business, attributes the loss to errors in estimating for fitting premises for lighting and power purposes. The examination was closed.

INCREASE IN PRICES.—Messrs. Siemens Brothers & Co., Ltd., Caxton House, Westminster, S.W., inform us that they have been compelled further to increase the prices of their india-rubber tapes and solution, as from the 8th inst.

ADVANCE IN PRICES OF WIRES AND CABLES.—Owing to the continued abnormal increases in the cost of rubber and other raw materials, the Sun Electrical Co., Ltd., 118 Charing Cross Road, London, are compelled to make the following advances in prices, forthwith :—V.I.R. insulated wire cables, &c., as under : Class N. and N.A. cable, 15 per cent. ; Class N.F. and C.F. cable, 10 per cent. ; bell wires, 10 per cent. ; multiple telephone cables, 10 per cent. ; flexibles, 10 per cent. ; electrolier wires, 10 per cent. Pure I.R. strip, 13s. 6d. per lb. net; I.R. solution, list price net.

The General Electric Co. (67 Queen Victoria Street, E.C.) announce a further rise of 10 per cent. in the prices of cables as from April 1st, in addition to the advance of 10 per cent. made recently, owing to the continued high price of rubber. The rise affects all rubber-covered wires, cables, flexibles, and materials containing rubber.

REDUCTION IN PRICE OF M.S. LAMPS.—The M.S. Lamp Co. announce important reductions in the prices of some of their metal filament lamps. The 100-125 volt 10-c.p. lamp is reduced from 3s. 6d. to 3s. 3d., and the 25-, 32-, and 50-c.p. 80-135 volt lamps are now 2s. 3d. each, instead of 2s. 6d., 2s. 9d., and 3s. respectively. The 25-50 c.p. 135-160 volt lamps and the 25-50 c.p. 160-260 volts are now 3s. each instead of 3s. 3d. and 3s. 9d. respectively. The above prices relate to pear-shaped bulbs. With spherical bulbs, all sizes from 16-50 c.p. 100 130 volts are reduced to 2s. 9d. each. Trade terms remain unaltered.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. E. Kingsbury has changed his address from Norfolk House, Victoria Embankment, to 7 Serjeants' Inn, Temple, London, E.C. Telephone No., Central 2,418. Telegraphic address, "Rexinter, London."

The Sheffield Electric Light Committee recommend that the salary of Mr. S. E. Fedden, the General Manager of the Electricity Department, be increased from £800 to £900 per annum by two annual increments of £50 each.

Applications are invited by April 22nd for the position of Assistant Electrical and Mechanical Engineer in the Swindon Corporation Electricity and Tramways Departments at a salary of £120 per annum. Particulars from the Town Clerk.

Messrs. Webster, Steel & Co., agents to the Durban Corporation, invite applications for the post of switchboard attendant. Applicants must be accustomed to single-phase high-tension working, and also tramways. The salary is £240 per annum.

Mr. Justus Eck, Engineer-in-Chief to the Union Electric Co., Ltd., of Park Street, Southwark, sailed on April 9th, by the s.s. *Lusitania*, for New York, with the intention of visiting the principal cities of the United States for the purpose of studying the latest American developments in street, shop, and railway lighting, and in the applications of electricity to manufacturing and mining.

The appointment of Mr. R. B. Leach, Borough Electrical Engineer of Farnworth, as Consulting Engineer to the Council at a salary of £50 per annum, was opposed at the last meeting of the Council. An amendment was moved that Mr. Leach be appointed at a retaining fee of £5 per annum, with payment for any services which he might render. The amendment was, however, lost.

The wages of the following staff at the Nelson Electricity Works have been increased : Jas. Stanworth, shift engineer, from 31s. to 33s. per week; W. G. Coates, shift engineer, from 26s. to 28s.; and W. Lawson, fireman, from 29s. to 31s.

Mr. E. S. Taylor, of the Watford undertaking, has resigned. Mr. J. E. Walley, Engineer-in-Charge, has been appointed to the vacant position at a salary of £110 per annum, rising by annual increments of £10 to £130. Mr. R. S. Savory (improver) has been appointed Assistant Main Superintendent, and Mr. J. B. Dent has been appointed Engineer-in-Charge.

The Town Council of Torquay invite applications for the post of Borough Electrical Engineer at a salary of £250 per annum, rising to £300 per annum. Particulars from the Town Clerk.

COMPANIES' MEETINGS AND REPORTS

AMERICAN TELEPHONE & TELEGRAPH CO.—The report for 1909 shows a net revenue of £6,040,000, and a net balance, after meeting interest and interim dividend, of £1,212,000. The capital of the company is to be increased from £6,000,000 to £10,000,000, but none of the increase is required in connection with the estimates for the coming financial year. During 1909 the company acquired a substantial interest in the Western Union Telegraph Co. The number of stations now constituting the "Bell" system in the United States is 5,142,692, an increase of 778,063 during the year. The report mentions the introduction shortly of a "night letter" service.

NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.—The report for 1909 shows that the revenue, viz., £88,925, was increased by £14,051, whilst the expenditure was only £1,290 in excess of the previous year. After providing for debenture, loan and mortgage interest, and transferring £2,000 to reserve fund for redemption of debentures, there remains an available balance of £34,315. It is proposed to place £7,000 to depreciation, to write £3,500 off preliminary expenses, and to recommend a dividend on the ordinary shares of 6 per cent. per annum, carrying forward £837. The total number of units sold during the year was 16,402,447, an increase of 2,332,836 units. The Willesden Urban District Council have decided to continue to take from the company a supply of energy in bulk for a further period of 7 years upon the expiration of the present agreement in February, 1911.

RHONDDA TRAMWAYS ELECTRIC SUPPLY CO.—After providing for debenture interest, the accounts for 1909 show a profit of £577, which is transferred to debenture redemption fund, increasing it to £1,323.

RHONDDA TRAMWAYS CONSTRUCTION CO.—At the meeting last week it was stated that, with the exception of Stockport and Belfast, the cost for electrical energy on the Rhondda tramways was the lowest in the kingdom, viz., 0·91d. per unit.

CALCUTTA TRAMWAYS CO.—The profit for 1909 amounted to £67,085. The directors propose to pay 4½ per cent. on the ordinary shares for the year, adding £7,000 to depreciation fund, and carrying forward £435. The Howrah portion of the company's system shows a profit for the first time.

METROPOLITAN ELECTRIC TRAMWAYS.—The report for 1909 states that the traffic receipts, which amounted to £326,441, show an increase of £26,428. There is a surplus of £50,437, making, with the £3,707, the balance brought forward from the last account a total of £54,144. The directors recommend £6,000 being placed to reserve, and a dividend on the ordinary shares of 5 per cent. per annum, and carry forward £3,578. Four additional sections of light railway in the County of Middlesex were opened for public traffic during the past year, bringing the total length of line to 51½ miles. The remaining 4¼ miles of the authorised light railways of the Middlesex County Council are in course of construction, and will probably be completed before the end of the present year.

NORTH OF SCOTLAND ELECTRIC LIGHT & POWER CO.—The report for 1909 shows a gross profit of £4,107, and after meeting interest on debentures and loans, and writing off £406 for loss on free wiring and motors dismantled, balance of cost of street lighting alterations and depreciation on meters, &c., there remains a net profit of £1,825. It is proposed to carry £1,600 to renewal reserve account and the balance of £225 forward.

Telegraph Traffic.—The list of cables awaiting repair is now much smaller. Those in need of attention are between Assab and Perim (down since July 8th, 1909), and the Western Telegraph Co.'s cable between Para and Maranham, which failed only recently. The line between Rome and Constantinople was interrupted on the 7th inst.—The German South American Cable Co. have published their rates, and no doubt when they reach Brazil they will make every effort to gain a share of the valuable traffic of the Western Co

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ELECTRICAL TRADES BENEVOLENT INSTITUTION

AT the annual general meeting of this Institution, which was held at the Hotel Cecil on Wednesday last week, the report and accounts for the year to December 31st, 1909, were adopted. Mr. W. B. Esson presided, in the absence of Mr. E. Garcke, who had consented to take the place of the Chairman of the Committee, Sir William Preece, but who was also unable to be present.

The report states that during the year considerable progress has been made by the Institution, both in the direction of securing financial support and in granting relief to desirable cases. The first Festival Dinner of the Institution in 1909 resulted in a net direct gain to the funds of about £300. The second Festival Dinner, held this year, produced equally satisfactory results, but the receipts from it do not appear in the present balance-sheet. Several cases came before the Committee for consideration, and five separate grants to the amount of £51 were made. This is an increase in the number and amount over those made the previous year. No pensions have been granted, as under the Rules no applicants are eligible at the present time. In the year 1909 the dividends on the investments amounted to £62 19s. 5d. The Committee have decided to inaugurate a system of collecting amongst the staffs of large electrical undertakings by means of House stewards, in order to secure support from such quarters, where many small sums can undoubtedly be obtained. The report refers to the unstinted and continued support given by the Electrical Press. Without this co-operation, the Institution would find its funds still more severely taxed for printing, postage, and other similar expenses. The following members of the Committee retire in accordance with Rule 3, and are available for re-election, namely, Messrs. Grainger, Johnson, Lundberg, Nalder, Northcote, Oppenheimer.

The balance-sheet shows that dividends, subscriptions, and donations amounted to £749 13s. 8d., and receipts from Manchester Electrical Exhibition £364 19s. 3d., making, with £129 16s. 6d. in hand, a total of £1,244 9s. 5d. After meeting grants to the amount of £51, printing, &c., and secretary's salary, a balance of approximately £1,000 has been invested in Cape of Good Hope 3½ per cent. stock, leaving £63 11s. 9d. in hand. The total invested now amounts to £2,089 8s., which, together with £63 11s. 9d. in hand, represents the assets of the Institution after only two years' existence.

In putting the report to the meeting, Mr. Justus Eck (Union Electric Co., Ltd.) said that although the sum distributed was small, yet every case that had come before the Committee had been adequately dealt with, and all the men concerned were now in work. Furthermore, the applicants were satisfied. Mr. Theodore Rich commented on the smallness of the sum distributed in view of the generally recognised fact that the electrical industry was in a by no means flourishing condition. Mr. Davenport, the secretary, pointed out in this connection that the policy of the committee was that only subscriptions should be distributed, and not donations, these latter being invested for the purposes of pensions. Consequently, the amount available for distribution as assistance was not very large. The report and accounts were then adopted.

The six retiring members of the Committee, Messrs. Grainger, Johnson, Lundberg, Nalder, Northcote, and Oppenheimer, were re-elected. As the Committee only consists of 18 members out of 30, Messrs. F. B. O. Hawes, B. Longbottom (Electromotors, Ltd.), and S. D. White (General Electric Co., Ltd.), were added.

THE MARYLEBONE SALES DEPARTMENT
Committee of Enquiry Refused

AT the meeting of the Marylebone Borough Council on Thursday, Councillor Duncan Watson moved that a committee be appointed, composed of the chairmen of the Standing Committees, to inquire into the methods of the sales department of the electricity undertaking. He said he put forward his motion in no spirit of hostility to the undertaking, but in order to ventilate a grievance held by a large section of the ratepayers who were electrical contractors, against the continuance of the sales department. In the first place he contended that the department was unnecessary, and, further, that the work carried on by it was hazardous and speculative, and detrimental not only to the interests of the electricity undertaking, but to the ratepayers. Sales departments had been tried all over the country, and had been proved to be disastrous to the success of the particular electrical undertakings. Shoreditch some years ago abandoned such a department on account of its non-success, and such cities as Manchester, Glasgow, and Edinburgh had all tried and abandoned them. The Marylebone department was nothing more or less than an importation from West Ham, which he contended had been unsuccessful. Finally, Mr. Watson criticised the method of carrying on the sales department. He said that only half the salaries of the manager and the assistant manager were debited against the general expenses. This, of course, was unfair competition with local contractors. He further criticised the manner in which the estimates were sent in by the electricity department, irrespective of whether the consumer had a contractor or not.

ALDERMAN DEBENHAM, Chairman of the Electricity Committee, said that in the first place the Council had decided, and he did not imagine it would go back upon that decision, that there was to be a sales department. It was absolutely necessary for the success of the department that the sale of electricity should be pushed in every way. The department at Marylebone did not cut prices and never would do, and they did not approach consumers when they knew there was a contractor engaged. Figures showed that the existence of a municipal sales department was not detrimental to the electrical contractors in the district.

COUNCILLOR HELSDON expressed the opinion that when the Council sanctioned the formation of a sales department they were not aware that it was to undertake wiring of private premises. The speaker, apparently ignorant of the fact that the Marylebone Council have special powers to undertake this work, and also that the London County Council (General Powers) Act of 1906 authorises London Borough Councils to carry on such work, foresaw the possibility of the members of the Council being surcharged in respect of such work.

COUNCILLOR HOPKINS said that he had asked for the names of cases in which complaints had been made, and had only been supplied with three, and on investigation there was not a shadow of truth that the department had taken work away from the contractor in any one of them. As a matter of fact, in one case the gas company got the job.

A vote on the motion was taken, but only four members voted for it, and it was consequently lost. Some members refrained from voting. This discussion and voting indicates the fact that the internal management of the electricity undertaking in Marylebone is coming to be regarded as outside the scope of politics, for the bulk of the members of the Marylebone Council cannot be accused of being ardent municipal traders.

WIRELESS TELEGRAPHY

AT present there is no wireless telegraph station on the east coast between Caister, in Norfolk, and Cullercoats, near Newcastle, where, by the way, no permanent watch is kept. The shipping interests on this portion of the coast have suggested that the Post Office should erect a station somewhere between these two points. The cost of working such a station is put at £650 per annum by the Postmaster, and he has expressed his willingness to erect one, if he is guaranteed against loss in working.

An interesting experiment was made recently in fitting several Netherlands steam trawlers with wireless telegraph apparatus, thereby enabling them to communicate with the State wireless station at Ymuiden. The experiment seems to have been thoroughly successful. During the strike that occurred in the autumn of 1909, steam trawlers at sea were warned not to return to Ymuiden harbour, but to proceed to British or German ports with their catches. It has also been found possible for the owners on shore to direct their trawlers at sea towards shoals of fish, from the information received from the numerous craft that arrive at Ymuiden.

The United Wirelers Telegraph Co. of New York (de Forest system) have closed contracts during the past month for equipping forty-six ships. These include some very large passenger and cargo vessels of the Pacific Mail Steamship Co., who, after making exhaustive tests with their s.s. *Korea* between San Francisco and the Orient and establishing the world's record between ship and shore—*i.e.*, over 4,000 miles—have given orders that the balance of their trans-Pacific fleet be equipped. Similarly, the Lloyd Brazileiro SS. Co., after testing the system on three vessels, have arranged to equip a further eighteen vessels. In addition, a number of cargo and tug boats of various American steamship companies are being equipped with this system. The H. & W. Nelson (London) line are having nine vessels equipped.

The experiments carried out by the German Government with the Telefunken system between Germany and the German colonies have been so successful that wireless stations are to be erected in German East Africa; German South-West Africa, and in the Cameroons.

Obituary.—The death is announced of Sir Walter Scott, of Messrs. Walter Scott & Middleton, the firm who constructed the City & South London Railway, and also portions of the Central London & Great Northern, Piccadilly & Brompton Railways.

Central London Railway Extension.—It is stated that tenders have been received for the extension of the Central London Railway from the Bank to Liverpool Street, and that the contract will shortly be awarded. The estimated cost is about £500,000, and the shareholders, as foreshadowed at the last general meeting, will be asked to sanction the raising of additional capital.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published April 7th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

6,053/09. **Motor Converters.** Bruce Peebles & Co., Ltd. (*O. S. Bragstad and J. L. la Cour*). Compensating windings are provided in the pole shoes of motor converters in order to improve the commutation and to regulate the voltage. These windings carry the whole or a proportion of the armature current, and are unequally and unsymmetrically distributed over the pole arc. This gives a compounding effect, as, besides neutralising the armature reaction, the windings effect a displacement and either increase or decrease the main field flux in proportion to the load. Commutating poles may be used as well, and these may be wound or not, according to the strength of the compensating windings. Four claims, eight figures.

6,177/09. **Electrical Marine Propulsion.** C. A. Parsons, G. G. Stoney, and A. H. Law. Owing to the presence of salt and moisture in the air on ships, it is difficult to maintain the quality of insulation, especially for high pressures. To avoid the use of high pressures for electric drive with polyphase motors, the generators and motors are interwound so that portions of the motor winding are connected with corresponding portions of the generator winding, so that only small differences of potential have to be dealt with. Thus, for a 2,000-volt winding, the voltage is generated and used in, say, 20 steps of 100 volts each. Various means of effecting this and of obtaining the required speed ratios are described. Eight claims, four figures.

6,674/09. **Resistance Grids.** British Thomson-Houston Co., Ltd. (*General Electric Co., U.S.A.*). Resistance units for flat-irons, hot-plates, &c., are constructed by stamping out a grid in any desired form from sheet metal. The sheet should be preferably of a resistance material which insulates itself by oxidation on heating. In order that the total resistance of the zig-zag path may be adjusted after cutting or stamping, some of the slits are only partially cut, so that short pieces of metal short-circuit some of the loops. Any number of these are then filed or cut away as desired to adjust the resistance. Two claims, four figures.

6,935/09. **Picture Reflector.** G. F. Allom. A lamp fitting for illuminating pictures and tapestries comprises a long reflector of a special channel section with tubular incandescent lamps, and two longitudinal metal strips, which are so arranged as to shade the eye of the observer from the direct rays from the lamps and upper part of the reflector and to prevent the glare on the top of the picture. Two claims, five figures.

6,916/09. **Automatic Generating Plant.** C. B. Walker. A combustion-engine generating plant suitable for lighting country houses, and provided with automatic arrangements for starting up the generating set when the battery is discharged, is described. The set is stopped automatically when the cells are fully charged, and automatic regulation by cutting cells in and out is also effected. The engine is started with compressed air or by running the dynamo as a motor. Five claims, two figures.

17,627/09. **Metal Filament Lamps.** H. Kuzel. Long filament loops are supported at three places, namely, at the extremities of the arms, at the bend of the loop, and in the middle by arms projecting from the stem to a greater distance than the end supports. The loop support is resilient, and puts such a tension on the filament that only those portions between the loop and the middle supports are prevented from sagging. The friction of the filament over the middle support prevents the tension from reaching the portions between the leading-in and middle supports, in order that the sag of these portions may be gradually reduced on burning, so as to compensate for the contraction of the filament. Three claims, one figure.

18,940/09. **Hot-water Bottles.** H. W. Christian. Hot-water bottles and other fluid heating apparatus containing a resistance heater are provided with a bi-metallic automatic switch for short-circuiting a portion of the heating coil or a series resistance until a certain temperature is reached. When the switch opens, the current is reduced to that sufficient to maintain any desired temperature. Three claims, three figures.

29,968/09. **Fan Oscillating Device.** R. G. Gibbons. A ventilating fan is oscillated in a direction at right-angles to the spindle by providing the latter with an extension at the back, which rolls along the upper and under surfaces of a fixed support, or along the upper or lower slides of a slot. Gearing may be interposed between the rolling spindle and the fan axle. Three claims, five figures.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: H. Leitner and R. N. Lucas [Train-lighting dynamo] 28,487/02; Phœnix Dynamo Manufacturing Co. and R. Pohl [Field coils] 28,156/04.

Instruments, &c.: H. G. Kunkelmann, C. E. Francois, and C. R. Loubery [Prepayment and other electricity meters] 27,269/98; S. Matthews [Mercury motor meter] 28,044/04.

Storage Batteries: N.S. Electric Storage Co. and J. T. Nibleit [Cell and plate construction] 27,986/04.

Switchgear, &c.: Otis Elevator Co. (*Otis Elevator Co., U.S.A.*) [Push-button lift control system] 26,395/01; H. Leitner and R. N. Lucas [Mercury switch] 28,486/02 and [Automatic regulator for train-lighting dynamo] 28,487/02.

Telephony, &c.: E. Weintraub [Vapour lamp detector for wireless telegraphy] 27,887/04.

Miscellaneous: R. Pearson [Fusible alloy for fire-alarm] 23,586/00; A. Favarger [A.-C. clock mechanism] 28,539/02; W. T. Munro and W. W. Lumsden [Mercury fire-alarm switch] 27,956/03; J. L. Movelle (*W. J. Morrison and J. C. Wharton*) [Electrically driven and heated sweet-making apparatus] 28,162/04.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Siemens Bros.' Dynamo Works, Hird and Grimston [Search-lights] 27,960/08.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Handcock, Dykes, Rawlings and Dieselhorst [Sheathing of conductors] 7,187/09; Handcock, Dykes, and Rawlings [Jointing conductors] 7,593/09; Newton (*Farbenfabriken vorm. F. Bayer & Co.*) [Insulation of wires and strip] 18,193/09.

Dynamos, Motors, and Transformers: Allgemeine Elektricitäts Ges. [Motor control] 6,566/09; Childs and Hill [Wind-power generating sets] 6,752/09; Crompton & Co., Macfarlane and Burge [Rotary transformers] 7,060/09; Maxaner [Combined centrifugal fan and motor] 15,659/09; Holdsworth [Motor] 18,511/09; Blathy [Turbo-alternator rotors] 27,252/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Control of A.C. motors] 5,044/10.

Electric Ignition: Fuller and Moore [Dual ignition apparatus] 19,601/09.

Electrometallurgy and Electrochemistry: De Martis [Primary cells] 4,034/09; Cowper-Coles [Electro-plating tubes and rods] 12,469/09; Fuller [Primary cells] 19,914/09; Foster [Pyrometers] 30,478/09.

Instruments and Meters: Wilson [Meter] 6,504/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Speed indicators for motors] 6,673/09.

Storage Batteries: J. Stone & Co. and Darker, 7,424/09; Accumulatoren-Fabrik A.-G. [Plates] 27,221/09.

Switchgear, Fuses, and Fittings: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Speed indicators for motors] 6,673/09; Allgemeine Elektricitäts Ges. [Polyphase relays] 6,675/09; Durant [Portable safety lamp] 7,141/09; Cochrane [Electro-magnetic control gear for train-lighting] 10,729/09; Gray (*Seabolt*) [Lamp fittings] 21,854/09; Waterhouse [Ceiling roses] 24,769/09; Soc. Anon. Ateliers Jaspar & Meller [Automatic regulators] 1,087/10.

Telephony and Telegraphy: Brown [Telephony] 4,162/09; Williams [Enumerating telephone calls] 6,447/09; Sharman [Oscillation discharge gap] 8,111/09; Aitken and British Insulated & Helsby Cables, Ltd. [Telephone switchboards] 16,642/09; Neuhold [Automatic telephone exchanges] 22,596/09; Rossi [Wave detector] 23,628/09.

Traction: Christie and Henderson [Air-brakes] 19,397/08; Treiheway and Bennett [Signalling] 4,992/09; Rizzo [Solenoid brakes] 6,849/09; Metcalfe [Vacuum brakes] 7,294/09; Stern and Doob [Signalling] 7,556/09; Köhler [Current collector] 26,907/09.

Miscellaneous: Green [Cathodes for X-ray tubes] 23,316/09; Siemens Bros. & Co. and Riber [Electrical condensers] 23,821/09; Ozonair, Ltd., and Joseph [Production of ozone] 24,945/09; Nourney and Niemeyer [Alarm thermometers] 30,003/09; Marshall [Electric hoists] 457/10; Siemens Bros.' Dynamo Works (*Siemens Schuckertwerke Ges.*) [Rotary pumps] 2,291/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: Könecke [Three-phase lamp] 6,868/10.

Electric Ignition: Soc. Aubert Frères [Ignition of gas burners] 286/10.

Electrometallurgy: Stora Kopparbergs Bergsslags Aktiebolag [Electric furnaces] 6,768/10.

Incandescent Lamps: Wolfram Lampen A.-G. [Supports for filaments] 6,397/10; Salzer [Supports for filaments] 6,658/10.

Telephony: Siemens & Halske A.-G. [Semi-automatic telephone exchange] 6,875/10.

Miscellaneous: Gebr. Siemens & Co. [High-temperature resisting material] 5,161/10.

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ELECTRICAL ENGINEERING

No. 173 [Vol. VI., No. 16] THURSDAY, APRIL 21, 1910. [Price One Penny.
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Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

Among the novelties exhibited at the "Ideal Home" Exhibition are a new pattern of electrically-driven knife cleaner for hotels, an electrically operated refrigerator without any moving parts, and a neat polishing set comprising a small motor and a selection of brushes, &c. A system of electrical control for gas burners was also exhibited. (Page 261.)

The new 12,000-ampere-hour battery plant at the Dickinson Street Station of the Manchester Corporation is now at work. This comprises a Tudor battery of 210 cells of unusual size, three reversible boosters, and the necessary switchgear. The latter is especially interesting on account of the heavy currents dealt with. Aluminium bus-bars are employed, and the connections with the switch contacts and with the cables are on quite new lines. The battery will run in parallel with the traction generators during the day, and take in the surplus power automatically. During the early hours of the morning it will take the whole traction load, and in the evening the lighting load peak. (Page 261.)

At a meeting of the British Constitution Association on Monday, Mr. Balfour-Browne, K.C., read a Paper on State and municipal trading, in the course of which he mentioned that in New Zealand the school children were carried free on the tramways. (Page 266.)

A slight fire which occurred last week at the Anti-vivisection Hospital, Battersea, was caused by the electrical installation, which had been allowed to get into bad repair. (Page 266.)

We publish the list of nominations for vacancies upon the Council of the Institution of Electrical Engineers. Mr. S. Z. de Ferranti is proposed as the new President. (Page 267.)

Much dissatisfaction has been caused by the acceptance by the Westminster City Council of the Gas Light & Coke Company's tender for lighting Regent Street, Piccadilly, and neighbouring thoroughfares, in spite of the fact that the electric lighting of Regent Street had been a pronounced success from every point of view. The Gas Light & Coke Co. tendered an extremely low price, which, it is thought, must be considerably under cost, when everything is taken into account. (Page 267.)

In a lecture before the Association of Engineers-in-Charge, Mr. R. J. Wallis Jones described the various

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methods of electric welding. The heavy current method had been adopted for softening portions of hard steel armour-plate previous to drilling. An electrolytic method, in which the resistance of a film of hydrogen caused the metal to heat up, had been used for the continuous annealing of wire. (Page 268.)

THE President of the Board of Trade does not think it necessary to promote legislation to compel the installation of wireless telegraph apparatus upon ocean-going steamers at the present time. The Marconi Co. announce the opening of a permanent wireless telegraph service between Europe and America on Saturday. (Page 268.)

THE Bill authorising an electric railway between Wimbledon and Sutton has been passed by the House of Lords Committee. The Charing Cross, Euston, & Hampstead Railway Co. have withdrawn their proposal for the through running of trains from their line at Charing Cross to the District Railway. A proposal by the Leeds Corporation to adopt trolley omnibuses has been passed by a House of Commons Committee. A similar proposal by the Bradford Corporation is now under consideration. (Page 269.)

THE Birmingham Electricity Committee propose to hand over £10,000 to relief of rates.—A Dublin resident questions the legal powers of the Corporation to meet a £14,000 deficit on the electricity undertaking out of the rates.—It is stated that the cost of the new power station of the Dundee Corporation, namely, £103,000, is within £3,000 of the estimate. The Tramways Committee propose to insure for third party risks instead of maintaining an insurance fund as hitherto.—The Manchester tramway receipts for the year just ended show an increase of £3,185. (Page 270.)

LEEDS Corporation require 5¼ miles of 6,600 volt cable; Newport Corporation a 1,000 kw. double-current turbo-generator, or a similar size turbo-alternator; and the Lanark County Council, steam dynamo, switchboard, cable, &c. Extensions are proposed as follows: Ashton-under-Lyne (£48,424); Bacup (£3,000); Eastbourne (£2,000); Edinburgh (£45,000); Gillingham (£3,000); Manchester (£40,000); Whitehaven (£2,500); Wolverhampton (£23,000); and Yarmouth (£3,500). The estimates of electrical work to be carried out in the Netherlands and Dutch East Indian colonies during the next few years amount to many millions of pounds. (Page 270.)

ALTHOUGH the accounts of the London United Tramways Co. for 1909 show a net balance of £21,950, no dividend on the preference shares is to be paid. The accounts of Messrs. Babcock & Wilcox show a net profit of over £400,000. (Page 271.)

A CORRESPONDENT criticises some of the formulæ in Mr. H. H. Harrison's recent article on Central Battery Telegraph Circuits.—Mr. W. P. Durtnall protests against the allegation by Mr. C. A. Parsons that a short circuit on a large generator in the engine-room of an electrically-driven ship would cause all the engine-room staff to be killed by copper poisoning.—An appeal is made to exhibitors at the Japan-British Exhibition to have their exhibits ready before the opening of the exhibition. (Page 273.)

AMONG the specifications published by the Patent Office on Thursday last was one by S. G. Brown covering the use of osmium-iridium alloys in place of carbon powder in microphone transmitters.—A combined transformer and meter for small A.-C. lighting consumers is described by Prof. E. and W. H. Wilson.—J. G. Childs and T. S. Hill have protected a system of automatic regulation for wind-power generating plants. The wind-turbine is enabled to run always at the most efficient speed by reducing the excitation of the dynamo as the speed increases.—A compact centrifugal fan, in which the blades are fixed to an armature rotating round a fixed field system, is described by K. Maxaner.—L. M. Waterhouse covers a ceiling rose with a spring-supported clip for taking up any vibration. (Page 274.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, APRIL 21ST.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, Westminster. "Hydro Electric Installations of Sweden," by A. V. Clayton.

FRIDAY, APRIL 22ND.

Physical Society.

5 p.m. At Imperial College of Science. "The Magnetic Balance of Curie and Cheneveau," by C. Cheneveau and A. C. Jolley.

Royal Institution.

9 p.m. Evening discourse by T. Thorne Baker on "The Telegraphy of Photographs, Wireless and by Wire."

MONDAY, APRIL 25TH.

Institution of Electrical Engineers: Newcastle Section.

8 p.m. At Armstrong College. "Earthed *versus* Insulated Neutrals in Colliery Installations," by W. W. Wood.

TUESDAY, APRIL 26TH.

Faraday Society.

8 p.m. At Institution of Electrical Engineers, 92 Victoria Street, London. Papers on water and aqueous solutions.

WEDNESDAY, APRIL 27TH.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. At the University. "Magnetic Oscillations occurring in D.-C. Machines," by G. W. Worrall.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At 92 Victoria Street, London. "Some Notes on Current Central Station Design in Germany," by J. C. Connan.

Faraday Society.

7.45 for 8 p.m. Dinner in Honour of Professor Walden of Riga, at Trocadero, London.

THURSDAY, APRIL 28TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. "Earthed *versus* Insulated Neutrals in Colliery Installations," by W. W. Wood.

Telegraph Traffic.—The 13th inst. brought news of the interruption and the repair of the Fao-Bushire cable; and on the 15th inst. the "El Arich" route was restored to working order.—The land-line between Saigon and Bangkok was down on the 18th inst. for a short time.

The Iron and Steel Institute.—We are asked to state, in connection with the programme of the annual meeting of the Iron and Steel Institute, that the Lancashire & Yorkshire Railway is included among the railway companies who have joined in granting a reduction in return fares, from May 3rd to 6th inclusive, to members of the Institute travelling to London to attend the annual meeting.

Cross-Channel Telephony.—It is announced that, in addition to the new London-Paris telephone cable which was recently described and illustrated in our columns (see ELECTRICAL ENGINEERING, March 17th. p. 179), arrangements are being made at Dover for laying an additional telephone cable to Belgium. It is expected that the new cable will be laid between St. Margaret's Bay (Dover) and La Panne, near Ostend.

The International Committee on Electrical Units and Standards.—An article in the *Electrical World* by Prof. E. B. Rosa gives an account of the work of the International Committee which is to carry on the work of the International Conference on Electrical Units and Standards, held in London in 1908. The Committee arrived at the conclusion that it was impossible to select a more exact value of the Weston normal cell in terms of the ohm and ampere than had been done by the London conference, nor would it be possible to agree upon the specifications of the silver voltameter without further experimental investigation, and, in response to an offer from Prof. S. W. Stratton, Director of the Bureau of Standards, it was decided that a joint investigation should be carried out at the Bureau of Standards by representatives of the Bureau of Standards, together with one delegate from the Physikalisch-Technische Reichsanstalt, Berlin, one from the National Physical Laboratory, London, and one from the Laboratoire Central d'Electricité, Paris. These delegates, as appointed by the directors of the several institutions, are Prof. Dr. W. Jaeger, Mr. F. E. Smith, and Prof. F. Laporte. The representatives of the Bureau of Standards are Prof. E. B. Rosa and Dr. F. A. Wolff. In addition to the work on standard cells and the silver voltameter, a comparison is to be made of the resistance standards of the several national standardising institutions. The European delegates have now been in America for some weeks, and it is hoped that the investigations will be completed in about two months.

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ELECTRICITY IN THE HOME

ALTHOUGH a large number of the domestic applications of electricity are only very poorly represented at the "Ideal Home" Exhibition now being held at Olympia, London, a few electrical contractors have taken stands and exhibit a selection of lighting fittings and heating and cooking apparatus.

Messrs. Lacy-Hulbert & Co., Ltd. (91 Victoria Street, Westminster, London) exhibit a self-contained electric polishing set, as illustrated in Fig. 1. This comprises a small motor with an assortment of buffing wheels, brushes, and mops for cleaning

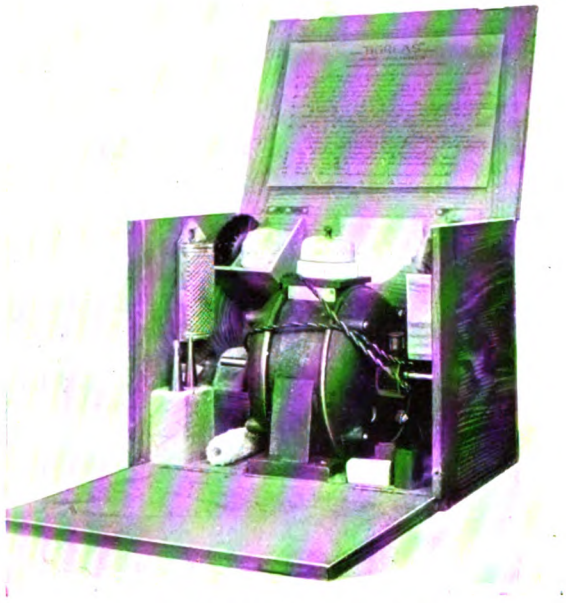


Fig. 1.—"Boreas" Polishing Set.

silver and other metal articles, boots, knives, &c. A flexible and an adapter for connecting the motor to the lighting circuit is provided. An ingenious starting switch is provided for the A.-C. motors.

A most attractive display including all the latest novelties has been arranged by Messrs. Rashleigh Phipps & Co. (147 Oxford Street, London, W.), who also give frequent demonstrations of electric cooking. The most interesting item here is a large electrically-driven knife-cleaner, suitable for hotels, schools, &c. The four polishing wheels are of rubber with leather rims, and these are mounted so as to exert pressure on the blade. The wheels are rotated through gearing by a ⅓-h.p. motor, and by means of a simple clutch the grinder and buffing brush can be quickly thrown into gear also. The machine polishes sides, back and shoulders in one operation, and is capable of dealing with 24 knives per minute. The leather rims can be readily removed when worn out. Another interesting device shown on this stand is an electrically-driven horse-clipper and sheep-shearer. An electrically-operated refrigerator is also exhibited. This is manufactured by Messrs. Werner Pfleiderer & Perkins, Ltd. (Westwood Works, Peterborough), and comprises a vessel containing a solution of ammonia in water and heated by a resistance coil consuming 1,000 watts. The anhydrous ammonia gas evolved is liquefied in a cooling tank and delivered into a vessel immersed in a brine tank. When all the gas is evolved, the temperature of the solution rises, and the heater is automatically cut out; then, as the solution cools, it absorbs the gas, causing rapid evaporation of the liquid ammonia and consequent cooling of the brine. The heating period is about one hour, and after an hour or an hour and a half after the heater is cut out it must be switched in again by hand if it is desired to maintain the low temperature. The temperature can easily be lowered sufficiently to make ice. Among the other items exhibited by Messrs. Rashleigh Phipps & Co. is an electric clock, in which an impulse is given to the oscillating wheel only once in every 2 or 2½ minutes. A lamp-holder with magnetic attachment for use when repairing and cleaning motor-cars, and a small portable drill, are also shown. An attractive feature of the display is an electrically worked and illuminated fountain, with the motor and pump hidden in the lower portion of the basin.

An interesting device for controlling and igniting gas-lamps electrically is exhibited by Telephos, Ltd. (16-20 Farringdon Avenue, London, E.C.). As shown in Fig. 2, this consists of a valve controlled by an electromagnet, and a platinum igniting spiral. The former consists of a perforated toothed wheel, which is rotated tooth by tooth by the magnet. The holes in the wheel coincide with corresponding holes in the base every alternate tooth. The controlling circuit consists of the magnet coils, the platinum spiral, and a push-button switch connected in series with a 6-volt dry battery and from 10 to 20 yards of No. 22 S.W.G. wire. When the circuit is closed, the magnet pulls up its armature and moves the wheel one tooth forward, thus opening the valve, and simultaneously the platinum spiral is caused to glow and ignite the gas. To turn out the gas, the push-button is pressed again, and this causes the wheel to move another tooth forward and close the valve. The spiral glows again, of course, but this does not matter. For inverted burners a modified form of the device is used. In this case there is an auxiliary gas-tube conveying gas down to the outside of the burner just above the mantle. When the circuit is completed, both the main valve and an auxiliary valve are opened, so that gas is led down to the outside of the burner and there ignited by the platinum spiral. This auxiliary jet ignites the main jet, and on releasing the switch the auxiliary valve is closed. As in the case of the upright burner, a second push of the button turns off the gas. These devices can be connected so that several work off one battery, and several may be controlled by one switch. We understand that an installation of 160 burners in the Technical College of Galashiels, and other large installations, have already been fitted with this system of control. For street lighting a plug-socket is provided in the lamp-post, and a man goes round with a battery and a plug to insert in the socket.

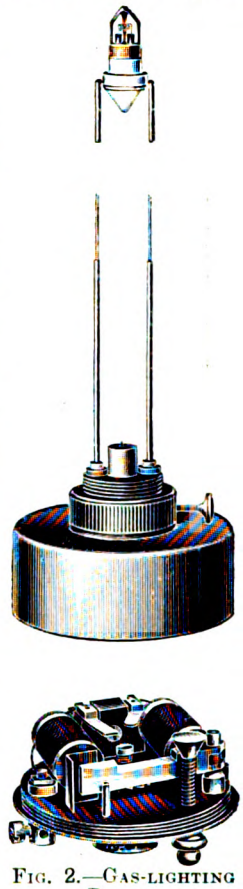


Fig. 2.—Gas-lighting Device.

Among the other exhibits of electrical interest are country-house lighting installations by Messrs. F. A. Glover & Co., Ltd. (Vine Street, Clerkenwell Road, London), and Messrs. Tredegar & Co. (56 Victoria Street, London). The latter firm also show their well-known wooden lighting fittings. Other artistic lighting fittings are exhibited by several firms, including the Birmingham Guild, Ltd., Ratcliff & Evens, and Oliver, Clark & Co., Ltd. The last-named firm has a 1½-pint kettle taking 682 watts, and listed at 7s. The British Vacuum Cleaner Co., Ltd. (Parsons Green Lane, Fulham), and Messrs. Wallach Bros. (Royal London House, Finsbury Square, London) exhibit electrically-driven vacuum cleaners. The Dowsing Radiant Heat Co., Ltd., have a large selection of electro-medical apparatus on view.

12,000 AMPERE-HOUR BATTERY PLANT AT MANCHESTER

A 12,000-ampere-hour battery has been installed to take the peak load on the Manchester electricity works, and to level the load on the generating plant. It has been erected at the Corporation's Dickinson Street station, and is now being taken into use. This battery is the largest storage battery yet put down in this country, and particular interest also attaches to the way in which it is designed to effect economies by being employed partly on the lighting and partly on the traction load. Through the courtesy of Mr. S. L. Pearce, Chief Electrical Engineer to the Manchester Corporation, we have been permitted to inspect this addition to the electricity supply system of that city, and Mr. Pearce and the various manufacturing firms concerned have kindly placed the fullest possible information at our disposal, which has enabled us to publish a complete description of the plant.

A brief description of the previous equipment of the

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Dickinson Street and Bloom Street stations, will assist the reader to follow the details of the new arrangements. There are four reciprocating sets at Dickinson Street, viz., two Musgrave-Siemens 1,500 kw. machines, and two Ferranti-Westinghouse 750 kw.



Fig. 1.—Part of the Batiery.

compound-wound traction sets. In addition, there are also two Parsons 1,800 kw. D.C. turbo-generators and two Parsons-Siemens D.C. 750 kw. turbo-generators. The latter turbo-sets are used on the traction as well as the lighting load. The Bloom Street plant is used principally for traction supply in the city, and consists of four Musgrave-Westinghouse 1,800 kw. reciprocating sets. These two stations are adjacent, and are interconnected so that all the plant runs in parallel. The battery will take the lighting peak load throughout the year, and the early morning traction load, and will at other hours assist the traction plant in both stations. This will render it generally unnecessary to take power for the central city area for the peak loads from the large Stuart Street three-phase station, which has hitherto supplied a portion of the Dickinson Street lighting load through La Cour converters at the latter station. These converters, however, still act as the necessary interconnecting link between the two stations. During the day the battery is charged from the surplus output of the traction generators at Dickinson Street and Bloom Street, which will thus be under practically constant load, and during the night from the lighting generators.

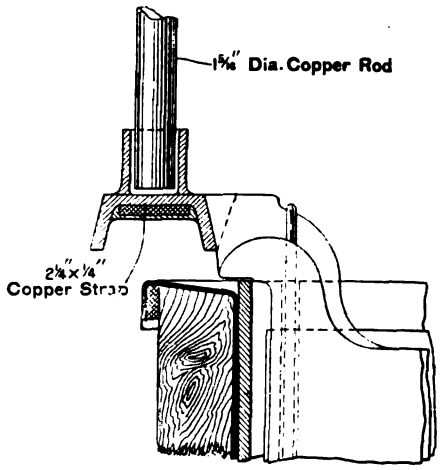


Fig. 2.—Arrangement of Connection to the End Cell of Each Row.

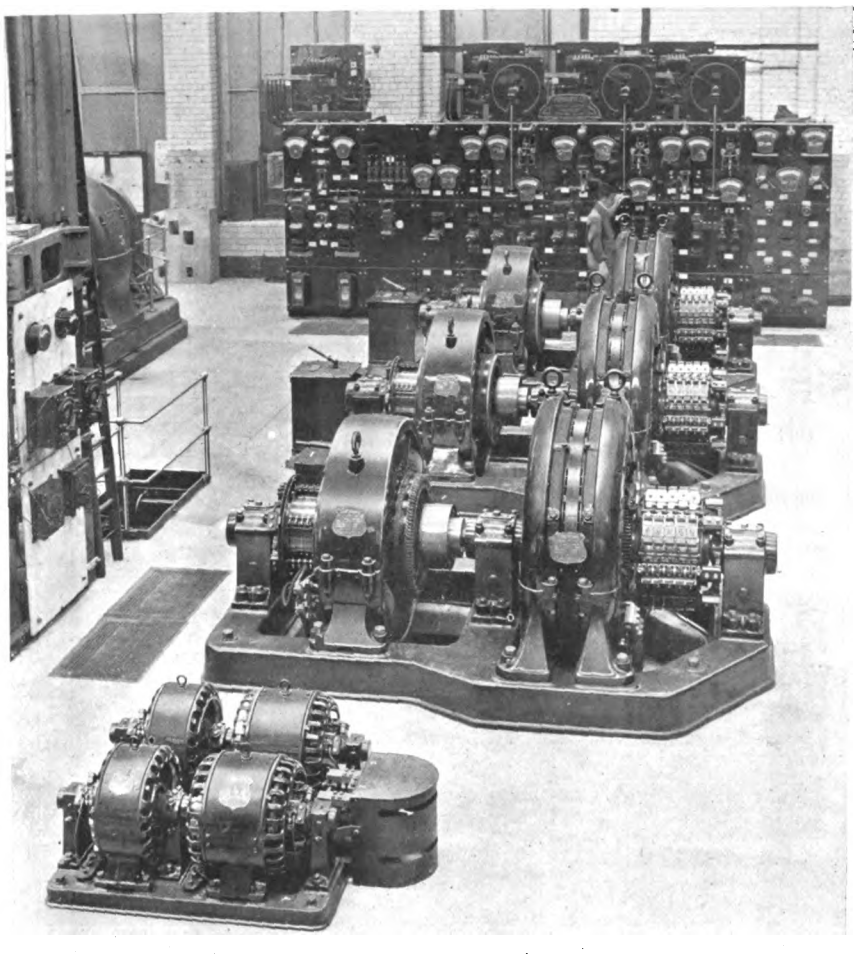


Fig. 3.—General View of Booster Sets and Switchboard.

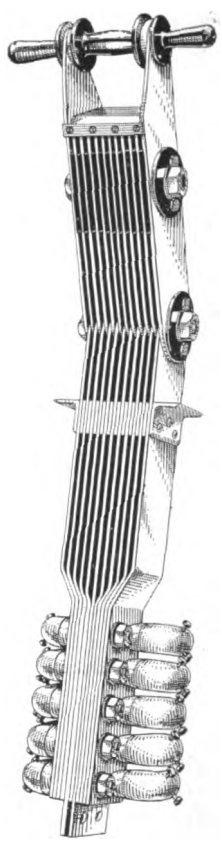


Fig. 4.—15,000-ampere Change-over Switch.

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The contract for the supply and erection of the battery and automatic reversible boosters was carried out by the Tudor Accumulator Co., Ltd., of London. The battery was manufactured throughout at the company's works, at Dukinfield, near Manchester, and consists of 210 cells in series, and can maintain with one of the boosters a voltage of 450 across the lighting 'bus-bars. Charging is carried out from the 525-volt

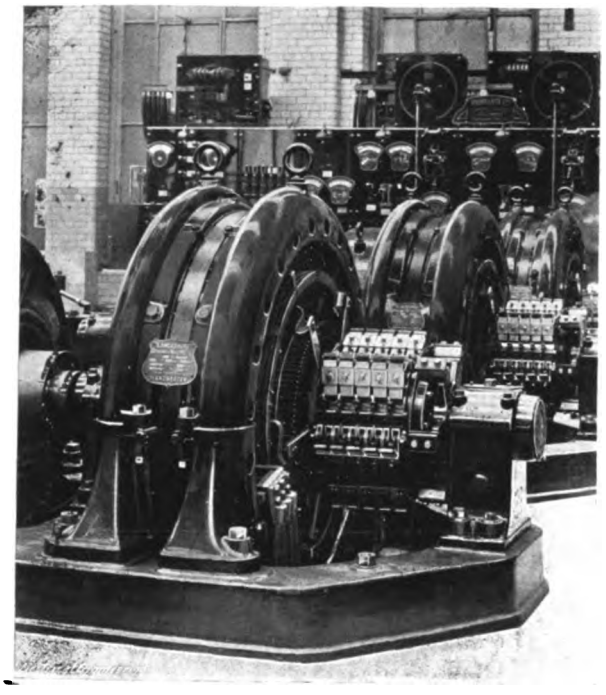


Fig. 5.—Generator of Booster Set.

traction 'bus-bars under the conditions outlined below. The following discharge rates are guaranteed:—8,400 amperes for 1 hour, 5,000 amperes for 2 hours, 3,900 amperes for 3 hours, and 11,200 amperes for half an hour. It is further to withstand a maximum discharge rate of 15,000 amperes. The normal charging rate is to be 4,100 amperes, and the maximum charging rate 6,500 amperes. The service will be rather severe, as the battery may be called upon for two complete discharges per day. A view in the battery-room, showing some of the cells, is given in Fig. 1. Both the positive and negative plates of the cells are of the standard Tudor construction, but of an unusually large size, the outside dimensions of the cell being 6 ft. 1½ in. long by 2 ft. 2½ in. wide by 3 ft. 4½ in. deep.

The containing boxes are constructed of pitch-pine, panelled and dove-tailed and pinned together with antimony-lead dowels; no screws or nails are used. They are lined with sheet-lead, and coated inside and out with acid-proof paint. Each cell contains 77 plates, the dimensions of which are 29 in. by 20¾ in. The positive plates are 0·4 in. thick and weigh 71 lbs. each, while the negative plates are 0·3 in. thick and weigh 31 lbs. each when finished. As shown in Fig. 2, the plates are suspended by their lugs, which rest on ⅜-in. vertical glass plates. Wood separators strengthened by longitudinal ribs are placed between the plates. A space of 8 in. is left beneath the plates for the accumulation of deposit, which need be cleaned out only at long intervals. The weight of each cell complete is about three tons.

The stands on which the cells are placed consist of four runners of pitch-pine, tied together at intervals and supported on large porcelain oil insulators. Each cell rests on twelve glass oil insulators placed on the runners. The woodwork is coated with acid-proof paint, and no metal fastenings of any kind are used. The whole rests on acid-proof flooring laid by J. Dickinson & Co., of Bolton. Connections are made from cell to cell by burning the lugs on to the lead connecting bars in the usual manner. The connections from row to row consist of six copper rods (each 1·4 sq. in. in section) in parallel. In order that the current shall be evenly divided, the rod from the extreme outside socket of one cell goes to the innermost socket of the other cell, and so on, so that all the rods are of equal length. The manner in which this is effected without the rods crossing each other is shown in Fig. 1. A copper strip, 2¼ in. by ¼ in. in section, is cast in the lead bar, from which the row to row connections are made, so as to reduce and equalise the resistance of the paths from the lugs to the rods. The copper rods are sweated into sockets, in the form of lead cups. The solder only reaches to within 3/16 in. of the top of the cups, and the remaining space is filled with vaseline to prevent corrosion of the copper at the junction.

The battery has been installed in a specially constructed room over the boiler-house, and is arranged on two floors, with only a few cells, however, on the upper floor. Above the latter is a platform on which is a "Normandy" distilling apparatus, supplied by the Thames Ironworks & Shipbuilding Co. for providing distilled water for the cells. The total floor-space covered by the battery is about 5,800 sq. ft. The room is lighted by 200-volt 25-c.p. Osram lamps in porcelain fittings, with hermetically sealed glass globes by the General Electric Co. The wiring consists of uninsulated lead-covered copper wire strung along the ceiling on porcelain insulators, and the connections from these wires to the switches and fuse-boxes are of lead-covered paper-insulated cable, the joints being well coated with acid-resisting insulating paint.

The Tudor Company have entered into an agreement to maintain the battery at 100 per cent. of its rated output for a period of ten years on the basis of 7½ per cent. of the purchase price. An efficiency of 85 per cent. in ampere-hours or 75 per cent. in watt-hours, when the total output is not less than three-quarters of its rated capacity, is guaranteed.

Fig. 3 is a general view of the booster sets, showing the switchboard in the background. The motor-driven booster sets were manufactured by the Lancashire Dynamo & Motor Co., Ltd., and are of the well-known Turnbull & Macleod automatic reversible type. Each set consists of an interpole shunt-wound motor driving a separately excited booster also fitted with interpoles. The boosters have laminated yokes and main magnet-

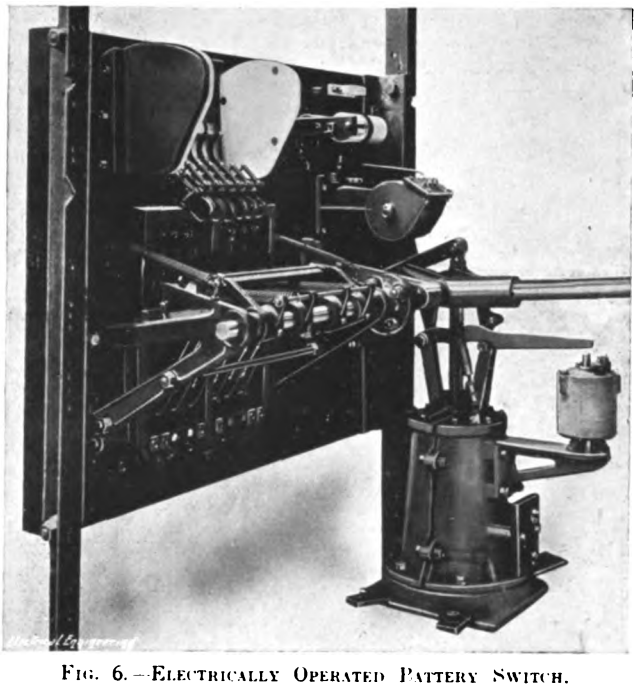


Fig. 6.—Electrically Operated Battery Switch.

poles to allow of rapid reversal of the field. The wrought-iron interpoles of both motor and booster are wound with copper strip on edge, and the connections are also of copper strip. The armature of the booster is parallel wound with equalising connections to every turn in the winding. A view of one of these machines showing the large commutator and substantial brush-gear is given in Fig. 5. Copper-gauze brushes with carbon tips are used on account of the heavy current to be dealt with.

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As shown in the illustrations, the sets have each three pedestal bearings mounted on a single bedplate. The motors run off the traction 525-volt 'bus-bars or

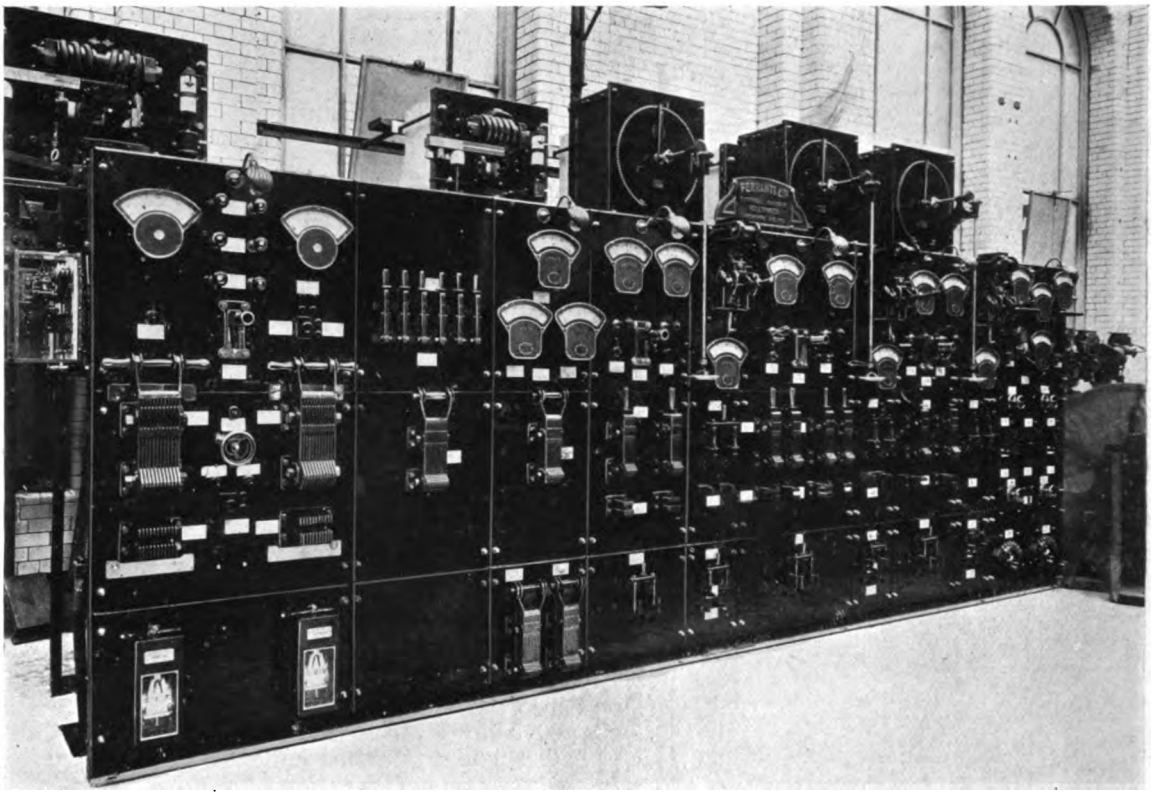


Fig. 7.—The Switchboard.

the lighting 425/450-volt 'bus-bars, and the capacities of the boosters are specified as follows:—2,000 amperes at 80 volts for 4 hours; 2,800 amperes at 60 volts

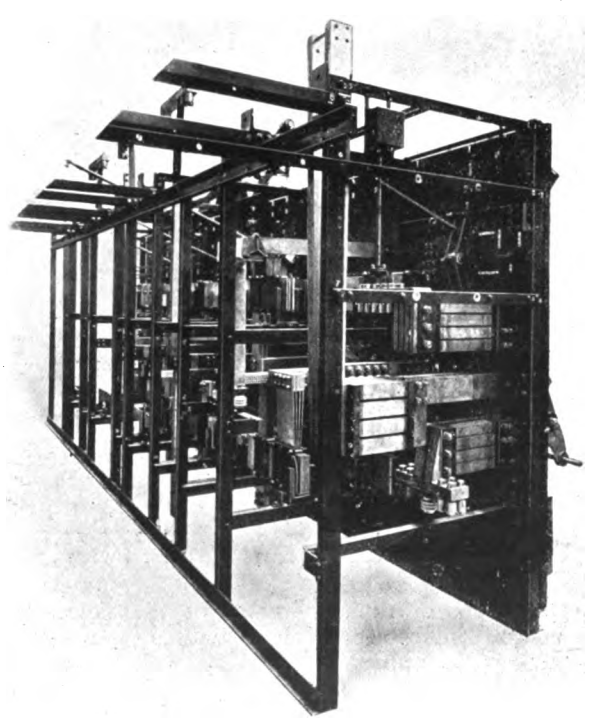


Fig. 8.—Back of Switchboard.

for 1 hour; 2,700 amperes at 80 volts for half an hour; 2,800 amperes at 100 volts for 15 minutes; and 5,600 amperes at 80 volts for from 3 to 5 minutes.

When the battery is on the traction load, any one (or two in series) of the boosters may be put in series with the battery, and in this case the regulation is automatic. When the output of the generators exceeds the traction load, the excess current is fed into the battery. When, however, the output of the generators for the time being is less than the load, the excess is supplied by the battery. Thus the generators are adjusted to supply the average load continuously. The method of bringing this about is as follows:—

In the traction negative bar, a diverter is inserted, consisting of six resistances in parallel, each of 0·002 ohms. Any number of these resistances can be inserted by an arrangement of six knife-switches, seen on the second panel of the switchboard. The series windings of each of the small generators for exciting the boosters are connected in parallel with the diverter, so that the current passing through the series winding is proportional to the load. These exciter generators, of which there are two, one being spare, can be seen in the foreground in Fig. 3. They are driven by shunt motors connected to the traction or lighting 'bus-bars, and will deliver 5 amperes at any pressure up to 450 volts. Besides the series winding, each exciter generator has two independent shunt windings, one connected across the terminals of the booster and including in its circuit a field switch and rheostat, and the other connected across either the lighting or the traction bars, with a potentiometer form of resistance inserted. The pressure across the first shunt winding is the difference between the battery and 'bus-bar volts, and consequently this winding causes the booster to balance all variations of the battery volts. The second winding is constantly excited in such a direction that the main generators tend to charge the battery. The series windings are opposed to the latter coil, and when the load increases beyond a certain value, these windings wipe out the shunt excitation, the boosters reverse, and the batteries discharge. For operation on the traction system the potentiometer and shunt-field resistance are adjusted, and the generator takes up the average duty required of it, and the fluctuations of the load are then dealt with by the booster automatically.

When the battery is on the lighting load, the boosters are connected singly, or two or three in parallel, according to the load. The regulation is then not automatic, but is effected by hand in the fields of the auxiliary exciter generator by means of either a shunt or a potentiometer regulator. Provision is made for the further possibility of exciting the boosters direct from the 'bus-

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bars by hand regulation and dispensing entirely with the motor-generator exciter.

The switchgear, which has been supplied by Messrs. Ferranti, Ltd. (Hollinwood, Lancashire), is particularly worthy of notice, since it embodies a number of novel features of design. The emergency currents which have to be dealt with are enormous, and the designers have fully taken this into consideration when constructing the switchgear. There is a natural tendency among designers who have already developed satisfactory standard apparatus for certain sized units, merely to modify dimensions all round when called upon to supply similar apparatus capable of dealing with currents considerably greater than have hitherto been handled. It frequently happens, however, that gear which is entirely suitable for dealing with a certain amount of power cannot be enlarged so as to deal with still greater quantities of power satisfactorily; on the other hand, radical modifications to the design are necessitated to render it suitable to deal with an increase of power, and in the switchgear under discussion the departures from hitherto recognised practice which have been necessitated by the exceptionally heavy currents to be dealt with form a striking example of this. In the first place, with a battery of 12,000 ampere-hours' capacity at a maximum voltage of 600, it was deemed advisable to insert two substantial circuit-breakers in the main leads connecting the battery to the switchboard and as close as possible to the battery-house. These circuit-breakers, one of which is illustrated in Fig. 6, are of the magnetic blow-out type, and are capable of carrying 15,000 amperes continuously. Each is enclosed in a separate concrete cubicle just outside the battery-room so as to shield it entirely from all other parts of the station, and each is independently operated electrically from the switchboard by means of solenoid control. They are non-automatic, and are provided with a suitable controller to show by means of signal lamps on the operating panel whether they are closed or open. The main cables connecting these switches to the automatic circuit-breakers on the main board are carried along under a gallery and the iron stairs, being supported in porcelain clamps suspended on iron straps. The automatic circuit-breakers on the main switchboard are of a similar type, but are mechanically operated from the front of the panels. They are also enclosed in concrete cubicles.

Fig. 7 shows a front view of the switchboard as erected at the manufacturers' works.

It consists of ten panels. The first (on the left of Fig. 7) is the main battery panel, in the centre of which is the socket for the operating handle of the main 10,000-ampere automatic circuit-breaker; just below this are two 15,000-ampere single-pole change-over switches for changing over from the traction to the lighting 'bus-bars, or *vice versa*. On the same panel are the indicating lamps for the solenoid-controlled battery circuit-breakers, an ammeter reading 5,000—0—15,000 amperes, a voltmeter for connection to the battery, lighting or traction bars, recording ammeter and voltmeter, and (on the side of the board) two watt-hour meters for measuring the energy supplied to the lighting and traction bars respectively. The second is the diverter panel, and comprises simply the six 500-ampere knife-switches for adjusting the value of the diverter resistance, and a 6,000-ampere switch in the series field circuit of the exciters. On the third panel are three 4,000-ampere switches for short-circuiting the boosters, the three voltmeters above them being connected across the three switches respectively. The next six panels are alternately generator and motor panels for the three booster sets. The generator panels each include two 3,000-ampere change-over switches connecting alternately with the traction or lighting bars; a 4,000-ampere automatic circuit-breaker (these are placed in concrete cubicles behind the board, and only the socket of the operating handle can be seen), a voltmeter and an ammeter, and a small change-over switch at the base of the panel for connecting the booster field either to the bars off which the main motor is run, or to the auxiliary exciters.

The automatic circuit-breakers on the generator panels are electrically interconnected with the motor circuit-breakers, so that the former come out if the latter do; this is necessary, as otherwise the boosters would be driven from the battery and would run up to a dangerously high speed. Each motor panel comprises a 500-ampere double-pole change-over switch for connecting to either traction or lighting bars, a 700-ampere automatic circuit-breaker, a starting rheostat above the board and operated through bevel gearing, and an ammeter. The remaining panel is allotted to the two exciters, and contains three double-pole 50-ampere change-over switches, two 50-ampere automatic circuit-breakers, two motor-starters, field and potentiometer regulators, ammeters, and a voltmeter. One of the double-pole switches connects the exciter bars to one or the other of the exciter-generators, while the other two are in the motor circuits.

Fig. 8 is a view of the back of the board before the concrete structure was put in, and is worthy of careful inspection in view of the unusually heavy construction. The bars and connections are of aluminium strips interleaved and firmly bolted together. They are carried on a very substantial iron framework, and the design is such that the various 'bus-bars are separated and enclosed in concrete troughs. The positive and negative bars are supported on cast-iron brackets lined with porcelain with an insulating bedding of sheet rubber.

The two 15,000-ampere change-over switches on the first panel are of a special design to avoid serious heating.

The principle used in smaller switches, say, those up to 1,000 amps., cannot be employed for larger sizes by merely increasing the dimensions all round. For the smaller switches, for instance, it is not unusual to employ for the hinged contact a substantial copper block, into which are let two or more jaw pieces to form the hinged contact. These jaw pieces are not only let into the main contact block, but are usually sweated and riveted. A round stem is then screwed into the contact block, which stem passes through the main panel, current being

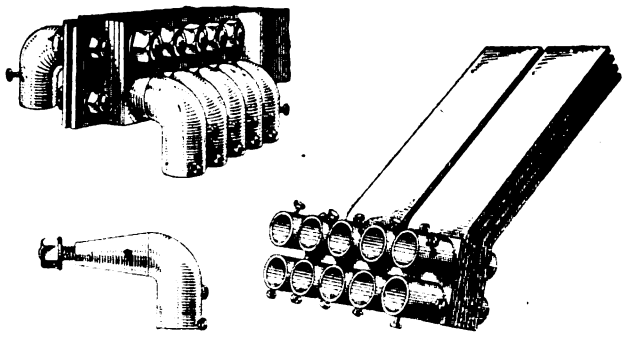


Fig. 9.—Cable Connectors on Switch and Circuit-breaker.

taken from the stem by means of surface contact nuts clamped up on each side of a cable socket. The current, therefore, passing from the movable member of the switch, enters first into the jaws, then through the surface contact between the jaws and the contact block, through a second surface contact between the contact block and the round stem, through a third surface contact between the round stem and the surface nuts (which, by the way, is a screw thread), and finally by a fourth surface contact between the surface nut and the cable socket. However carefully these surfaces are prepared, heating it bound is occur, and in the large sizes of switches this heating is a very serious consideration indeed.

Messrs. Ferranti, Ltd., however, avoid all intermediate surface contacts between the jaw pieces and the cable sockets or corresponding connectors. The construction is illustrated clearly in Fig. 4. A number of parallel copper strips are clamped together with suitable distance pieces between, and at each side is riveted an angle bracket by which the whole is attached to the panel. The distance pieces and angle brackets are, it will be noticed, at the back of the panel, so as to give maximum flexibility to the jaw pieces where the movable member enters. The jaw pieces are thus carried right through in one continuous length, and in the case of cable connections they are drawn together, riveted and soldered into a solid mass, and then drilled with taper holes, for conical plug cable sockets, as shown in Fig. 9. Where, however, the connection from the switch is by means of copper or aluminium strips, the same are interleaved between the back ends of the various jaw pieces so as to form a junction of very extensive contact area, as shown in Fig. 9. It will be noticed that in each case no screw threads are depended upon for taking the current from one link of the circuit to another, but that accurately trued up surfaces of exceptionally large cross-section and bolted together are provided. After the movable member or the blade of the change-over switch has been closed, the bolts passing through, not only the hinged, but also through the upper or lower contact, as the case may be, are tightened by means of an insulated detachable

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ratchet spanner. It is found that with this construction the total drop over the entire switch, with 10,000 amperes flowing through it, does not exceed 5·5 milli-volts.

The same principle has been adopted in the large circuit breakers. A number of copper strips are taken and separated by distance pieces of copper, and the whole are drilled through longitudinally, sweated and riveted up, when the upper surface is machined, accurately planed, and brought to a fine bedding surface. The distance pieces between the separate copper strips are of considerable depth, and so securely riveted together that the contact block thus formed is in all respects equivalent to a single block of forged copper, with the exception, however, that the greater proportion of the current entering the block from the laminated brushes of the circuit breaker passes direct into the copper strips which, being extended at the back, form a connection for the bus-bars or elsewhere, and thus again intermediate surface contacts are eliminated. As stated, the circuit breakers supplied are of the magnetic blow-out type, and in view of the fact that the distance between the cheeks of the blow-out coil is very great, most careful experiments were made to determine the shape of the magnetic field in the intervening space. The effect of the iron portions of the circuit breaker, as well as the current-carrying conductors which form part of the circuit breaker, in deflecting the magnetic field in the blow-out space were also experimentally determined. The final rupture is exceedingly quick, and is effected in the following way. The circuit breaker consists essentially of two independent movable elements, the one carrying the main laminated brush, and the second carrying the blow-out finger contacts. Both are operated by toggles, but in such a way that on releasing the switch the main brush opens first, and after it has travelled quite clear of the main contact, it releases the toggle of the second element, which, being of relatively small inertia, opens with a quick action and without excessive jar.

MUNICIPAL AND STATE TRADING

AT a meeting of the British Constitution Association at the Whitehall Rooms, London, on Monday evening last, Mr. J. H. Balfour-Browne, K.C., read a Paper on the subject of State and Municipal trading. The chair was occupied by the Earl of Hardwicke. Mr. Balfour-Browne asserted that though municipalities always showed a marked desire to get hold of paying concerns with which to relieve the rates, the risks of new enterprises were always left to be taken by private individuals. When tramway companies asked for powers to run trams, the conditions were made far too onerous. Thus, it was often made a condition that the company should bear the expense of any street alterations. When a municipality carried out street alterations for their own tramways, however, only one-third or less of the cost was charged to the tramways accounts. In 1907 the London County Council only charged one-eighth part of the cost to tramways accounts, the remainder being charged to the rates as town improvements. The State monopoly of the telegraph system had meant a loss to the country of ten million pounds; in 1906, for example, the deficit was £489,000. Now, the State was shortly to take over the telephone system, after crippling its early progress. Meanwhile the National Telephone Co. was, he said, not in a position to develop and improve the system, and the public suffered in consequence. The Post Office was already overburdened with work, and the addition of the telephone service would not help matters. After referring to the cases of the Water Board and the Port of London Authority, the lecturer asserted that the enterprise, ability, and initiative of private work would soon be destroyed by State encroachment. In most State or municipal undertakings the policy was still to make a profit, but it would soon be otherwise. In New Zealand, for instance, school children were already carried free on the tramways. Profit was the driving wheel of all individual enterprise, but all profit was now looked on with suspicion.

The Textile Institute.—The inauguration of the newly formed Textile Institute will take place at a meeting on Friday next at the Midland Hotel, Manchester, and after the meeting a reception and banquet will be held. The President is Sir William Holland, and Sir William is Vice-President of the Engineering Section. Several electrical engineers and specialists in electric driving of textile factories are included in the list of supporters. Further particulars can be obtained from the Hon. Sec., Mr. G. Moores, 12 Exchange Street, Manchester.

Manchester Students' Section of the Institution of Electrical Engineers.—The last meeting of the session was held on Tuesday evening last, at the Municipal Technical School, Manchester, when a Paper was read by Messrs. F. Shaw and J. Davies on the application of the cradle dynamometer to the testing of electrical machinery. At the annual general meeting held the same evening the following members were elected for the committee, to hold office for two years:—Representative members: R. G. Parrott (British Westinghouse Electric & Manufacturing Co.); A. R. Stelling (Mather & Platt, Ltd.); W. Parry (Manchester School of Technology). General members: H. A. Carney, J. N. Hindle, T. G. Travis.

ELECTRIC LIGHTING AND FIRE RISK

AN outbreak of fire occurred one evening last week at the Anti-Vivisection Hospital, Battersea Park Road, and on investigation proves to have been due to the electrical installation having been defective. Fortunately, the outbreak was discovered before it had attained any serious proportions, and was practically extinguished by the hospital staff before the arrival of the Fire Brigade. The circumstances are such that we feel it our duty to call attention to the case. It appears that, not only was the installation in bad repair, but this fact was known to the hospital authorities, the contractors, and the Electricity Department of the Metropolitan Borough of Battersea, who supplied the electrical energy.

The fire broke out under the flooring of the first floor in the oldest part of the building, and just above a distribution-box, from which all the circuits of the whole institution are taken. This box is situated on the wall of a corridor on the ground floor, and some twenty 7/20 vulcanised rubber cables are led up from it to the ceiling in wood casing. The casing stops short at the ceiling, and the cables pass through a hole in the lath and plaster (about 1½ in. by 6 in. in size). They are all bunched together above this hole, and pass along loosely to wood casing laid on the joists under the floor. It was in this bunched portion (about 3 ft.), between the ceiling and the casing on the joists, that the fire broke out. As all the insulation was burnt off the wires just at this part, the state of the cables before the fire could not be ascertained, but it appears that the building is unusually damp, and that there were several T- joints in the bunched portion of the wires. Our representative inspected the wiring near where the fire occurred, and found both the casing and cable in a very bad condition. The installation is about 8½ years old, and the building was uninhabited some time previously to its being put in.

Our representative was informed that both the Battersea Corporation Electricity Supply authorities and the contractors called in to do small repairs had repeatedly warned the hospital authorities that the installation was unsafe. The contractors, we understand, had been called in on more than one occasion because a fuse would not hold, and had found that this was due to bad earths in the wiring, but although they had recommended rewiring, the hospital authorities had not seen their way to have this done. Now, however, they have decided to rewire the whole building.

It seems fairly obvious that the wiring of the installation was not suited to the nature of the building, which called for a screwed barrel system and the very best workmanship. We cannot but think, however, that considerable blame rests with the Battersea Borough Council if it is true that they were informed of the bad condition of the installation. Immediately there is a suspicion that the electric wiring of a building of this character is in an unsafe condition, it is the duty of the supply authority to test it, and if, as must have been the case here, the leakage current is greater than one ten-thousandth of the maximum supply current given to the premises, they are authorised to disconnect it from the mains. As apparently the hospital authorities were not in a position to enable them to incur the cost of rewiring, this should have been done.

The Institution of Post Office Engineers.—The Dublin Section of the Institution of Post Office Engineers are holding a meeting on Tuesday, April 26th, in the theatre of the Royal College of Science, when an address, with lantern illustrations, on "Modern Wireless Telegraphic Methods" will be given by Mr. J. E. Taylor, of the Engineer-in-Chief's Department, General Post Office, to which the members of the Dublin Section of the Institution of Electrical Engineers have been invited.

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THE NEW COUNCIL AND COMMITTEES OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE Council of the Institution of Electrical Engineers have nominated their candidates to fill the vacancies on the Council created by the retirements which will take place at the end of the session in accordance with article 45 of the Articles of Association. The President, two Vice-Presidents, five Members of Council, and one Associate Member of Council will retire. These nominations will be announced this evening, prior to the ordinary business of the meeting.

The retiring members are the President, Prof. Gisbert Kapp; two Vice-Presidents, Colonel H. C. L. Holden, R.A., F.R.S., and Sir H. H. Cunynghame, K.C.B.; and Messrs. W. Rutherford, J. H. Rider, W. H. Patchell, J. W. Jacomb-Hood, and Dr. E. Hopkinson, and Mr. H. Human (Associate Member).

The new Council will be constituted as follows, if the candidates nominated are duly elected (the new nominations are in italics):—

PRESIDENT: *S. Z. de Ferranti.*

VICE-PRESIDENTS: *W. H. Patchell, J. H. Rider,* W. Duddell, F.R.S., S. Evershed.

ORDINARY MEMBERS OF COUNCIL: *H. Dickinson, J. E. Kingsbury, P. V. McMahon, R. K. Morcom, S. L. Pearce,* W. W. Cook, G. K. B. Elphinstone, W. Judd, Professor T. Mather, F.R.S., W. M. Morrison, Major W. A. J. O'Meara, C.M.G., J. F. C. Snell, G. Stoney, A. H. Walton, C. H. Wordingham.

ASSOCIATE MEMBERS OF COUNCIL: *S. Morse,* E. Russell Clarke, J. E. Taylor.

The Honorary Treasurer, Mr. R. Hammond, and the Honorary Auditors, Messrs. H. Alabaster and Sidney Sharp, are eligible for re-election.

If there are any alternative nominations, these must be made by two members, supported by eight other members, and sent in to the Secretary by Thursday next, together with the written consent of the nominee to accept office if elected. In the event of no alternative nominations being received by Thursday next, the Council's nominees will be declared duly elected at the annual general meeting on May 26th.

At the annual general meeting of the Manchester Local Section on March 22nd, the following Committee was appointed, the names of new members being given in italics:—

CHAIRMAN: *J. S. Peck* (British Westinghouse Co.)

VICE-CHAIRMAN: *W. Cramp* (Manchester School of Technology).

COMMITTEE: *C. J. Beaver, Dr. F. H. Bowman, A. A. Day* (Chief Electrical Engineer, Bolton Corporation), A. P. M. Fleming (British Westinghouse Co.), J. Frith, *Prof. E. W. Marchant* (Liverpool University), *T. L. Miller, S. L. Pearce* (Chief Electrical Engineer, Manchester Corporation), *Dr. E. Rosenberg* (British Westinghouse Co.), Prof. A. Schwartz (Manchester School of Technology), C. D. Taite (Chief Engineer Lancashire Electric Power Co.), and A. P. Wood (Lancashire Dynamo and Motor Co.). Hon. Secretary and Treasurer: Mr. H. W. Wilson.

The following are the nominations for the Glasgow Committee:—

CHAIRMAN: *Sam Mavor.*

VICE-CHAIRMAN: *J. A. Robertson* (Burgh Electrical Engineer, Greenock).

COMMITTEE: *W. McWhirter, T. B. Murray* (Albion Motor Car Co.), *T. C. Parsons* (Burgh Electrical Engineer, Govan), *John Ferguson* (Chief Engineer, Glasgow Corporation Tramways), J. C. McMillan (Burgh Electrical Engineer, Falkirk), W. C. Martin, Robert Robertson, Prof. Magnus MacLean (Glasgow and West of Scotland Technical College), Dr. J. T. Bottomley. Hon. Sec. and Treasurer: J. E. Sayers.

The Committee of the Yorkshire Local Section have made the following nominations:—

CHAIRMAN: *T. Harding Churton.*

VICE-CHAIRMEN: *Wilson Hartnell* and *W. B. Woodhouse* (Chief Engineer, Yorkshire Electric Power Co.).

COMMITTEE: H. Visger, J. D. Bailie (Messrs. C. A. Parsons & Co., Ltd., Leeds), *H. H. Wright, G. Wilkinson* (Chief Engineer, Harrogate Electricity Works), *W. N. Y. King, W. F. Mylan* (British Westinghouse Co., Sheffield), *E. A. Barker* (Chief Engineer, Barnsley Electricity Works), *R. Pohl* (Phœnix Dynamo Manufacturing Co.), and *J. Fawcett.* The Honorary Secretary is H. Dickinson.

The following nominations have been made for the Dublin Section Committee, and as no further nominations have been received, the Committee's nominees will be elected in due course on May 8th:—

CHAIRMAN: *W. Tatlow.*

VICE-CHAIRMAN: *S. L. R. Price.*

COMMITTEE: *G. F. Pilditch* (Chief Engineer, Rathmines Electricity Works), *P. H. Stewart* (Messrs. Guinness, Son & Co.), *Professor W. Brown* (Royal College of Science, Dublin), *Major Roberts, R.E.* (Superintendent P.O. Telegraphs, Dublin), *L. G. Kettle* (Chief Assistant, Dublin Electricity Works), S. T. Land (Chief Assistant, Rathmines Electricity Works), M. Ruddle (Chief Engineer, Dublin Electricity Works), R. N. Tweedy (W. Coates & Sons, Ltd.). The Honorary Secretary is Mr. T. Tomlinson.

STREET LIGHTING IN REGENT STREET AND PICCADILLY

CONSIDERABLE dissatisfaction is expressed in electrical engineering circles by the decision of the Westminster City Council to accept the tender of the Gas Light & Coke Company for the lighting of Regent Street, Piccadilly, St. James's Street, Pall Mall, Coventry Street, and part of Shaftesbury Avenue by high-pressure gas instead of by electricity. The decision was come to last Thursday, after some discussion, at which Mr. Jacques Abady, Chairman of the Works Committee, who recommended the acceptance of the Gas Company's tender, spoke very strongly in favour of gas lighting.

The dissatisfaction at this decision is shared by the residents and tradesmen in the district, particularly in Regent Street. Hitherto, Regent Street has been lighted by sixteen 12-ampere "Excello" flame lamps, giving, according to a test made by the Westminster City Engineer, Mr. J. W. Bradley, a candle-power of 3,575 each. The lamps are fitted with clear globes and dioptric diffusers, and this arrangement is so successful that the light given by the single 12-ampere lamps compares favourably with that given by the pairs of 10-ampere "Excello" flame lamps in Oxford Street, for which ordinary opalescent globes are used.

The St. James's and Pall Mall Electric Light Co., Ltd., proposed to continue the use of these lamps, as they were tendering to the Westminster City Engineer's specification for 3,000 c.p. lamps. In Piccadilly and the other streets it was proposed to use four 8-ampere flame lamps of the same make and with similar arrangements, giving from 1,800 to 2,000 c.p. each. Four of these lamps are now in use in St. James's Street, and the circuit would have been extended to 50 lamps. Piccadilly is at present lighted by 10-ampere ordinary arc lamps, giving somewhat over 900 c.p., and the replacement of these by 8-ampere flame arc lamps would, of course, have been a considerable improvement.

No prices were published by the Council, and the only information with regard to this important point was that the Gas Co.'s tender was the lowest. So far as we have been able to ascertain, however, the price quoted by the Gas Company was an extremely low one, and there can be little doubt that the contract will be carried out at a loss. Apparently the lamps supplied will be somewhat similar to the 1,000 c.p. high-pressure incandescent gas lamps used in Fleet Street, although, in a report made by Mr. Bradley, the Westminster City Engineer, it was pointed out that for certain reasons street lighting by these was distinctly inferior to that by flame arc lamps. He pointed out, for instance, that there are very great variations in candle-power, due to the condition of the mantles, and that, in addition to the difficulty of keeping the mantles in good order, the effective candle-power from any lantern does not increase in the same ratio as the number of mantles.

In a case such as this it is greatly to be regretted that the decision of the City Council should have been

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made merely on the question of price, and, moreover, that no announcement should have been made of the price quoted. In the case of the electric lighting company, the difficulty in quoting must have been aggravated by the fact that the specification called simply for prices per lamp of various candle-powers in stated districts, so that at the time of tendering it could not have been clear to what extent the existing mains and standards could be utilised, and to what extent new mains would be required. It is obvious that either the gas company or the electric lighting company are encouraged in the case of street lighting to quote a price actually below cost, in view of the advertising value of street lighting. This is particularly the case with gas lighting, as a result of the successful competition of electric lighting in the central districts of London. We cannot accept the suggestion made to us by a correspondent that the electric lighting company, in the case of competitive tenders, should deliberately tender below cost price in order to retain the electric lighting, and that the other supply authorities in London should assist in indemnifying it from loss. An electric lighting company which has given absolute satisfaction in its method of street lighting, and could prove that its tenders for a continuance of lighting was not excessive, should meet with more generous treatment by a public body.

ELECTRIC WELDING

A VERY interesting lecture on the subject of welding was delivered by Mr. R. J. Wallis-Jones on Wednesday of last week before the Association of Engineers-in-Charge. Welding could be defined, he said, as the union of metals under pressure at the temperature of incipient fusion. As iron, steel, and platinum were practically the only metals which did not pass rapidly from the solid to the liquid state, they were the only metals which could be welded by the old forge methods. The more recent methods, chief among which were the electrical processes, had increased the number of weldable metals to a large extent, and it was now possible to weld copper and its alloys, aluminium, and other metals with ease. This was on account of the rapidity with which the two pieces of metal to be welded could be brought to a high temperature and pressed together. The great advantage of the electrical methods was the ease with which the heat could be controlled and localised. The development of the various electrical processes was then described by the lecturer and illustrated with a large number of lantern slides. Among these were some illustrating the "Prescot" welder, of the British Insulated & Helsby Cables, Ltd. One of these machines, in use for welding tyres at a London wheelwright's shop, was described in Electrical Engineering, March 25th, 1909, Vol. V., p. 279. The electrical processes could be placed into two classes : first, those in which the electric arc was used to bring about the required temperature for welding; and, secondly, those in which the heating effect was produced by the passage of the current through the metal itself. In the Benardos arc process, only one carbon was used, the arc being formed between it and the work. This method was specially suitable for repairing broken castings. Some very interesting slides illustrating examples of work done by this method were shown. Electric welding was now used to a large extent in the manufacture of barrels and tubes, and some examples of work done by this method were on view.

In Germany, continued the lecturer, electric welding had been used for tramway rail joints for some time, and was now being introduced into this country by the Tudor Accumulator Co. Current was taken from the trolley wire at 550 volts or thereabout, and by means of a motor-generator set reduced to from 60 to 90 volts. The current required for welding was from 300 to 350 amperes. After the weld was made, the joint was ground done to the contour of the rail by means of special rail-grinding apparatus. The whole process occupied about one hour. A trouble with electric arc welding was the intense light of the arc, but this could be minimised by the use of a special form of glass screen, in which a yellowish-green coloured glass was compounded with a glass of spectrum blue colour. Another method of electric welding which had been successfully used was an electrolytic one. A metal plate formed the +pole and the metal pieces to be welded the −pole. The hydrogen evolved at the −pole formed a high-resistance film over the parts to be welded, and the passage of the current through it generated a large amount of heat, which was transferred to the metal. This method had been successfully used for continuously annealing wire. With a pressure of only three volts, only ordinary electrolytic effects were produced, but when raised above this, hydrogen was rapidly evolved and considerable heating took place. The pressure was then raised to 100 volts or more until the required temperature was reached. The usual method of obtaining the heavy currents required for welding was to use a special step-down transformer. This method was devised by Elihu Thomson in 1881, and was that employed in the "Prescot" welders. The welding current was regulated on the primary side of the transformer. This method had been adopted for softening parts of Harveyised armour plate for drilling. The secondary of the welding transformer was of heavy section copper, water-cooled, and the two ends were brought down over the plate a short distance apart. A current of some 40,000 amperes per sq. in. was passed, and the heat generated annealed the plate at the portion between the two points. The current in the primary would be from 75 to 90 amperes only. The Thomson process for the manufacture of tubes was then described and illustrated by means of slides, and the lecturer also described some non-electrical processes, including the oxy-acetylene, water-gas, and fusion methods.

WIRELESS TELEGRAPHY

IN answer to a question in the House of Commons on Thursday, the President of the Board of Trade stated that his attention has been directed to the legislation on the subject of compulsory wireless telegraph installations on ocean steamers which is contemplated in certain foreign countries. A large and increasing number of British vessels are voluntarily fitted with radio-telegraphic apparatus, and compulsory legislation at the present moment would be premature. The matter, however, will be carefully watched.

The Marconi Wireless Telegraph Co. announce that a permanent service between Europe and America will be opened on Saturday. The company will maintain a 24-hours' service for commercial and other purposes, and messages will be received at the company's offices, Watergate House, York Buildings, Adelphi, London. For Eastern Canada the rate will be 7½d. per word for coded messages, with a minimum of ten words, and 6d. per word for non-coded messages. For distant parts of Canada the rates will be 4½d. per word less than the existing telegraph rates.

According to *South Africa*, preparations are being made for getting the Durban wireless telegraph station to work, and there is every prospect of the service being available within two or three months. The site of the station is at the top of the Bluff, a height of 260 ft. above sea-level. The station will have practically a range of 300 miles. It is expected that within a year or two all the important towns round the South African coast will be similarly equipped.

Edison Storage Battery on Tramcars.—According to the New York correspondent of the *Standard*, the car equipped experimentally with a battery of Edison cells has proved so successful that the tramway company has ordered sixteen more. The running costs are stated to have been slightly less than ½d. per mile.

Agreements under the London Electric Supply Act, 1908.—In our issue for October 21, 1909 (Electrical Engineering, Vol. V., p. 919), we reported certain agreements between the London Electric Supply Corporation and the St. James and Pall Mall Electric Light Co., and between the London Electric Supply Corporation and the Westminster Electric Supply Corporation, under the London Electric Supply Act of 1908. The London County Council at the time took exception to the agreements, mainly on the ground that some of the Companies in question were not yet purchasable by them, and they requested the Board of Trade, in the event of it deciding to approve of the agreements, to arrange that they should cease in 1915, unless in the meantime legislation should be passed constituting the Council purchasing authority of the Companies in question. They also suggested the insertion of clauses to ensure that the interests of the consumers in the areas affected by the agreements should be safeguarded. The Board of Trade, whilst having made certain amendments on the latter point, have not fallen in with the view of the Council that the agreements should be terminated in 1915, on the ground that legislation constituting the Council the purchasing authority of the Companies not scheduled to the Act of 1908 was being proceeded with. The Highways Committee now report upon this correspondence, and adhere to their original suggestion, and recommend that the Board of Trade be informed to this effect.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

[*Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."*]

METAL FILAMENT LAMPS.—A new leaflet from Messrs. Siemens Brothers' Dynamo Works, Ltd., gives particulars of the "one watt" drawn tungsten filament lamp, which was described and illustrated in Electrical Engineering, April 7th, page 231. The lamp is made in the 100-c.p. size only, for 100–130 and 200–250 volts, and is listed at 4s. 6d.

CRANES.—An illustrated leaflet from the London office of the Maschinenfabrik Augsburg-Nürnberg A.G. (M.A.N.), 219 Caxton House, Westminster, S.W., gives particulars of a number of special forms of electric cranes for iron and steel works and rolling mills, including ingot transporting cranes with revolving tongs, ladle cranes, transporters for pig iron, iron bars, &c. Another leaflet calls attention to the system of "double drive" employed on some of the firm's cranes, in which two hoisting motors are used to produce extensive variation of hoisting speeds on the controller alone without mechanical gear change. By this means rapid movement of the empty hook or of light loads can be obtained, as well as slow raising and accurate setting down of heavy loads. The need for an auxiliary hoist for light loads is obviated, and the duplication of the motors provides a stand-by feature.

ELECTRICAL DRIVING OF SPINNING MACHINERY.—An illustrated pamphlet from the British Department of the Maschinenfabrik Oerlikon contains a description of the firm's system of individual drive for ring spinning frames, in which single-phase commutator motors are used, and the tension on the thread is kept as constant as possible by variation of the speed of the drive in accordance with the diameter of the portion of the cap on to which it is being wound.

TECHNICAL EDUCATION.—We have received a prospectus of the Working Men's College, Melbourne (Australia), containing full particulars of the technical classes carried on at this institute, including those in electrical technology, &c.

CENTRAL STATION ADVERTISING.—The Electricity Supply Department of Hanley have prepared a most useful series of circulars of information, calling attention to recent developments in the utilisation of electrical supply, giving particulars, for example, of metal filament lamps, flame arc lamps, and heating and cooking apparatus. Illustrated booklets for the use of prospective consumers also deal with electric lighting and electric motors, and numerous illustrations show the manifold uses to which the latter may be put with economy.

AIR COMPRESSORS AND PORTABLE TOOLS.—A new catalogue of pneumatic tools and appliances from Messrs. Balcke & Co., Ltd. (27 Clement's Lane, E.C.) describes a series of "Empire" compressed-air hammers, drills, sand-rammers, hoists, riveters and accessories which the firm are putting on the market in this country, as well as electric-driven and other air compressors, &c., for use with pneumatic installations.

CORRESPONDENCE INSTRUCTION.—We have received from the International Correspondence Schools, Ltd., the current issue of the *I.C.S. Student*, a monthly journal dealing with subjects of interest to the students of that institution. A number of appreciative references to the work of the schools by the heads of industrial and engineering concerns are included.

FANS.—A new list is to hand from the Wilson-Wolf Engineering Co., Ltd. (Thornton Road, Bradford). This gives particulars and prices of the firm's "Arctic" propeller ventilating fans for direct-current circuits. A feature of these fans is that the motors are fitted with a combined thrust and journal ball race at the commutator end, and a long gun-metal bush with Stauffer lubrication at the fan end.

ELECTRIC LIGHT AND POWER IN COUNTRY HOUSES

AN interesting book entitled "Electricity Applied to Light and Power," and forming a treatise on the application of electric current to every phase of country-house and estate requirements, has just been published by Messrs. Drake & Gorham (66 Victoria Street, Westminster). This contains just the sort of information which will be useful to owners of large or small houses in enabling them to realise the great possibilities open to them by the employment of electric light and power. Some most effective illustrations of various styles of lighting are included, and many examples of the applications of electric power, heating, &c., for domestic and estate purposes. Particulars are also given of the various ways in which the supply can be derived for isolated installations, and details of actual water-power, oil engine, suction gas, and steam plants are given. The concluding portion of the work gives a list of some hundreds of installations carried out by the firm, with many interesting photographs. The work is published at the price of 1s. 6d., but we have at our disposal a certain number of copies which we shall be glad to send free to any of our readers who would be interested in the contents. Applications should be made to the Editor, 203-206 Temple Chambers, Temple Avenue, E.C.

PARLIAMENTARY INTELLIGENCE

A NEW LONDON ELECTRIC RAILWAY.—The House of Lords Committee, which has been considering the proposed electric railway between Wimbledon and Sutton, which is to be worked as an extension of the District Railway Company's line to Wimbledon, passed the preamble of the Bill on Thursday. A junction is to be made with the London & South Western Railway at Wimbledon, and access is to be arranged for the public between the London, Brighton & South Coast Railway station at Sutton and the proposed station of the new company. In addition, the London & South Western Railway Co. is to receive a sum not less than the amount received at present from the District Railway Co. for the use of the terminal station at Wimbledon. The Committee inserted this provision in order that the London & South Western Co. should not suffer loss by the termination of the present agreement with the District Co.

THE CHARING CROSS, EUSTON & HAMPSTEAD RAILWAY.—As stated in our last issue, the opposition of the proprietors of the Hotel Metropole to the scheme for constructing junctions so that trains from the Charing Cross, Euston & Hampstead Railway may run through on to the District line at Charing Cross was successful, but the Committee allowed the promoters to confer with the hotel authorities to see if an arrangement could be come to. On Friday it was announced on behalf of the railway company that, although an agreement has been come to between the Hotel Metropole and themselves, the new scheme, which avoided the Hotel Metropole, would come under the foundations of the South Eastern Railway Company's bridge, and as an immediate agreement was not likely to be come to with that company, the Bill was withdrawn for the present year.

THE TROLLEY 'BUS.—Two proposals by municipalities for powers to spend money upon the installation of trolley omnibuses have been before the House of Commons since our last issue, viz., by the Leeds and Bradford Corporations. In both cases the Bills have been considered by the Local Legislation Committee. The evidence in support of both propositions was to the effect that the capital cost of the system was 20 to 25 per cent. less than tramways, whilst the working expenses were estimated at one penny per car mile less than tramways. The proposed route in Leeds is from the City Square along Wellington Street, Aire Street, Whitehall Road, and terminating at the boundary of the city at Drighlington. Borrowing powers are sought to the extent of £5,000, repayable in ten years, for the provision of omnibuses, and £9,000, repayable in twenty years, for electrical equipment. There was some opposition to this Bill by the railway companies, but eventually this was disposed of, and the Bill was ordered to be reported for third reading.

There was, however, more opposition to the Bradford Bill by the railway companies and the local carriers. In this case it is proposed to construct new tramways, to use the trackless trolley system, and to supply electricity in bulk to districts outside the borough boundaries. Powers are taken to borrow £81,632 for the construction of the tramways specified in the Bill, to be repaid in thirty years, and £42,748 for other tramway purposes. It is also proposed to borrow £22,800, repayable in twenty years, for feeder cables, switchboard plant, and apparatus for tramway purposes. Among the other clauses in the Bill is one providing for the erroneous registration of electricity meters. When any error is detected, this is to be taken as having commenced from the preceding quarter unless the error is proved to have arisen during the current quarter. On the proposal to use the trolley-'bus system, evidence was given in favour by Mr. J. M. McElroy, of Manchester, Mr. A. R. Fearnley, of Sheffield, Mr. J. Hamilton, of Leeds, and Mr. C. J. Spencer, general manager of the Bradford tramways. Col. Yorke, of the Board of Trade, expressed the opinion that the powers possessed by that body as to sanctioning routes were sufficient, in his opinion, for the safeguarding of the public. The greatest opposition to the tramway clauses was from the carriers in Bradford, who objected to powers being granted for the carrying of goods and minerals upon the Bradford tramway system generally.

YORKSHIRE ELECTRIC POWER.—The Unopposed Committee in the House of Lords passed the Yorkshire Electric Power Bill last week. The Bill seeks power to issue new capital in the form of preference shares, and to invest moneys not exceeding £100,000 in industrial or municipal undertakings to which the company supplies electrical energy.

PROGRESS OF ELECTRICAL BILLS.—The London Electric Railway Amalgamation Bill and the Yorkshire Electric Power Bill were read a third time in the House of Lords on Monday.

The Reading and District Electric Supply Bill and the Metropolitan District Railway Bill were read a third time in the House of Lords on Tuesday.

On the second reading of the Bishop's Stortford, Harlow, and Epping Gas and Electricity Bill, Mr. Wardle has given notice of his intention to move that it be an instruction to the committee to insert a clause limiting the interest on capital, and directing that the profits in excess of such interest shall be applied to a reduction in the price of gas and electricity.

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LOCAL NOTES

BIRMINGHAM: *Electricity Profits.*—It is stated that the Electricity Supply Committee are prepared to hand over £10,000 to the relief of rates.

DERBY: *Electricity Extensions.*—A Local Government Board inquiry was held last week concerning a loan of £5,203 for electrical extensions. There was no opposition to the application. A tender has already been provisionally accepted for the work.

DUBLIN: *Price of Electrical Energy.*—In view of the decision of the Council to meet the large deficit on the electricity undertaking from the rates, a resident has sent a letter to the Corporation questioning whether the Council have the legal power to do this until they are charging the maximum price for electrical energy laid down in their provisional order. The correspondent in question states that, should the Council make a rate for the purpose of covering the deficit, he will be forced to take proceedings in the matter. At the meeting of the Corporation last week, a motion to meet the whole £14.000 deficit on the undertaking out of the rates was abandoned, and a resolution passed to meet only £4,000.

DUNDEE: *Cost of New Power Station.*—It is estimated that the cost of the new power station at Carolina Port has been £103,000, compared with an estimate of £100,000. The closeness of the actual cost to the estimate is interesting in view of the statements which have been circulated in Dundee to the effect that the excess of expenditure over the estimate had been enormous.

Charge for Tramway Energy.—A Sub-Committee has been appointed by the Tramways Committee to confer with a Sub-Committee of the Electricity Committee as to the charge made for tramway energy. The Tramway Committee complain that whereas private consumers have had reductions in recent years amounting to 38 per cent., the price to the Tramways Committee has only been reduced by 25 per cent. On the other hand, the Electricity Committee state that the price for tramway energy in Dundee is as low as in any other town in the country, and very much cheaper than in many.

Tramway Third Party Risks.—Hitherto the Tramways Committee have maintained a fund for dealing with third party risks, but it is now proposed to insure with a company to the extent of £10.000. It is stated that the premium on this amount will be less than one-third of the sum now paid into the insurance fund annually.

GLASGOW: *Valuation of Tramways.*—The Corporation have appealed against the valuation for the year to May, 1911, of the tramways undertaking for purposes of assessment, viz., £278,070. They claim it should be £230,573. The valuation is based on revenue, and in previous years the assessor has allowed as a deduction from the gross revenue not only one-half of the cost of maintenance of the permanent way and electrical equipment of the line, but also one-half of the sum annually set aside for renewal thereof. He now proposes to allow no deduction whatever in respect of such renewal, but to continue to allow one-half of the cost of repairs. As one-half of the sum set aside for renewals amounted last year to over £57.000. the alteration proposed is a very serious one. The appeal will be heard at an early date.

MANCHESTER: *Tramway Receipts.*—The traffic revenue from the Corporation tramways for the year to March 31st amounted to £777,220, an increase of £3,185 over the previous year. The number of passengers carried was 159,049,096, an increase of 4,037,212.

MOLD: *Public Lighting.*—A Leeds firm have submitted a scheme of public lighting, and it has been referred to the Lighting Committee for consideration.

NEWPORT: *Tramway Renewals.*—At the last meeting of the Corporation a proposal to increase the fares was negatived. The Tramways Committee, in putting forward the proposition, pointed out that the renewals fund was very inadequate, only £5.000 standing to its credit, whilst £10.000 would have to be spent during the next two or three years.

RENFREW: *Electric Lighting Order Revoked.*—The Board of Trade have revoked the Renfrew Electric Lighting Order of 1905.

RUSSIA: *St. Petersburg Tramways.*—It is reported that the St. Petersburg Tramway Commission have decided to grant a concession to a firm for the construction at once of 37 miles of tramway. The city authorities will receive in consecutive periods of five years 4, 6, 8, and 10 per cent. of the gross revenue. At the end of the 20 years the municipality has the right to purchase. The name of the concessionaires may be obtained at the Board of Trade, 73 Basinghall Street, London.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ASHTON-UNDER-LYNE.—A Local Government Board inquiry has been held concerning a loan of £48,424 for electric lighting extensions. It was stated that during the past two or three years there had been applications for several thousands of horse-power, which the Council had been unable to supply.

BACUP.—A Local Government Board inquiry has been held into an application by the Council for a loan of £3.000 for electric lighting. The Council will lay the necessary mains and take current from the Rawtenstall Council.

EASTBOURNE.—A Local Government Board inquiry was held last week concerning an application by the Council to borrow £2.000 for additional condensing plant.

EDINBURGH.—The Town Council have adopted the Electricity Committee's recommendation to instal three cooling towers and exhaust steam turbines at the Dewar Place Electricity Works at an estimated cost of £45.000.

GILLINGHAM.—A Local Government Board inquiry was held last week concerning a loan of £3.000 for new generating plant. Mr. H. R. Hooper, the inspector, complained of the method of book-keeping adopted, and postponed the inquiry *sine die* for the accounts to be straightened out. He would then come down and conclude the inquiry.

LANARK.—The County of Lanark require tenders for a small steam dynamo, switchboard, and main cable, also complete wiring installation, at the Refuse Destructor at Bogs Brae, near Bellshill. Particulars from the Resident Engineer, Electricity Works, Bothwell Street, Cambuslang, and tenders to the Clerk, The Cross, Bellshill, by May 4th.

LEEDS.—The Council require 5¼ miles of 0·15 square inch three-core cable for a pressure of 6.600 volts. Particulars from the Manager of the Electric Lighting Department, and tenders to the Town Clerk by May 9th. (See an advertisement on another page.)

LONDON: *Hammersmith.*—The Council invite tenders for concentric cable, ducts, and prepayment meters (see an advertisement on another page).

Stepney.—The Finance Committee of the London County Council recommend sanction being given to loans of £7.150 and £40.500 for generating plant and accessories.

MANCHESTER.—The Electricity Committee have asked permission to borrow £40.000 for electrical extensions.

NETHERLANDS.—According to a British Consular report, the cost of engineering works likely to be undertaken in the Netherlands and the Dutch East Indian colonies during the next few years is estimated as follows:—Netherlands: Electrification of light railways and extension of steam tramways, £2.000.000; erection of about ten electric power stations, £500,000. Colonies: Electric lighting and power works in twelve Java towns, high-tension transmission in three provinces, and two electric motor-bus services, £5,000,000; electrification of the Java State Railway, £15.000,000.

NEWPORT.—Tenders are invited for a 1.000-kw. double-current turbo-generator, or alternatively a 1.000-kw. or 1.500 turbo-alternator with surface condenser. Particulars from the Borough Electrical Engineer, and tenders to the Town Clerk by May 2nd. (See an advertisement on another page.)

ROUMANIA.—The Municipal Authorities of Vaslui invite tenders for an electric supply installation. Tenders to the Conseil Municipal, Vaslui, by May 25th.

TURKEY.—Tenders are invited by the Turkish Ministry of Commerce for a concession for the supply of electrical energy in Constantinople. A deposit of £9.000 is required. Tenders by May 28th to Ministère Impérial Ottoman des Travaux Publics, Adjudication de la Concession d'Electricité de Constantinople. Local representation is essential in the case of Turkish Government contracts, and a list of British commission agents established in Constantinople may be seen at the Board of Trade, 73 Basinghall Street, London.

WEST BROMWICH.—A 750-kw. direct-current turbo-generator and surface condenser is required. Tenders to the Clerk by May 2nd.

WHITEHAVEN.—The Electricity Committee recommend the installation of an economiser, mechanical stoker, switchboard, and motor converter at an estimated cost of £2,500.

WOLVERHAMPTON.—The Corporation have adopted the scheme of Mr. C. E. C. Shawfield for spending £23,000 upon extensions of plant at the Electricity Works, and the provision of distributing mains.

YARMOUTH.—Application is to be made to the Local Government Board for sanction to borrow £500 for high-tension mains, and £3.000 for low-tension mains.

Miscellaneous

DALMARNOCK.—The Glasgow Corporation require electrically driven travelling lime mixers, valves, &c., for their sewage works at Dalmarnock. Particulars from the Public Works Office, 64 Cochrane Street, and tenders to the Town Clerk by April 30th.

SOUTHAMPTON.—The Tramways Manager has been authorised to purchase controller regulators at an estimated cost of £137 10s.

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Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

E.—The L.C.C. invite tenders for the wiring of Fairclough Street School. Particulars from the Chief Engineer, and tenders by May 4th.

E.—Cinematograph theatre, 560 Mile End Road, Stepney, E. Saville & Martin, architects, Dacre House, Arundel Street, W.C.

W.—Alterations to fire station, Manchester Square (£1,197). Builders, J. & C. Bowyer, Ltd., Upper Norwood, S.E.

W.—The L.C.C. invite tenders for the wiring of the Amberley Road School. Particulars from the Chief Engineer, and tenders by May 4th.

W.—Cinematograph theatre, Oxford Street, W. (370 persons). Architect, F. W. Foster, 26 Bedford Row, W.C.

S.W.—Theatre, Fulham, S.W. Architects, Anher Stoneham, 32 Nicholas Lane, E.C.

S.W.—Cinematograph hall on site of Clapham Junction tramway depot, St. John's Hill, Battersea (830 places). Architects, Gilbert & Constanduros, 43 Finsbury Square, E.C.

N.W.—Overhaul of electric wiring at Madame Tussaud's Exhibition, Marylebone Road. B. H. Jenkinson, Consulting Engineer, 9 Gray's Inn Square, W.C.

PROVINCES.

ASTON.—Cinematograph theatre. Builders, Harrison & Smith, Birmingham.

BECKTON.—Factory and stores for the London Flambo Fuel Co. (£2,350). Architect, John Moir Kennard, 13 Railway Approach, London Bridge.

BLACKPOOL.—Public library and art gallery (£18,000). J. S. Brodie, Surveyor, Blackpool Town Council.

BOLTON.—Theatre. T. E. Smith & Son, Bradshawgate, Bolton.

BURY.—124 workmen's dwellings (£30,000). A. W. Bradley, Surveyor, T.C.

COVENTRY.—Cycle factory. Architect, H. E. Chattaway, Butcher Row, Coventry.

ERITH.—The Council invite tenders from wiring contractors in connection with their assisted wiring scheme for a period of three years. Tenders by April 25th.

HALIFAX.—Church (£7,000), for St. Paul's Parish.

HENDON.—Enlargement of Parish Church (£6,000). Architect, Temple Moore, 37 Old Queen Street, S.W.

HENDON.—The Council invite tenders by April 25th for the wiring of the Council offices. Particulars from the Clerk.

LIVERPOOL.—Printing works for Blake & McKenzie. Architects, W. & J. Burroughs, Vernon Street, Liverpool.

LEICESTER.—Factory and warehouse, Sanvey Gate (£4,682). Architects, Topott & Son, 15 Hotel Street, Leicester.

MOSSLEY.—Tenders are invited by May 2nd for the electric wiring of St. John's Church, Roughtown. The Vicar.

STOCKPORT.—Extension of isolation hospital (£16,000). J. Atkinson, Surveyor, Town Hall.

TENDERS RECEIVED AND ACCEPTED

ABERDEEN.—The tender of Mr. W. Tawse, of Aberdeen, has been accepted at £6,249 for relaying the tramway track on Woodside.

AUSTRALIA.—It is stated that a contract has been let for an installation to supply electric light and power to the fourteen Blue Mountains towns. The area will be divided into three parts, each having its own generating station, which will comprise three-phase fifty-cycle 2,200-volt gas-driven alternators. The name and address of the firm who have the contract can be obtained upon application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London.

CHICHESTER.—After keen competition and considerable discussion with the Council, a tender by the Chichester Electric Light & Power Co. to light the city for five years at £3 5s. per lamp per annum, has been accepted.

GRIMSBY.—The Corporation have accepted the tender of the Jandus Arc Lamp Co. for the supply of 80 flame arc lamps with line switches and resistances for the sum of £662. The lowest tender submitted was £307, the highest £789. The figures given last week were published in error.

LONDON: *London County Council.*—The tender of Messrs. Hurst, Nelson & Co. for brass fittings for electric cars at £186 11s., and £168 for window-operating gear, has been accepted.

The tender of Messrs. W. McGeoch, Ltd., for the supply of 545 roof light fittings for electric cars at 5s. 5d. each, less 2½ per cent. discount, has been accepted.

The tender of the Deptford Engineering Co., Ltd., for the supply of six conduit cleaning trucks at £152, has been accepted.

LOWESTOFT.—The Council has accepted the tender of W. G. Murrin, of Lowestoft, for free wiring up to a total of 200 lamps at 8s. 8d. per point.

PLYMOUTH.—The Town Council have accepted the tender of Willoughby Bros. for annual supplies of tramway brake blocks, at 6s. 6d. per cwt.; brake slides, 2d. each; steel slipper block bolts, 5d. each; and steel suspension bolts, 1s. 4d. each.

SHEFFIELD.—The Tramways Committee have accepted the tender of Hadfield's Steel Foundry Co., Ltd., to manufacture, supply, and deliver special work, comprising junctions, required for track renewals in Hounsfield Road, and from Fitzalan Square to the Wicker, at £1,000, plus £213 7s. 10d. for rails and fish-plates to be supplied by the Corporation. The Electricity Committee have accepted the tender of the Electric Construction Co., Ltd., for a rotary transformer and switchgear, at £302 15s. 10d.

COMPANIES' MEETINGS AND REPORTS

MERTHYR ELECTRIC TRACTION & LIGHTING CO.—After meeting debenture interest and placing £1,500 to renewals account, the balance sheet for 1909 shows a sum available of £4,498. The directors recommend placing £1,000 to depreciation, a dividend of 5 per cent. on the ordinary shares, and carrying forward £498.

BABCOCK & WILCOX.—The net profit for 1909 was £360,004, in addition to £43,279 brought forward. The directors recommend further dividends of 8 per cent. on the ordinary shares, together with a bonus of 8 per cent. The sum of £100,000 is placed to reserve; £25,000 to dividend equalisation fund, and £10,000 to staff pension fund, carrying forward £63,083.

MERTHYR ELECTRIC TRACTION & LIGHTING CO.—At the annual meeting last week it was stated that more electrical plant will be required about the end of 1911. The company had experienced difficulties with regard to overcrowding of cars at Dowlais, and double-deck cars were to be put on this route. Considering the unsettled condition of the steel and coal trades in the district, Mr. G. J. Summerville, who presided, thought the shareholders should not be dissatisfied with the result of the past year's working.

LONDON UNITED TRAMWAYS.—The report for 1909 shows that after meeting interest on debentures and loans and providing for income tax, there is a balance of £21,950. It is proposed to place £21,000 to reserve for renewals, and to carry forward the balance of £950. The gross receipts decreased by £30,164, whilst the working expenses show an increase of £6,334. The chief increase in expenses has been due to repairs to permanent way and rolling stock, but a considerable saving was effected in the cost of electrical energy. As will be seen, no dividend is paid on the preference shares.

METROPOLITAN ELECTRIC TRAMWAYS.—Mr. E. Garcke presided at the annual meeting last week, and commented upon the satisfactory position of the company compared with most other tramway companies in the kingdom. He attributed this to the special arrangements which had been made between the company and the Middlesex and Hertfordshire County Councils, which allowed fair play between all parties. With the extensions which had been opened during the year, they had practically completed the important system of tramways in the North Metropolitan area, and for the present they might consider the capital account closed. The payment of a 5 per cent. dividend upon their ordinary shares must be regarded as very satisfactory.

SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.—At the annual meeting last week satisfaction was expressed at the progress of the company. An agreement has been entered into with the Caerphilly Council for taking over their electric lighting order, and negotiations are proceeding with a number of other respective consumers. Mr. W. Gascoyne Dalziel thought it satisfactory that after only 2½ years work the Treforest Company were considering extensions of plant. The prospects for securing considerable increase in output were never more favourable than at present.

Tantalum Lamps.—Messrs. Siemens Brothers' Dynamo Works, Ltd., have sent us a reproduction of a postcard illustrating a tantalum lamp installation on a merry-go-round at St. Kilda, Melbourne, which well demonstrates the ability of these lamps to withstand vibration.

Discussion on Tariff Reform.—A meeting will be held on May 23rd, at 8 p.m., at Caxton Hall, Westminster, by the National Electrical Manufacturers' Association, to discuss the effect of Free Trade or Protection upon the electrical industry. The discussion will be opened by Mr. Hugo Hirst from the Protection point of view, and Mr. J. E. Kingsbury from the Free Trade point of view. The chair will be taken by Mr. H. W. Butler, of the Electric Power Storage Co., the chairman of this Association. No resolution will be placed before the meeting or vote taken. Only those who are directly connected with the electrical industry will be allowed to take part in the discussion. Any person desiring to take part in the discussion is requested to kindly send his name to the Secretary, Balfour House, Finsbury Pavement, E.C., before May 21st next. This Association will, as such, be in no way responsible for the views held by either of the openers of the discussion or the opinions expressed by its members individually or by others at the meeting.

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APPOINTMENTS AND PERSONAL NOTES

Mr. A. J. Thornton has been appointed managing director of Messrs. A. G. Thornton, Ltd., rendered vacant by the death of his father, Mr. A. G. Thornton.

Dr. J. Erskine Murray asks us to state that the rumour that he has been appointed technical adviser to a wireless syndicate is untrue and calculated to injure his position as an independent consultant. He has no pecuniary connection with, or interest in, any particular system, his relations with all his clients being on the same basis, namely, that of an occasional consultant.

The Devonport Corporation have increased the salary of Mr. W. F. Stamp, the Assistant Electrical Engineer, from £170 to £180 per annum. The following increases have also been made:—Junior assistant, 38s. to 40s. per week; chief clerk, £93 12s. to £100 per annum; second clerk, 20s. per week; mains assistant No. 1, 30s. to 31s. per week; mains assistant No. 2, 32s. to 33s. per week; switchboard attendant, to a maximum of 32s. per week; stokers, 27s. 6d. to 28s. per week; trimmers, 23s. 6d. to 24s. 6d. per week.

Mr. T. M. Colson, resident engineer at the Hamilton Electricity Works, has been presented with an inlaid Sheraton clock and a Sheraton aneroid barometer on leaving, to take charge of the Surbiton Electricity Works.

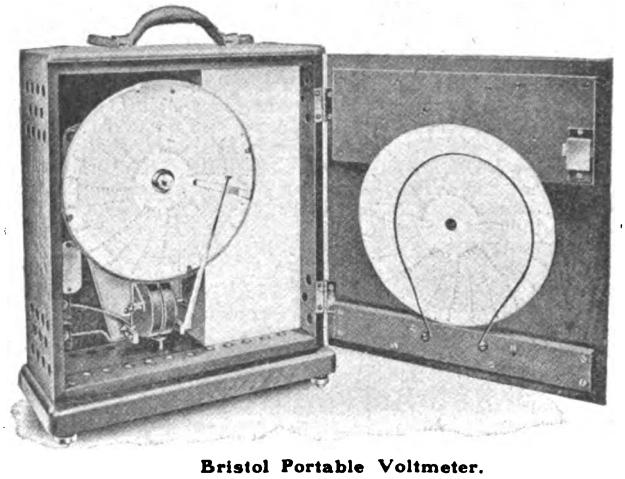
Mr. James Stott, Electrical Engineer to the Heywood District Council, has been appointed manager of the tramways in addition.

Mr. A. R. Sillar has resigned his appointment as Borough Electrical Engineer at Colchester. The senior Assistant Engineer, Mr. W. Frisby, and the second Assistant Engineer, Mr. P. H. Buzza, will be in charge of the undertaking pending the appointment of a successor to Mr. Sillar.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 15s. to £60 5s. per ton (last week, £60 to £60 10s.).

CANADIAN AGENTS WANTED.—A London firm manufacturing metal filament and carbon electric lamps wish to appoint agents at Montreal, Quebec, Ottawa, Toronto, Winnipeg, Vancouver, &c.—A Yorkshire firm manufacturing steam engines, independent condensing plants, mill gearing, &c., are desirous of getting into touch with Canadian importers.—Further particulars from the High Commissioner for Canada, 17 Victoria Street, London.



Bristol Portable Voltmeter.
J. W. & C. J. PHILLIPS, 23, College Hill, London, E.C.

MISCELLANEOUS CITY NOTES

BRITISH ALUMINIUM CO.—Subscriptions have been invited for an issue of £800,000 five per cent. prior lien debentures at 97, redeemable by drawings at 105 or by purchase or tender. The trust deed provides that no charge shall be created upon any of the properties of the company ranking in priority to, or *pari passu* with, the prior lien debentures.

DIVIDENDS ANNOUNCED.—Cuba Submarine Telegraph Co.: Six per cent. on the ordinary shares, carrying forward £7,221.

British Columbia Electric Railway Co., interim dividend at the rate of 8 per cent. per annum on the deferred ordinary stock for the half-year to December, 1909. Montevideo Telephone Co., interim dividend for the half-year to January 31st at the rate of 6 per cent. per annum on the ordinary shares.

Wycombe (Borough) Electric Light & Power Co., 2 per cent. on the ordinary shares, transferring £1,000 to renewals.

Kalgoorlie Electric Power & Lighting Co., 5 per cent. on preference shares for six months to March 31st. Brisbane Electric Tramways Investment Co., final dividend at the rate of 8 per cent. for 1909.

Electric Shock Fatality.—An inquiry was held at Bromford on Saturday last into the circumstances attending the death on the previous Wednesday of L. Evans, an electrical engineer, at the Birmingham Tame and Rea District Drainage Board's sewage disposal works. It appears that the deceased and two others were engaged in testing a newly installed induction motor running direct off the 6,000-volt three-phase supply. As it was not known what starting current the motor would take, the ammeter had been short-circuited. During the test it was decided to try the effect of allowing the full starting current to pass the instrument, and the deceased, forgetting that the main switch was closed, went to take off the short-circuit. He received a shock and fell unconscious; artificial respiration proved ineffective. The deceased was an experienced man, and had been chief operating electrical engineer at the works for over two years. Evidence was given to the effect that he knew that the instrument was alive, but must have forgotten for the moment. A verdict of accidental death was returned.

John E. Raworth,
Queen Anne's Chambers, 30, Broadway, Westminster, London, S.W. Chartered Patent Agent.

THE 'PATENTEES' HANDBOOK,'
By J. G. LORRAIN, M.Inst.E.E. M.Inst.M.E.,
Chartered Patent Agent.
Gives full information and advice to intending Patentees. Sent Post free on application to Mr. J. G. LORRAIN, Norfolk House, Norfolk Street, Strand, London, W.C.

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CORRESPONDENCE

CENTRAL BATTERY CIRCUITS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I have read with interest the article by Mr. H. H. Harrison on "Central Battery Omnibus Telegraph Circuits," published in your issue of March 17th last, and shall be glad if you will permit me to offer some observations in reference thereto.

Mr. Harrison states that (assuming v equal to unity), with the terminal out-station key depressed, the potential

$$v_1 = \frac{r}{x+r}.$$

In this assumption, Mr. Harrison has neglected to take into consideration the line insulation R, which must be considered as a parallel circuit to r.

The voltage would, I think, be more accurately expressed by the equation—

$$v_1 = \frac{Rr}{Rx+rx+Rr},$$

and in this event, the PD $(1-2)$ becomes—

$$\frac{R}{x+R} - \frac{Rr}{Rx+rx+Rr},$$

which is a maximum when—

$$x = \sqrt{\frac{R^2r}{R+r}}.$$

In the case quoted, the most efficient value of x would therefore appear to be 1,258ω instead of 1,340ω as stated.

It is not clear how the values 423ω and 4,200ω are obtained for r and R. Should not these values be 439ω and 4,000ω for r and R respectively?

Yours truly,

P. J. RIDD.

Woodcote, Elgin Road,
Wallington, Surrey.
April 12th, 1910.

APPLICATION OF ELECTRICITY TO SHIP PROPULSION.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In the interest of the electrical engineering trades, I respectfully wish to draw attention to a statement that Mr. Charles A. Parsons made at the discussion on a Paper that I recently had the pleasure of reading before the Institution of Naval Architects, to the effect that: "If a short-circuit occurred on board of an electrically-driven ship, that all the men in the engine-room would be killed by copper poisoning, and therefore its adoption involved grave risks," &c.

This statement he again repeated in the reply which he gave to the discussion on his Paper the next day on the transmission of power by means of mechanical gears to slow-speed propellers from high-speed turbines.

In view of such a strange statement being made by Mr. Parsons before one of our Technical Institutions in which vast interests in the shipping world are represented, the writer appeals to the electrical engineering profession to ask Mr. Parsons to withdraw this statement publicly, as it is not only difficult of proof, but, embodied in a discussion on electrical power generation and transmission for ship propulsion, may mislead shipowners to the extent of overlooking the great advantages that are to be obtained by its adoption for the purpose named.

I have failed to find out a case in which anyone has been poisoned by means of a short-circuit on a generator of large power, and the matter is of some importance bearing in mind Mr. Parsons's patent specification (No. 6,177/09), published on the 7th inst. From this he appears to be following the ground over which I have gone years ago, as anyone can see by reference to my patent No. 17,248 of 1905. I might point out that it has no connection with my recent patents, which refer to what is now known as the "Paragon" system. Trusting that you will be so good as to find room for these few remarks, thanking you in anticipation,

Yours faithfully,

WILLIAM P. DURTNALL.

11 Bush Lane, Cannon Street, E.C.
April 14th, 1910.

JAPAN-BRITISH EXHIBITION.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Might I ask you, through the medium of your columns, to impress upon all participating in the British Section of the Japan-British Exhibition, the necessity of taking advantage of the facilities afforded by the administration in order to have their exhibits completely installed in ample time before the opening early in May.

The Japanese have already made great progress, and there is no reason why British manufacturers, who are on the spot, should be one whit behind their Far Eastern colleagues.

In the past many a valuable exhibit has been entirely passed over by both Press and public, because on the first visit to the Exhibition they had no opportunity of forming a judgment upon its merits.

As the advantages of preparedness are therefore so evident, I trust that all those taking part in the Japan-British Exhibition will do their utmost to ensure that no reproach shall attach to the British Section when the day of opening comes.

NORFOLK, President,
Japan-British Exhibition.

Shepherd's Bush, London.
April 14th, 1910.

The Osram Lamp Works.—The large scale upon which Osram lamps are now being manufactured in England is shown by a certificate from Messrs. Edmund Bull & Darton, chartered accountants, 10 Old Jewry Chambers, E.C., to the effect that on the pay roll of the Osram Lamp Works, Ltd., on March 30th the number of persons employed, including staff and managers, was set out as 946. This is a good illustration of the increasing employment of British labour in metal filament lamp manufacture.

Machine Mining.—Our attention has been called to a clerical error in our abstract of Mr. Sam Mavor's Paper on machine mining, read in November before the South Wales Institute of Engineers, published on page xiv. of our supplement on ELECTRICAL ENGINEERING IN MINES of February 3rd. In the tenth and eleventh lines from the end, "No other machine had so wide a field of application as the disc," should obviously have read "No other machine had so wide a field of application as the *bar*." One of the chief points of the Paper was to record the author's opinion that in most circumstances the bar coal-cutter is superior to the disc machine.

The Brussels Exhibition.—Among the exhibitors in the British Section of the Brussels Exhibition will be the following: Messrs. Applebys, Ltd. (58 Victoria Street, S.W.), Sir W. G. Armstrong, Whitworth & Co., Ltd. (Elswick Works, Newcastle-on-Tyne), The British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.), The Cambridge Scientific Instrument Co., Ltd. (Chesterton Road, Cambridge), The Campbell Gas Engine Co., Ltd. (Halifax), Crossley Bros, Ltd. (Openshaw, Manchester), John Dugdill & Co. (Failsworth, near Manchester), Faraday & Sons (146-150 Wardour Street, W.), E. Green & Son, Ltd. (Phœnix Works, Wakefield), Holden & Brooke, Ltd. (West Gorton, Manchester), The Home Office (Whitehall, S.W.), J. Hopkinson & Co. Ltd. (Britannia Works, Huddersfield), Kelvin & James White, Ltd. (18 Cambridge Street, Glasgow), Kendall & Gent, Ltd. (Victoria Works, Hyde Road, Gorton, Manchester), Lacy-Hulbert & Co. Ltd. (91 Victoria Street, S.W.), Marryatt & Place (28 Hatton Garden, E.C.), Mavor & Coulson, Ltd. (47 Broad Street, Mile End, Glasgow), J. & H. McLaren (Midland Engine Works, Leeds), The Morgan Crucible Co., Ltd. (Battersea Works, S.W.), Nalder Bros. & Thompson, Ltd. (34 Queen Street, E.C.), The National Gas Engine Co., Ltd. (Ashton-under-Lyne), C. A. Parsons & Co. (Heaton Works, Newcastle-on-Tyne), R. W. Paul (Newton Avenue Works, New Southgate, N.), The Power Gas Corporation, Ltd. (39 Victoria Street, S.W.), Reavell & Co., Ltd. (Ranelagh Works, Ipswich), Hans Renold Ltd. (Brook Street Manchester), Ruston, Proctor & Co., Ltd. (Sheaf Iron Works Lincoln), Sheepbridge Coal & Iron Co., Ltd. (Sheepbridge Works, Chesterfield), The Sturtevant Engineering Co., Ltd. (147 Queen Victoria Street), The Synchronome Syndicate (32-34 Clerkenwell Road, E.C.), The Underfeed Stoker Co., Ltd. (Coventry House, South Place, Finsbury), R. Waygood & Co., Ltd. (Falmouth Road, S.E.), G. & J. Weir, Ltd. (Holm Foundry, Cathcart, Glasgow), Wellman, Seaver & Head, Ltd. (47 Victoria Street, S.W.).

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published April 14th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

19,397/08. **Air Brake Alarm Device.** N. C. Christie and W. Henderson. In order to sound an alarm bell if an angle-cock is left closed after coupling up the train pipe of a compressed-air brake system, wire conductors are woven into the hose pipe, and a circuit is completed through these wires, the hose couplings, and the cock handles. The turning of the cocks or attaching of the couplings is caused to rub and remove dirt or grease from the contacts. The alarm may be operated on either the open- or closed-circuit principle. Six claims, twenty-three figures.

4,162/09. **Metal Powder Microphone Transmitters.** S. G. Brown. Fragments of Osmium-iridium, osmium, or ruthenium are substituted for carbon powder in microphone transmitters, telephone relays, &c. As the resistance of such metals is low, the resistance of the rest of the circuit must be low. A microphone containing a single contact of an osmo-iridium alloy, and other constructions with powdered metal between hard iridium faces, are described. Seven claims, seven figures.

6,504/09. **Combined Transformer and Meter.** Prof. E. Wilson and W. H. Wilson. A wattmeter of the induction type is combined with an auto- or other transformer for supplying house circuits. The construction of the device is practically the same as that of a meter except that the shunt winding is made of sufficient section to take the full current from the mains, while a secondary winding is added or a portion of the primary winding thickened in the ordinary way to supply the load current at low pressure. The core plates are cut so as to preserve a closed magnetic circuit for transformer action, and yet to give sufficient leakage for the purposes of the meter. Six claims, nine figures.

6,752/09. **Wind-power Generating Plant.** J. G. Childs and T. S. Hill. In a plant comprising a wind-turbine, a dynamo, and a storage battery, the wind-turbine is arranged to run at its most efficient speed for all values of the wind velocity by causing an increase in the current supplied to the battery to effect a decrease in the excitation. A number of series relays are adjusted to put resistance into the dynamo field circuit in successive steps, so that for high velocities of the wind, the dynamo is running at a high speed with minimum excitation. A similar arrangement for switching in the ends cells of the battery when the current rises, is described. Alternatively the battery may be divided into two halves and connected in parallel for low speeds and in series for high speeds. An automatic switch effects the change-over, allowing a suitable interval for the pressure of the dynamo to increase. A double-commutator machine may be used, the two commutators being connected in either series or parallel. A wind-power plant according to this invention was described in Electrical Engineering, March 25th, 1909, Vol. V., p. 280. Seven claims, two figures.

15,659/09. **Pressure Fan.** K. Maxaner. In centrifugal ventilating fans of the pattern in which the air enters axially and is driven out tangentially, the driving motor has an annular armature rotating about a fixed field system. The fan blades are attached to the exterior of the armature, as is also a guiding cone to prevent the formation of eddies. Four claims, three figures.

18,193/09. **Insulation of Fine Wires.** P. A. Newton (*Farbenfabrik vorm. F. Bayer & Co.*). Wires or strips are first covered with thin tissue paper or cotton, and are then passed through a 10 per cent. solution of acetylised cellulose. The paper or cotton causes the insulating compound to adhere to the wire. Two claims.

19,914/09. **Porous Pot for Leclanché Cell.** G. Fuller. A cylinder of cardboard is wrapped round with a woven fabric such as butter-cloth, and one end is closed by a disc of wood. The carbon electrode is packed round with manganese peroxide and carbon, and top and base are treated with a bituminous compound. One claim, one figure.

24,769/09. **Ceiling Rose.** L. M. Waterhouse. The flex supporting the lamp fitting is attached to an insulating gripping piece, which is spring-supported from the base of the rose. Short lengths of flex lead from this gripping piece to the fixed terminals. Any vibration is taken up by the spring support. Four claims, four figures.

27,252/09. **Turbo-Alternator Construction.** O. T. Blathy. The shaft, hub portion, and magnet cores of a rotor for turbo-alternators, are forged in one piece, while the pole-pieces, which are provided with sleeve-like extensions, are pushed over the pole-cores and screwed on. The field windings are wound on the pole-shoe sleeves before these are placed on the cores. Two claims, five figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Jaburg, 15,880/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Taylor [Storage battery sub-stations on A.C. systems] 2,147/09; Brookes (*Thomas & Betts Co.*) [Cable connection] 7,576/09; Spencer [Distibuting systems] 8,165/09; British Insulated & Helsby Cables, Ltd., Cole and Shaw [Cable insulation] 11,135/09; Dane and Perks, Dane & Co. Proprietary, Ltd. [Drying cables] 19,368/09.

Dynamos, Motors, and Transformers: Shepherd [Constant-pressure dynamo] 7,058/09; Giglio [Current rectifier] 17,742/09; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Rectifier for H.T. currents] 26,466/09; Siemens Schuckertwerke Ges. [Commutators] 1,292/10.

Electric Ignition: Unterberg & Helmle [Distributor for H.T. apparatus] 19,024/09; Ehrich & Graetz [Automatic gas lighting] 19,955/09.

Electrometallurgy and Electrochemistry: Johnson (*Chemische Fabrik Griesheim Electron*) [Arc furnace for treating gases] 11,060/09.

Instruments and Meters: Siemens Schuckertwerke Ges. [Pressure-indicating instrument] 17,620/09.

Storage Batteries: Taylor [Battery sub-stations on A.-C. systems] 2,147/09.

Switchgear, Fuses, and Fittings: Brookes (*Thomas and Betts Co.*) [Connector] 7,576/09; Mackay [Lamp-shade holders] 9,812/09; Marsh [Time switches] 10,940/09; Johnston [Wiring fittings] 11,773/09; Curtis, Mould and Adams Manufacturing Co. [Motor-starters and rheostats] 13,142/09; Baker [Switches] 17,561/09; Karolyi, Klupathy and Berger [Operating switches at a distance by sound and other waves] 17,932/09; Conradi [Connector plug] 18,228/09; Jakobsen and Jensen [Switches] 25,551/09.

Telephony and Telegraphy: Burstyn [Diaphragm condensers for wireless telephony] 7,906/09; Sharman [Telegraph signal recorders] 9,686/09.

Traction: Ellison [Emergency brake] 18,072/09.

Miscellaneous: Cowper-Coles [Smoke consumer] 4,906/09; Lake [Ventilating apparatus] 7,080/09; Turnbull [Coal conveyor] 7,977/09; Greener, Thompson and Morgan [Coal conveyor] 8,318/09; Thomson [Electric coal-cutter] 8,694/09; Freeman [Printing-press controller] 9,052/09; Spalazzi [Dial signalling device] 11,338/09; Zhaniel [High-frequency stage effects] 16,309/09; Moy and Bastie [Electric scenery-raising gear] 22,081/09; Page (*Coal & Coke By-products Co.*) [Centrifugal separators] 23,313/09; Carbonnelle [Telegraphic transmission of photographs] 229/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: Bellem and Brégéras, 6,962/10.

Telephony, &c.: Petersen and Sem [Long-distance telephony] 6,895/10; Siemens & Halske A.-G. [Semi-automatic telephone exchange] 6,964/10.

Traction: Siemens & Halske A.-G. [Automatic recording of intervals and speed of trains] 376/10.

Miscellaneous: Sherl [Gyroscopic apparatus] 27,590/09.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

8,644 of April 24th, 1896. **Prepayment Meter Mechanism.** J. Tourtel. This patent covers a mechanism suitable for slot meters.

The following are the more important Patents that have become void through non-payment of renewal fees.

Electrometallurgy, &c.: H. C. Harrison and J. Day [Depositing metals on rotating cathodes] 23,647/00.

Incandescent Lamps: F. W. Howorth (*J. H. Guest and C. I. Hills*) [Copper leading-in wires] 28,458/04.

Storage Batteries: J. W. Stover and N. H. Suren [Charging arrangements and automatic apparatus] 26,702/01 and 26,754/01.

Switchgear, &c.: R. Wallwork and C. H. Wallwork [Lamp bracket or pendant] 26,659/01; Bruce, Peebles & Co. and A. C. Peebles [Liquid motor-starter] 29,607/04.

Traction: W. H. Braim and J. C. Jamieson [Operating points and switches from car] 28,478/03.

Miscellaneous: H. Helberger [Electric chain-welding machine] 28,662/03; C. Geddes [Time-alarm apparatus] 28,460/04; F. W. Reed and Craven Bros. [Electric crane and hoisting gear] 28,678/04; W. List and F. Ritchie [Indicating extinction of vehicle lamps] 28,920/04; W. M. Llewellin [Time-checking apparatus] 29,215/04; H. W. Sullivan [Trembler-switch for induction coils] 29,368/04.

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ELECTRICAL ENGINEERING

No. 174 [Vol. VI., No. 17] THURSDAY, APRIL 28, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Other Advertisement Rates on Application.

Latest Time for Receiving
Letters for Insertion, *Tuesday first post.*
Small Advertisements and Official Announcements, *Wednesday first post.*
Displayed Advertisements, *Tuesday first post.*
Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

A Paper describing some typical water-power installations in Sweden was read on Thursday last before the Institution of Electrical Engineers by Mr. A. V. Clayton,, formerly of the Magnet Co., Ludvika, Sweden. The Paper included particulars of the hydraulic work in connection with these stations, and some interesting alternators were described. Owing to extreme pressure on our space we are obliged to withhold the publication of our report of the meeting until next week.

We publish photographs and biographies of the members nominated for the vacancies on the Council of the Institution of Electrical Engineers. In addition to the nominations made by the Council for the five vacancies of ordinary members of Council, members in the West of England have nominated Mr. H. Faraday Proctor as their candidate, so that there will be a ballot. Mr. W. A. Chamen, who is proposing Mr. Proctor, made a short statement with regard to this at the meeting of the Institution of Electrical Engineers on Thursday. (Page 277.)

A new pattern of tramcar body is being adopted at Liverpool, with cross-seats on the lower deck as well as on the upper deck. (Page 279.)

A list of the papers to be read at the Annual Congress of the Tramways and Light Railways Association at Dublin next month is given on page 279.

A new metal filament lamp of British manufacture has been introduced. The bulbs of even the high-voltage lamps are quite small. To avoid the filament loops being too close together, they are arranged in two concentric rows. (Page 279.)

A large amount of the plant at the Shieldhall Sewage Works, Glasgow, is electrically driven, although some of the main pumps are steam-driven. Continuous-current generating plant is provided on the premises. We give in an illustrated article a detailed description of the electrical equipment. (Page 280.)

Considerable progress continues to be made in the supply of electricity in Shanghai. The house service connections now number over 3,200, and the charges for lighting vary between 3·7d. and 2·28d. per unit. Lamps are sold by the department at a small profit, and heating and cooking apparatus is to be let out on hire. It is proposed to institute a flat rate of 0·86d. for heating and cooking. The total working costs are 1·246d. per unit. (Page 282.)

In a lecture before the Royal Institution on Friday, Mr. T. Thorne Baker described the latest advances in photo-telegraphy. A portrait transmitted from Brighton to London by a portable apparatus was shown, and it was mentioned that Prof. Korn is constructing apparatus on his own system, using selenium cells with a view to transmitting photographs between New York and London. Mr. Thorne Baker also described his wireless apparatus, and showed some results. (Page 282.)

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WE publish some further particulars with regard to street-lighting contracts in the West End of London, and also Correspondence we have received on the subject. (Page 283.)

THE meeting of the Illuminating Engineering Society on Thursday, April 14th, was devoted to a discussion on illumination photometry. Mr. A. P. Trotter described the characteristics of a practical photometer for street-lighting and similar measurements. Mr. Clarke, of the Gas Light & Coke Co., and Mr. Haydn Harrison emphasised the importance of light distribution curves as compared with single observations of mean spherical candle-power. (Page 284.)

SOME interesting figures are published relating to the number of licensed wireless telegraph stations in the United Kingdom and the traffic in connection with these. The Marconi Co. have restarted their wireless telegraph service across the Atlantic, and it is stated that long-distance stations in Italy, on the Red Sea, and on the east coast of Africa are approaching completion. (Page 285.)

THE Bradford Corporation have been authorised to adopt the trackless trolley system of electric traction experimentally on one line, but they must apply for special powers should they wish to extend the system. —The Rhondda Tramways Bill authorising an expenditure of £35,000 has been passed. (Page 285.)

THE Manchester Tramways Committee propose to contribute £60,000 to the relief of rates, and the Leeds Tramways Committee £55,000.—The Liverpool Electric Lighting Committee will contribute £20,000 to relief of rates and the Tramways Committee £27,450. —For the first six months' working of the Fleetwood Council's electricity station, there has been a net profit of £1,000.—The Bethnal Green Council are again considering the question of taking a supply of electricity in bulk from a neighbouring Council. (Page 286.)

A 250-KW. GENERATING SET and steam plant is required at Hounslow.—Extensions are contemplated at Leicester (£19,000), Felixstowe (£4,500), and Erith, where a 300-kw. set is to be installed.—The Arbroath Electric Light & Power Co. also propose extensions.—The L.C.C. require 250 new tramcars.—Electrical plant is required by the Prince Rupert (British Columbia) Council.—A scheme for lighting the new graving dock at Belfast is recommended.—Large quantities of telephone material are required in Australia. (Page 286.)

AT the meeting of the London United Tramways Co., last week, it was stated that considerable sums will have to be expended in the near future upon renewals of track, &c.—The Chairman of the Cork Electric Lighting & Tramways Co. stated at the meeting last week that a federation has been formed to prevent unreasonable strikes. The company suffered considerably last year in this connection. (Page 288.)

Two Bills, by the Bishop's Stortford and Farnham Gas Companies respectively, proposing to supply electrical energy, were considered by the Unopposed Committee of the House of Commons on Thursday. Mr. J. F. C. Snell and Mr. A. H. Dykes had been retained by the two gas companies. The Farnham Bill was passed, but a decision upon the Bishop's Stortford Bill was postponed for a week, in order that a resolution may be passed by the Council in favour of the proposal. (Page 289.)

AMONG the Specifications published by the Patent Office on Thursday last was one by A. M. Taylor for an arrangement of storage battery sets in sub-stations on A.C. distribution systems, whereby the synchronous motor-generators are over-excited when charging the batteries, thus compensating automatically for the lagging currents in the system.—The British Insulated & Helsby Cables, Ltd., protect an insulated cable with alternate layers of vulcanised rubber and bitumen.—An automatic device for use in conjunction with motor-starters to break the main circuit directly the starting lever is given a backward motion is patented by the Adams Manufacturing Co.—A wall-plug provided with a handle and shield, and in which the flexible passes out at right-angles to the axis of the pins is described by J. F. and E. S. Conradi.—Messrs. Siemens-Schuckertwerke Ges. protect a method of insulating commutator segments; the hard insulation extends below the radial wearing depth only, and short-circuiting by carbon dust in the gaps between the segments is prevented by varnishing the sides of the segments. (Page 290.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, APRIL 28TH.

Institution of Electrical Engineers.

8 p.m. At 25 Great George Street, London. "Earthed *versus* Insulated Neutrals in Colliery Installations," by W. W. Wood.

SATURDAY, APRIL 30TH.

Institution of Mining Electrical Engineers.

4.30 p.m. Warwickshire Branch. At Imperial Hotel, Birmingham. (1) "Notes on Mining Switchgear," by Mr. A. Hall; (2) "The Earthing of Coal Cutting Machines," by J. R. English.

6 p.m. Lancashire Branch. At Victoria Hotel, Sheffield. "Is Flame-proof Gear Possible?" by H. Jenkins.

TUESDAY, MAY 3RD.

Electro-Harmonic Society.

4.30 p.m. Annual General Meeting at Institution of Electrical Engineers, 92 Victoria Street, London.

Iron and Steel Institute.

7 for 7.15 p.m. Annual Dinner at the Hotel Cecil.

WEDNESDAY, MAY 4TH.

Iron and Steel Institute.

10.30 a.m. Annual Meeting at the Institution of Civil Engineers, Great George Street, Westminster, London. (1) "On the Girod Furnace and the Electric Smelting Works of the Paul Girod System," by Prof. Dr. W. Borchers; (2) "On the Progress of Electro-Smelting," by Donald F. Campbell; (3) "On Developments in the Production of Electric Power: Its Application and Bearing upon the Iron and Steel Industries," by D. Selby Bigge.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. Annual General Meeting at the University.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. Annual General Meeting at 92 Victoria Street, London, S.W.

THURSDAY, MAY 5TH.

Institution of Electrical Engineers.

8 p.m. At Royal Society of Arts. "A Telephone Relay," by S. G. Brown.

Institution of Electrical Engineers: Dublin Section.

8 p.m. Annual Meeting at Royal College of Science.

Röntgen Society.

8.15 p.m. At 20 Hanover Square, London. "Quantitative Measurements of the Conversion of Cathode Rays into Röntgen Rays by Antikathodes of different Metals," by J. H. Gardiner.

Victoria Telephone Exchange, Birmingham.—On April 16th the National Telephone Company transferred the subscribers in Birmingham connected to its Victoria Exchange to a central battery equipment installed in new premises (which have been specially designed) in Sandy Lane, Small Heath, Birmingham. The new equipment has been manufactured and installed by the Western Electric Co., Ltd., and is of the No. 10 C.B. type, consisting of six subscribers' positions, giving accommodation for 420 lines and three incoming junction positions, one of which is temporarily arranged as a plugging up position. The equipment is of similar design to that installed at the company's Crosby, Great Yarmouth, Greenock, and Rusholme exchanges, already referred to in our columns.

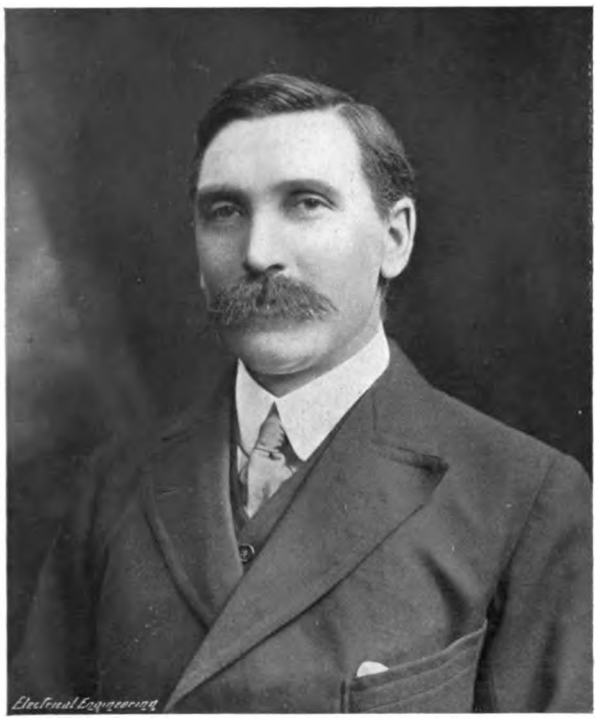
Alteration of Declared Pressure by the St. James & Pall Mall Electric Light Co.—The St. James & Pall Mall Electric Light Co. has obtained permission of the London County Council to alter its "declared" pressures to consumers from 107 and 214 volts to 110 and 220 volts, in order to enable it to use meters calibrated to these figures. Hitherto the supply has actually been given at 110 and 220 volts, but the ampere hour meters which have been in use are calibrated for 107 and 214 volts. It is proposed to adopt watt-hour meters in future, when the additional percentage of the recorded consumption will be charged to consumers. The permission for the change in declared pressure is given on the understanding that any variation shall be within the 4 per cent. on to 107 and 214 volts respectively prescribed by the regulations of the Board of Trade.

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THE NEW INSTITUTION COUNCIL

We give below a portrait of Mr. S. Z. de Ferranti, who has been nominated as President of the Institution of Electrical Engineers for next session, and also photographs of the members nominated to fill the seven vacancies on the Council. The Council have nominated seven members (two vice-presidents and five ordinary members), and one independent member has been nominated up to the time of going to press. Balloting papers will be sent out to Members and Associate-Members of the Institution in due course.

Mr. S. Z. de Ferranti, the new President, who was born at Liverpool forty-six years ago, has, in spite of his comparatively young age, had a striking career in both the manufacturing and supply branches of electrical engineering. Mr. Ferranti was one of the pioneers of the electricity supply industry, and it was he who originated in 1887 the system now adopted in practically all large schemes of placing the generating eccentrically to the supply area at a point where coal and water are comparatively cheap, and transmitting the energy at high pressure



Mr. S. Z. de Ferranti.
(President-Designate of the Institution of Electrical Engineers.)

to the district to be supplied. When he first developed his scheme for supplying practically the whole of London from Deptford, transmitting the energy at 10,000 volts, a pressure then considered enormous, he was met with scepticism from all quarters, alike from other electrical engineers and financiers. Yet practically all the essential features which were derided at the time are now standard practice of the present day, and it has been recognised that the metropolis would be able to buy its energy more economically if it were generated from one or two large stations situated on the Thames than by a multiplicity of smaller stations as at present. Mr. Ferranti designed every detail of the scheme, and manufactured not only the generators, but even the high-tension trunk mains between Deptford and London. He was, we believe, the first to use concentric cables. Previously to the building of the works at Deptford, he supplied a portion of London from the famous Grosvenor Gallery station, from which 2,000-volt cables were originally led overhead to the consumers.

The manufacturing firm of Ferranti, Ltd. (then S. Z. de Ferranti & Co.), as is well known, has always made transformers, meters, and switchgear, in addition to generating plant and steam engines, but the manufacture of these two latter classes of plant was discontinued when the firm was reconstructed a few years ago.

Mr. Ferranti is still associated with Ferranti, Ltd., as Director, and is at present living near Sheffield. He has long held the opinion that electrical development in all directions will almost entirely depend on the cost of generation, and has recently devoted himself particularly, in conjunction with Messrs. Vickers Sons & Maxim, to the development of improvements in steam turbine design.

Mr. Ferranti served on the Council from 1895-98, and again from 1903-6, and was Vice-President from 1900-3.

The cordial reception of the announcement of the Council's choice for the new President at the meeting last Thursday indicated—if indication were necessary—the popularity of Mr. Ferranti among the members of the Institution.

Mr. W. H. Patchell, one of the new Vice-Presidents, is the late chief engineer to the Charing Cross, West End & City Electricity Supply Co., a position to which he was appointed in 1893 and resigned in 1906 to take up consulting work. During this period he was responsible for all the extensions of the company's undertaking, including the design of the Bow generating station. Since then Mr. Patchell has carried out a considerable amount of work in connection with the application of electricity to mines and the design of electric power stations. Mr. Patchell was a member of the Home Office Committee which in 1904 considered the drafting of rules governing the use of electricity in mines. He served on the Council of the Institution as Vice-President from 1900 to 1903, and as ordinary member of Council from 1895 to 1898, and 1907 to 1910.



Mr. W. H. Patchell.

Mr. J. H. Rider, the other nominee as a Vice-President has been chief electrical engineer to the London County Council tramways since 1901, and has supervised the electrical arrangements for the entire change over from horse to electric traction in the County of London. The large generating station at Greenwich has been built to his designs. Previously, Mr. Rider was with the Plymouth and Bolton Corporations as borough electrical engineer. He served on the Council of the Institution from 1901-4, and again last year. Mr. Rider was practically the founder of the Incorporated Municipal Electrical Association, and was President in 1902.



Mr. J. H. Rider.

Mr. H. Dickinson is manager of the Leeds Corporation Electricity Department. In 1888 he obtained an appointment with the London House-to-House Company (now the Brompton & Kensington Electricity Supply Co.), and later he was offered an appointment in Madrid by the Electricity Company for Spain, as assistant engineer. After eleven months' stay in Madrid he joined Messrs. Hammond & Co., to look after the laying down of the electrical plant for the Dublin Corporation Electricity Supply Station. In 1893 Mr. Dickinson became manager of the Yorkshire House-to-House Electricity Co., and transferred his services to the Corporation in 1898, when the company's business was taken over. He was first chairman of the Leeds Local Section of the Institution of Electrical Engineers in 1903, now the Yorkshire Local Section, and in 1906 became honorary secretary of that Section.



Mr. H. Dickinson.

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MR. J. E. KINGSBURY.

MR. J. E. KINGSBURY has been interested in the development of the telephone, and has taken an active part in its exploitation since 1878, and he also took an active part in other electrical enterprises during this early period of the industry. In 1883 he entered the service of the Western Electric Co. as manager of their London branch, which was opened in that year. As recently announced in our columns, Mr. Kingsbury retired from the position early in the present year. He was a member of the Council of the Institution from 1900-1903, and again from 1906-1909, and was a Vice-President from 1903-1906. Our photograph was taken specially for ELECTRICAL ENGINEERING by Mr. Kingsbury's son, who is an ardent amateur photographer.



MR. P. V. MCMAHON.

MR. P. V. MCMAHON, Engineer to the City and South London Railway, the first tube railway to be constructed in this country, was appointed in 1896, upon the retirement of Mr. Basil Mott. Shortly after his appointment the extensions of the railway to Moorgate Street and Clapham Common were commenced, and he acted for the Company as consulting engineer in connection with the electrical equipment and rolling-stock for the above extensions, as well as for the extensions of the railway to the Angel and Euston which followed, and involved a change over to a three-wire continuous-current system of distribution, at 2,000 volts, with battery substations. During the years 1897-98 he conducted a number of tests and experiments on tractive resistance in tunnels and drawbar pull of locomotives in actual service. The results of these observations were embodied in a Paper read before the Institution of Electrical Engineers in 1899, and for which he was awarded the Institution Premium. In 1904 he read a Paper on the "Application of the Three-wire System to Electric Traction" before the same Institution, and for this and his former Paper he was awarded the Willans Premium.



MR. R. K. MORCOM.

MR. R. K. MORCOM is a partner in the firm of Messrs. Belliss & Morcom, Ltd., the well-known engine-builders of Birmingham, and a son of the founder. He has devoted himself particularly to the experimental and testing work of the firm. Mr. Morcom was chairman of the Birmingham Section of the Institution in 1909-10, and as such he was an *ex officio* member of Council.



MR. S. L. PEARCE.

MR. S. L. PEARCE, Chief Electrical Engineer to the Manchester Corporation, comes on to the Council for the second time, he having served previously in the year 1907-8. He was, of course, *ex officio* member of the Council during the year he served as chairman of the Manchester Section, viz., 1905-6. In addition to being City Electrical Engineer at Manchester, Mr. Pearce is also responsible for carrying out the extensions there. Two 6,000 kw. turbo-alternators have been put down to his specification and under his supervision, and, among other extensions, he has put down the 12,000-ampere-hour storage battery (the largest in the United Kingdom), a description of which, and the switchgear and boosters in connection with it appeared in our last issue. Mr. Pearce identified himself energetically with the work of promoting and organising the Electrical Exhibition in Manchester in 1908, and acted as Joint Consulting Engineer, and is a Past President of the Incorporated Municipal Electrical Association.



MR. SYDNEY MORSE.

MR. SYDNEY MORSE, who has been nominated for Associate Member of Council, is well known as the Solicitor to several important electrical companies, including the British Electric Traction Co. and its allied undertakings. He has taken a keen interest in the promotion of electric tramways, and has worked hard in endeavouring to secure the removal of the local authorities' veto under the Tramway Acts. He has previously served as Associate Member of Council from 1896 to 1899 and from 1902 to 1905, and will doubtless do further useful work on the Council.

The list of nominations made by the Council of the Institution of Electrical Engineers to fill vacancies on the Council was announced prior to the commencement of the ordinary business of the meeting on Thursday. At the close of the announcement, Mr. Chamen said he wished to nominate Mr. H. Faraday-Proctor (Chief Electrical Engineer to the Bristol Corporation) as a candidate for membership of the Council.

This nomination was seconded by Mr. W. W. Lackie (Glasgow), and was supported by the following: H. Collings Bishop (Newport, Mon.); A. Ellis (Cardiff); H. W. Munro (Exeter); E. G. Okell (Plymouth); H. T. Sully (Bristol); C. A. L. Prussman (Swansea); W. J. Bache (Cheltenham); R. A. Chattock (Birmingham); T. O. Callender (London); D. E. Roberts (Cardiff); T. Schontheil (Cardiff); A. J. Hodgson (Chelmsford).



MR. H. FARADAY-PROCTOR.

MR. H. FARADAY-PROCTOR has the distinction of being the first nominee for a Member of Council whose name has not been put forward by the Council itself. He has been Chief Electrical Engineer to the Bristol Corporation since 1892, prior to which he was Assistant Engineer to the Newcastle-on-Tyne Electric Supply Co. Mr. Proctor reflects with somewhat mixed feelings that he has provided from his chief assistants at various times, chief engineers to some half-a-dozen other important electrical undertakings. He is a past-President of the Incorporated Municipal Electrical Association, of which body he is a very energetic honorary secretary.

Mr. Chamen said he wished to explain that he did not make the nomination in any spirit of antagonism to the Council, but because he had found, with regret, that in various parts of the country, and certainly in the West, the Institution was not looked upon with that favour which he was sure they would all wish. There was a feeling—at any rate out of London—that no one had any interest in the election of members of Council except the members of the Council themselves. He wished to show by this action of his and his supporters that this was not the case, and that the members of the Institution, if they so wished, could share in the election of members of Council. Although Mr. Faraday-Proctor might not be known to all of the members, yet he was known to a great number, and he knew he would attend the meetings of the Council, and, furthermore, he thought there should be members from the provinces on the Council. He believed this would be the first time when there would have been a ballot for the election of members of Council, and he felt that the members of the Institution throughout the country would take a vastly greater interest in the Institution if they realised they could vote themselves. He knew that in many Institutions the Council themselves nominated a larger number of members than there were vacancies to fill, so that each year there was an election. This had been found a most desirable course, and he really hoped the Council of the Institution would see their way to take such a step in the future.

Mr. Chamen, whose speech was received with considerable enthusiasm by the large number of members present, then formally handed in his nomination papers to the secretary.

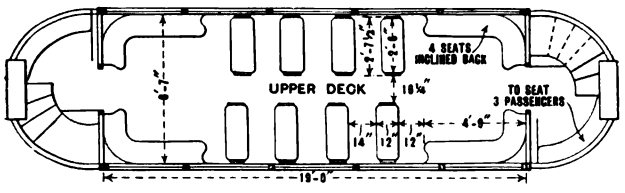
THE PRESIDENT (Prof. Gisbert Kapp) said they were all very much obliged to Mr. Chamen for the trouble he had taken in the matter. The only wish of the Council was to represent fully and fairly the wishes of the members. Mr.

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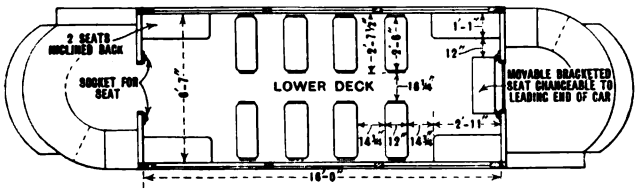
Chamen's nomination would, of course, be sent round to the members to vote upon. He took the opportunity of reminding the members that it was within their province to send suggestions for new members of Council. It was always an assistance to the Council to know the wishes of the members, and if in future years names were suggested to the Council before the Council's nominations were published, they could be included in the Council's list. In voting on the present occasion, the President pointed out that it would be necessary to strike out one name, otherwise the ballot paper would be invalid.

NEW TYPE OF TRAMCAR

A FORM of car with increased accommodation is being adopted by the Liverpool Corporation Tramway Department, and one of the new cars is already in service on the old Swan route. The principal difference between it and the older cars lies in the increased width of the lower deck, which practically equals that of the upper deck, and thus enables rattan cross seats to be employed on both decks. The width of the new body inside, just above the seats, is now 6 ft. 7 in., as against 6 ft. in the older cars, and the outside measurement is 7 ft. 4¼ in., as compared with 6 ft. 9 in. The arrangement of seats is shown in the figure, which is from a drawing sent us



Arrangement of upper deck to seat 32 passengers under cover and 6 outside.



Lower deck with seats for 26 passengers.

Arrangement of Seating on New Car on Liverpool Corporation Tramways.

by Mr. C. W. Mallins, General Manager, Liverpool Corporation Tramways. The lower deck has accommodation for 26 passengers, as against 20 or in some cases 22 on the older type of car, without any increase in length. On the upper deck the seating arrangement has been changed in order to give better facilities for passengers entering and leaving the car, as shown on the above plan, and has accommodation for 38 passengers. The car is fitted with lifting windows of the noiseless type on the upper deck. It has a 7 ft. 6 in. wheel base, which gives it much smoother running than the cars with shorter wheel base at present in use.

Tramways and Light Railways Association Congress.—For the annual congress of the Tramways and Light Railways Association, which will be held on May 12th and 13th, the following programme has been arranged:—On Thursday, May 12th, the Papers down for reading are: (1) "Short History of the Dublin United Tramways Company," by R. S. Tresilian; (2) "Should the Act of 1870 be revised?" by Fred Coutts (Engineer and General Manager, Paisley District Tramways Co.); (3) "Railless Traction," by H. England (General Manager, Wakefield & District Light Railways Co.); (4) "Standardisation of Brake Blocks," by J. A. Panton (Superintendent, Rolling Stock, Liverpool Overhead Railway); (5) "Tramway Economics," by J. R. Salter (General Manager, Lancashire United Tramways, Ltd.). There will be a short discussion after each Paper. In the evening a dinner will be given by the Dublin United Tramways Co. On Friday, May 13th, a visit of inspection will be paid to the power house, &c., of Dublin Tramways. Pleasure trips in the district have also been arranged.

A STREET LIGHTING PHOTOGRAPH

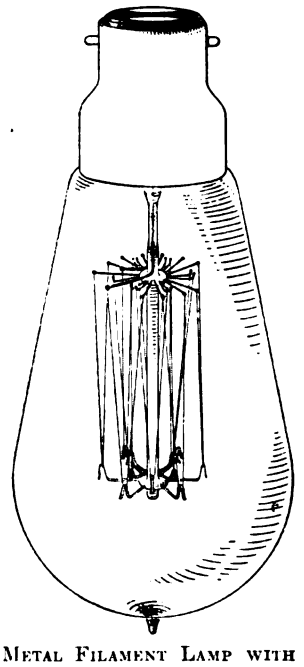
THE General Electric Co., Ltd., has sent us the following reproduction of a photograph taken in a street in the West End of London to show the effect of street lighting. Each of the



lanterns contains two 110 watt Osram lamps with special reflectors. The existing gas lanterns fixed on to the sides of the houses have been utilised.

SMALL HIGH-VOLTAGE METAL FILAMENT LAMPS

THE accompanying illustration shows a new metal filament lamp, which is being placed on the market by Messrs. Galsworthy, Ltd. (15 Newman Street, London, W.). The chief features of the lamp are the small size and the special arrangement of the filaments, which prevents the short-circuiting of the arms of the loops in spite of their being enclosed in such a small bulb. The 40-watt lamp measures 5 in. long by 2¼ in. maximum diameter. In the lamp shown, which is a 40 watt (38 c.p.) 200 volt lamp, there are twelve filament loops arranged in two concentric rows of six each. The radial supports at the base of the pedestal are in one plane, the shorter arms being for the inner loops. The hooked supports at the top are in two planes. Besides being in two rows, the loops are arranged unsymmetrically as shown, thus giving the maximum distance between them. The few loops per row enables them to be spread wide apart at the base, and this gives a wide angle at the bend of the loop, preventing short-circuiting of the bend and consequent overrunning. Owing to the extreme fineness of the filaments, placing them in two rows has no appreciable effect on the amount of light emitted. By employing a larger number of short loops instead of a few long ones, a stronger construction is obtained. These lamps are made in all the standard sizes, and we are informed that an 18 c.p., 20 watt, 200 volt lamp can be supplied. The lamps are manufactured by Mr. S. Horvath at his works at 51 Standen Road, Southfields.



Metal Filament Lamp with Two Concentric Rows of Filament Loops.

The "James Forrest" Lecture.—The eighteenth "James Forrest" lecture will be delivered at the Institution of Civil Engineers, Great George Street, Westminster, London, on Wednesday, June 22nd, at eight p.m., by Sir John Gavey, C.B., the subject being "Recent Developments of Telegraphy and Telephony."

Electric Traction in Chile.—According to the *Financial Times*, the Chilian Government will shortly invite tenders for the conversion to electric traction of the main line railway from Santiago to Valparaiso and its branches. The total length of the line is 156 miles. It is further stated that the conversion of the remainder of the Chilian railways will follow.

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ELECTRICAL EQUIPMENT OF THE SHIELDHALL SEWAGE WORKS, GLASGOW

THE outfall works at Shieldhall are some miles below the centre of the city, and are the completing link in the chain of works which form the important sewage scheme begun some years ago. The works, it may be explained, deal with the whole of the sewage collected in what is known as the southern section, which includes the whole of the municipal area of Glasgow on the south side of the river, the Burghs of Rutherglen, Pollokshaws, and Govan, and various parts of the counties of Renfrew and Lanark. The area drained approximates 14 square miles. A large amount of sewage, collected along the Glasgow riverside area, is pumped through the Kinning Park pumping station (opened on April 4th, 1910) up to a high-level sewer, and is delivered by gravitation into

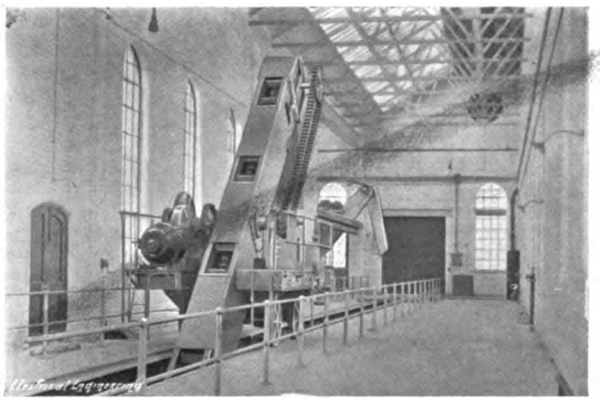


Fig. 1.—Dredger Elevator with Top and Shoot of High Level Screenings Elevator in Background.

the Shieldhall Works. The sewage drained from Govan and South Lanark is pumped up to a height of 21 ft. in the pumping station at Shieldhall. In the ensuing description of the plant the first sewer mentioned above is known as the high-level sewer, and the other as the low-level.

From the electrical engineer's point of view it is perhaps unfortunate that one is not able to say that the whole of the plant is electrically driven. The works are in such a position that it was not possible to come to a satisfactory arrangement with any of the suppliers of power in the vicinity. Consequently it was necessary to lay down a steam plant, with the result that the pumps dealing with the sewage discharged by the low-level sewer are all steam-driven. With the exception of the Weir feed and Edwards' air-pumps, however, all the auxiliary plant and all the various plant required for dealing with the sewage and its purifying process is driven electrically.

The boiler plant consists of a range of three Babcock & Wilcox water-tube boilers, constructed for 150 lbs. pressure, and fitted with superheaters giving a moderate degree of superheat. Chain-grate stokers capable of wide speed variation are employed in conjunction with automatic hoppers, which are fed from an overhead coal conveyor of the Babcock & Wilcox push-plate type; an ash hoist of Messrs. Lowden Bros'. & Co.'s make is also fitted. An economiser has been supplied by the Claycross Co., of Chesterfield. Three Weir feed pumps are provided. The main steam ranges in the engine and boiler room are constructed of wrought-steel piping, and are supported on roller bearings, and the main steam branches are all constructed with wrought-steel bends. Cast-iron exhaust pipes are used. Pockets are fitted at intervals in the main steam ranges in order to facilitate the draining arrangements. Baker oil separators are fitted in the main exhaust from the generating engines, and also from the various sections of the pumping plant. A central condensing plant is installed. This consists of two Mirrlees-Watson condensers, complete with two Edwards air-pumps, and provision is made for automatically exhausting to the atmosphere in the event of any failure of the condensing plant. The most interesting point in connection with the condensing arrangements is that the circulating water consists of effluent water drawn by gravitation from two of the precipitation tanks. Our representative was informed that in the outfall works of the Western District, where a similar system has been in use for some time, it is only necessary to clean the condenser tubes once in three or four months.

There are three generating sets installed, with provision for a fourth. The generators are of Messrs. Crompton's make, shunt-wound, and constructed to give 150 kw. output at 250 volts at a speed of 450 r.p.m. The triple expansion reciprocating engines are of Messrs. Jas. Howden & Co.'s enclosed type; this firm also supplied the main pumping engines.

The main switchboard and power distributing board and sub-boards are of polished slate, the motor-panels being of unpolished slate. The main switchboard is divided into four generating panels, two power-feeder panels, and two lighting-feeder panels. The generator and power panels are equipped with Whipp & Bourne S.P. and D.P. circuit-breakers, with laminated contacts and adjustable time-lag devices. With the exception of the main D.P. switches on the generator panel and No. 2 power-feeder panel, the switches are all arranged in vertical tandem. All the fuse handles are of the Reyrolle ventilated tubular type. Everett Edgcumbe instruments (including the integrating wattmeters on the generator panels) are used throughout.

No. 2 power-feeder panel mentioned above controls the main power distributing board, which is placed but a few feet away from the main switchboard; from this distributing board are controlled all the motor panels in and around the main buildings. No. 1 power panel controls the feeders to the sludge house and the high-level inlet chamber; both of these points are some distance from the main block of buildings. The backs of the main switchboards are arranged with strip copper connections to the bus-bars, the cables are brought into a trench, and the connection of the tails to the terminals is very neat and workmanlike.

An unusual feature in connection with the distribution scheme is that, in addition to telephonic communication from the main switchboard to the sludge

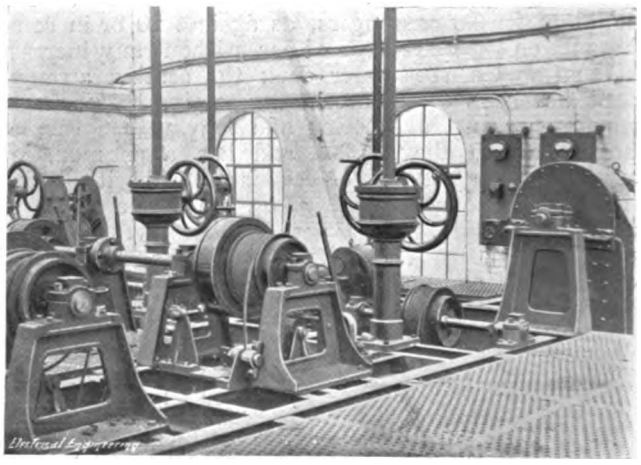


Fig. 2.—Low Level Screen House.

pump house and the high-level inlet chamber switchboards, there is provided a bell-signalling system between each motor panel and the main distributing board, by which the motor operator can signal to the switchboard attendant when power is required.

The lighting feeder and distribution cables are rubber covered, taped and braided, but with this exception, the whole of the cables from the main board

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are vulcanised bitumen, lead-covered, armoured, and braided overall. The cables to the sludge house and inlet chamber are carried on cleats on the building walls as far as possible, but where they enter the ground the armouring ceases, and they are continued as plain vulcanised bitumen, lead-covered cables, in creosoted wood troughing filled with Trinidad bitumen. This arrangement saved the necessity for jointing while giving the desired protection. There are no joints in any of the main circuits. The whole of the cables from the main distributing board are vulcanised bitumen, lead-covered, and are carried through ducts or conduits, as is most convenient. Free use has been made of inspection boxes, some of very large size, in order to avoid making bends in the main conduit runs. The armoured cables are taken through the engine room in trenches, and where they rise up the walls of the adjoining rooms they are clipped in oak cleats spaced about three feet apart. For supports along the wall C.I. stepped racks are used.

There are altogether some 38 motor panels, varying from 3 h.p. for the inlet penstock motors to 30 h.p. for pump and oxidiser motors. Each motor panel is equipped with a totally enclosed starter, a D.P. knife switch in cast-iron hinged case, an ammeter with H.P. scale, and a push-button for the bell-signalling system already mentioned. The starters, which are of Messrs. Hamilton Bros.' make, have no-load and overload solenoid release, and are constructed without the use of asbestos; the larger proportion being water and gas tight. When necessary, the motor panels are equipped with reversing switches.

The whole of the motors are shunt-wound, and a large proportion are totally enclosed; they are all, except the smaller sizes, provided with commutating poles, and have split frames and bearings, thus allowing the armatures to be removed by a direct vertical lift. The specification called for a two hours' run at 30 per cent. overload; under these conditions, the temperature rise has not to exceed 80° Fahr. for the totally enclosed motors.

In order to understand some of the motor applications, it is necessary to have some idea of the various operations and processes. The low-level sewer discharges into a chamber known as the low-level screen house, which is equipped with two lines of box screens and one line of rough bar screens; these screens, which are 4 ft. wide and 7 ft. 6 ins. high, are designed to retain the solid matter entering with the sewage, and are raised and lowered into position by one 5-h.p. motor on each line of box screens, and a 3-h.p. motor on the line of bar screens. The shafting actuating the drums is controlled by clutches in such a manner that only one screen on each line can be operated at once. It is possible to lower the screens by their own weight, controlled by the action of the clutch brake supplemented by an electro-magnetic brake. The screenings are directed into a catch channel, and are discharged into waggons by means of a suitably designed dredger elevator operated by a 10-h.p. motor. The sewage, after leaving the low-level screen house, is lifted a height of 21 ft. by the steam-driven centrifugal pumps, and is discharged into what is known as the catch pit, where it is joined by the high-level sewage, which is discharged by gravitation through a screen house similarly equipped to the one described above. In the catch pit the sewage is mixed with purifying solutions, known respectively as the iron liquor and lime mixture. The catch pit is 160 ft. long by 17 ft. deep and 16 ft. wide at the widest part, and in section it resembles somewhat the outline of a peg-top with square shoulders. The top is partially closed in leaving a longitudinal opening 160 ft. long by about 3 ft. 6 in. wide. Surmounting the opening and running parallel to its centre is a railway track, which accommodates the novel dredger elevator, designed by Mr. W. D. Hamilton to lift and discharge the precipitated matter which collects in the narrow gulley at the bottom of the pit into waggons which are attached to the dredger truck. The dredger travels backwards and forwards at a constant speed, and is entirely automatic in its action. It is operated by a 1-h.p. shunt-wound motor, which is supplied by power from a triple trolley line, the lines being positive, negative, and shunt. This arrangement was adopted in order to allow of the machine being started and stopped from a point near the end of the building.

From the catch pit the sewage is discharged into the precipitation tanks, and, after the resulting effluent water has been drawn off, the sludge remaining is lifted by centrifugal pumps into cast-iron tanks, in which it is stored until the arrival of the sludge vessel at the riverside wharf. The sludge is discharged from the storage tanks into the ship's hold by gravitation, and is then carried out to sea. The equipment of the sludge pumping house consists of three 9 in. centrifugal pumps of Messrs. William Drysdale & Co.'s make, each driven by a 30-h.p. motor running at 600 r.p.m. The half-couplings on the pump shafts have large holes, into which pins projecting from the face of the half-couplings of the motor ends of the sets fit loosely; this arrangement allows the motor armatures to have the necessary end play. Rubber washers are fitted round the pins in order to take up shock.

The pumps just mentioned are for dealing with the sludge, but in addition there is fitted a 6-in. pump driven by a 15-h.p. motor for the purpose of spraying clean water into the tanks for cleaning-down purposes. Two 6-h.p. Brackett exhausters are installed for the purpose of assisting the sludge pumps at starting. The main feeders from the engine house are brought into a main panel, which supplies four power and lighting distributing panels, equipped in similar manner to the distributing board already described. A distributor is taken to the Riverside Wharf, where a 3-h.p. motor is installed to raise and lower the sludge discharge pipes to correspond with the position of the sludge vessel on a rising and falling tide.

The iron liquor mentioned is oxidised in what are known as oxidising chambers, which are large round tanks constructed of oak, with revolving paddles of the same material inside; there are three of these tanks in line, and the revolving paddles are actuated from a three-section shaft, fitted with clutches in such a way that no more than two sections can be driven from one end at once. A 30-h.p. motor is fitted at each end of the shaft line, and the arrangement described allows of one or two oxidisers being driven from either motor. The solution is fed into the oxidisers by gravity from a small supply tank, into which it is forced, from an air chamber under the floor level, by compressed air supplied from a 3-h.p. motor-driven air-compresser.

In the preparation of the lime mixture there are two processes. In the first, the lime is passed through machines known as lime-mixers, of which there are two pair, each pair being driven by a 30-h.p. motor through spur and pinion gearing. In the second, the prepared lime is made into solution in what are known as lime-stirring tanks, which are shallow concrete-lined ponds, equipped with moving iron structures designed to agitate the solution. These agitators are three in number, and are constructed principally of angle iron, forming open frames about 20 ft. wide, and sufficiently deep to reach the bottom of the tank. The structures travel backwards and forwards along the tanks, and are arranged to tilt right down into the corners at the ends of the tanks in such a way as to prevent the accumulation of lime at these points. They are actuated by wire ropes driven from 15-h.p. electrically-operated haulage gears arranged for automatic reversal. In the inlet chamber already mentioned there are four Glenfield & Kennedy penstocks operated through worm gearing by four 3-h.p. motors. The feeder is branched into enclosed power and lighting fuseboards arranged on the wall.

One 8-ton crane is arranged in the engine room, and another in the main workshop. The cranes are of Messrs. Jas. Carrick & Son's make, with three-motor equipments. In the main workshop there are two groups of engineering tools, both driven by 10-h.p. motors, the only individual drives being a 5-h.p. bandsaw and a 5-h.p. blast fan.

A notable feature of the mechanical equipment is the free use of worm-reduction gears on practically all the motor drives, and the large number of clutches in use. The former are of Messrs. D. Brown & Son's make, and the latter Messrs. D. Bridge & Co.'s make; the only other forms of mechanical transmission adopted appear to be spur and pinion gears and chain drives.

At the ends of the main buildings there are installed five 36-in. Blackman fans. The general interior lighting in the engine room is by means of Osram weather-fitting clusters hung on brackets from the wall; in other parts of the main building there are some 28 Gilbert enclosed arc lamps, arranged with lowering gear of Messrs. the North Western Electric Appliance Co.'s make. Provision is made for the installation of further arc lamps on standards around the precipitation tanks.

The offices are equipped with a complete set of "Prometheus" electric heating and cooking apparatus, supplied by Simplex Conduits, Ltd.

The whole of the electrical and mechanical equipment, the necessary buildings, substructures, super-

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structures, &c., have been constructed to designs of Mr. William D. Hamilton, M.Inst. Mech.E., of 59 Bath Street, Glasgow, and under supervision of Mr. W. P. Miller, assistant to Mr. Hamilton.

The whole of the electrical work, in fact, the whole of the power equipment of the works, has been in the hands of Messrs. Lowdon Bros. & Co., of Dundee and Glasgow, who themselves constructed the main switchboards and other important parts of the plant, and Mr. W. D. Hamilton has expressed himself as being highly satisfied with Messrs. Lowdon Bros.' work. The sub-contractors for the motors were The Rees Roturbo Co. and Messrs. Wright, Wood & Co., and for the motor panels Messrs. Hamilton Bros., Glasgow, who also supplied the Everett Edgcumbe instruments. The cable was all supplied by Messrs. W. T. Glover & Co., Ltd., of Trafford Park, Manchester.

In conclusion, we should like to express our thanks to Mr. W. D. Hamilton, and to Mr. Morris, representative of Messrs. Lowdon Bros. & Co., for information supplied, and for facilities afforded to our representative for inspecting the plant.

ELECTRIC LIGHT AND POWER IN SHANGHAI

THE annual report of the electricity department of the Shanghai Municipal Council shows that close on six million units were sold during the year 1909, an increase of 29 per cent. over the previous year. These include two million units for the tramways, over 600,000 units for public lighting, and 320,000 units for power and heating. The maximum load on the station was 3,100 kw., while the generating plant capacity is 4,400 kw., including the 800 kw. Willans-Peebles turbo-alternator installed in 1908. The load factor is 22·05 per cent. In spite of trouble with the turbine plant, necessitating the more frequent use of the older reciprocating engines, the coal per unit sold has been reduced to 6·02 lbs. The total working costs, including repairs and maintenance of the distribution system, rent, rates, and taxes, and management expenses, work out at 1·246 pence per unit.

The charges in Shanghai are, we believe, lower than those charged anywhere else in the East. The price per unit for lighting, which is made up either on the discount system or on the maximum demand, is from 13 to 8 cents (3·7d. to 2·28d.). The power rates are on the sliding scale, according to the monthly consumption per horse-power installed, and range from 6 cents (1·71d.) to 2·5 cents (0·713d.) per unit. In the hope of building up a large heating and cooking load, energy for these purposes is shortly to be sold at a flat rate of 3 cents (0·86d.). Gas is supplied by a company at 3s. per 1,000 ft. for lighting, and 2s. 8d. per 1,000 ft. for power, heating and cooking, with discounts. It is proposed to hire out electric heating and cooking appliances to create a demand for domestic purposes. An arrangement has been made to purchase these heaters and cookers by open tender through the local contractors, in order to benefit them at the same time as affording facilities to the consumers.

Incandescent lamps (specially stamped) of only good makes are sold by the department to consumers, at a small profit. These lamp contracts are placed with the local contractors, the last one being for 23,000 metal filament and 10,000 carbon filament lamps. Motors and arc lamps are hired out to consumers on a monthly rental.

Mr. T. H. U. Aldridge, the Municipal Electrical Engineer, reminds us that in comparing the above costs with home undertakings, it must be remembered that interest on money in Shanghai is at 6 per cent., as against the average of 3 per cent. in England; that the plant is depreciated at higher rates than those prevailing in England; that wages and management costs are not so low as might be expected, because the European members of the staff are paid nearly double what they would receive in England, and native labour is not really cheap, since so much of it is required to do the work which less than half the number of Europeans could perform; and lastly, that repairs and maintenance costs are higher on account of the overhead mains. The coal used is Japanese, having calorific value of 11,915 B.Th.U. The cost averages about 14s. to 15s. per ton, landed at the works.

During the year the distribution system has been enlarged by the amount of 109 miles of cable, including over 30 miles of H.T. feeders. Five new sub-stations were installed, bringing the total number up to 60. Eleven of these are equipped with Berry automatic series switches for cutting out the large transformers during periods of light load. The power load has increased considerably, and there is now some 800 h.p. connected. Some 4,000 fans are connected, and the punkah is practically extinct. The public lighting includes 343 arc lights and 364 metal filament lamps. The house service connections now number over 3,200. A 1,000 ampere hour (Chloride) storage battery and a 300 kw. motor generator have been added to the plant. Two 480 kw. Howden-Siemens mixed pressure turbo-alternators will shortly be installed, and will enable the building of the proposed new power station to be postponed. The accounts show a net profit of 5 per cent. on the capital, the gross profit on the year's working being 10·3 per cent.

PHOTO-TELEGRAPHY

AT the Royal Institution, London, on Friday evening last, Mr. T. Thorne Baker, of the photo-telegraphic department of the *Daily Mirror*, delivered a lecture in which he described the latest advances in photo-telegraphy by wire and wireless. Mr. Thorne Baker's apparatus, the "telectograph," was fully described in an illustrated article in Electrical Engineering, August 6th, 1909, Vol. V., p. 697. At the sending station is a metal drum revolving under an iridium stylus. The photograph to be transmitted is printed on to a bichromatised film on a sheet of lead foil through a coarse single-line screen. This foil is then wrapped round the drum. The receiver consists of a similar drum revolving synchronously with the sending drum, and having a wrapping of chemically prepared paper, on which bears a platinum stylus. Every time the transmitter stylus comes in contact with the lead foil, a current impulse is transmitted along the line, and a black mark appears on the receiving paper. The method of reproducing the photograph is clear, when it is remembered that each stylus traces a spiral path round its drum. The impulses follow rapidly one after another at the rate of 300 per second, and in order to make the marks well defined and exactly equal in length to the spaces between the gelatine lines, an arrangement of cells, resistances and condensers, called a line balancer, is used, which wipes out the residuary currents from the cable as in duplex telegraphy. The drums are driven by small motors run off accumulators. The motors are started at the same speed by means of frequency meters connected to slip-rings, and are then left, the gain in speed of each being approximately the same. Mr. Thorne Baker showed for the first time a portable instrument of this pattern, with the aid of which a photographer could telegraph a photograph to a newspaper office directly he had taken it, by connecting the apparatus to the nearest telephone station. The apparatus is said to weigh only 24 lbs. complete, and to cost about £25. A portrait of the Queen, transmitted by one of these portable instruments from Brighton to London in six minutes was shown. Very successful results obtained with the larger apparatus used between London and Manchester, and between London and Paris, were also exhibited, and during the lecture a portrait was transmitted from Manchester direct to the lecture hall.

The lecturer then proceeded to describe Prof. Korn's system, in which use is made of the electrical properties of selenium (Electrical Engineering, Vol. II., page 766), and mentioned that Korn was now constructing apparatus with a view to transmitting photographs from New York to London. The method employed to compensate for the inertia of the selenium cells was then explained. Mr. Thorne Baker also described an apparatus for measuring the strength of X-ray tubes by allowing the rays to fall on a fluorescent screen in contact with a selenium cell. The scale of a milli-ampere meter in circuit with the cell could be calibrated so as to give a direct reading of the strength of the rays, or of the time necessary for the correct exposure of a given photographic plate.

Finally, Mr. Thorne-Baker described a modified form of his telectograph, in which the current impulses are transmitted by wireless with the aid of a special form of decohering apparatus. An outline portrait of the King transmitted in this manner in 7½ minutes was shown, as well as a simple plan, such as might be used for military or naval purposes. A modified form of the Einthoven galvanometer for use with wireless telephotographic apparatus is being constructed. The received oscillations will be rectified by a valve receiver and passed through the silvered quartz fibres. The fibre is in a strong magnetic field, and is displaced, and this allows a beam of light to reach a pair of compensated selenium cells. By means of a relay, the variation of resistance of the cells is caused to work the receiver of a telectograph instrument.

Glasgow Local Section of the Institution of Electrical Engineers.—In the list of the nominations for the new committee of the Glasgow Local Section of the Institution of Electrical Engineers on page 267 of our last issue, the name of Mr. J. C. McMillan was given in error for that of Mr. Campbell McMillan (Electrical Control, Ltd.).

Electric Light and Power in Country Houses.—We have received so many applications for copies of this book that the supply of copies kindly placed at our disposal by Messrs. Drake & Gorham did not suffice to meet the demand. We regret, therefore, that we have been unable to send copies to several of our readers who asked for them.

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STREET LIGHTING IN THE WEST-END OF LONDON

As announced on p. 267 of our last issue, the City of Westminster, at a meeting held on April 14th, decided to accept the tender of the Gas Light & Coke Co. for street lighting in Regent Street, Piccadilly, St. James's Street, Pall Mall, Coventry Street, and part of Shaftesbury Avenue, in which electric lighting is now employed. The contracts for the electric lighting of these streets by means of 46 ordinary arc lamps and 20 flame arc lamps expire this year, together with contracts with the Gas Light & Coke Co. for gas lighting in a large number of other streets in the area under the control of the City of Westminster. Fortunately, this resolution does not exclude electric street lighting altogether within the City of Westminster, for there are other contracts running. In the Strand district there are 121 ordinary arc lamps and 3 flame arc lamps, the contract for which is terminable in 1913 or 1920 at the option of the Council, and in the St. George's Parish, the contract for five flame arc lamps is terminable in 1913, while that for the bulk of the lighting (957 ordinary arc lamps and 216 "various" lamps) only expires in 1931. We have no doubt, however, that the electric lighting companies will not be satisfied merely in retaining this latter portion of the street lighting, and will make a determined effort to-night, through their supporters on the Council, to obtain a reconsideration of the award at the meeting a fortnight ago. The circumstances which should render this possible are as follows:—

Instead of simply scheduling the streets which are to be lighted, and the number and size of lamps in each, and asking for tenders, the Council invited tenders both from the Electric Lighting Companies and the Gas Company *per lamp* of various sizes, and in four districts. These tenders were considered at the meeting on April 14th, and that of the Gas Company accepted, and to-night the Works Committee are bringing forward a further report recommending the number and size of the lamps to be utilised in the four districts. These represent a very large number, although, as we have said, it was only in Regent Street, Piccadilly, and some adjoining streets that electric lighting was employed.

Owing to the tenders being invited in this manner, the electric light companies were, of course, at a considerable disadvantage. Obviously, if the streets already lighted in which arc lamps are in use, the cost of the lighting would be considerably less than that in other streets in which mains, lamp-posts, lamps, and lanterns would have had to be erected. On the basis upon which the tenders had to be made, the Gas Company's tenders were considerably lower in each of the districts and for each size of lamp; so much so, in fact, that it would have been very surprising if the Westminster Council had not accepted them. On the other hand, it is reasonable to suppose that the electric light companies would have been able to offer a far lower price, and been able to compete effectively with the Gas Company for the lighting in Regent Street, Piccadilly, &c. A still further handicap against the electric light companies is that it is free to the Council actually to use the existing electric light standards in these streets for their new gas lamps.

At to-night's meeting of the Council the Works Committee are presenting a report giving the list of the streets to be dealt with under the new contracts, a schedule of the number of lamps of the various sizes which they propose to use, and the cost. The total numbers of lamps which it is proposed to put in are as follows:—1,246, 90 c.p.; 1,165, 180 c.p.; 297, 300 c.p.; 10, 1,000 c.p.; 153, 1,800 c.p.; and 16, 3,000 c.p. The first three sizes refer to low-pressure gas lamps, and the last three sizes to high-pressure gas lamps, and they include the substitution of 55 1,800 nominal c.p. gas lamps for 51 1,000 c.p. and 4 1,800 c.p. arc lamps, and 16 3,000 nominal c.p. gas lamps for 16 3,575 c.p. arc lamps, the latter being the much-discussed lamps in Regent Street.

In their new report, the Works Committee go out of their way to "rub in" the discrepancy between the tenders for gas and electric lighting, pointing out that, on a five years' contract, the cost of the gas lighting will be £14,450, as compared with a cost of £24,900 if the streets had all been lighted by electricity. On a ten years' contract the comparative figures would have been £13,800 for gas, and £21,800 for electric lighting.

We cannot but think that, in all fairness to the electric company, it should be given an opportunity of giving an amended tender for the electric lighting in those streets already mentioned in which the arc lamps already exist. Although it has been suggested on many sides that the Gas Light & Coke Co.'s tender is considerably below cost, and the electric lighting company's tender might therefore still be higher, yet there is no doubt, having particularly in view the fact that the householders in Regent Street have expressed a decided preference for electric lighting, that the electric lighting company's tender would prove the more acceptable in those streets.

At the last meeting, a petition was presented by the ratepayers asking the Council to postpone any contract for the gas lighting of Regent Street till the matter might be further considered, but the petitioners have been informed that the Council did not see their way to postpone the consideration of the tenders, and had decided to accept the lowest.

In response to several requests that we should publish the actual tenders, both for electricity and gas, we are now able to give the two tables below, from which it will be seen that both for the cost of installation and for maintenance, the gas tenders are very much the lower. The "maintenance" quotations include supply of gas or electricity, and, in the case of electric lighting at any rate, interest, &c., on the capital outlay.

Summary of Tenders for Installation per Lamp.

Candle Power Units.	Gas. A, B, C and D Districts.			Electric. A, C and D Districts.			Electric. B District.		
	5 yrs.	10 yrs.	15 yrs.	5 yrs.	10 yrs.	15 yrs.	5 yrs.	10 yrs.	15 yrs.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
90	2 16 6	2 15 0	2 12 6	5 0 0	4 0 0	3 7 6	5 0 0	4 10 0	4 0 0
180	4 10 0	4 7 6	4 4 0	8 0 0	6 10 0	5 15 0	8 0 0	7 5 0	6 10 0
300	6 10 0	6 6 0	6 0 0	12 0 0	10 10 0	9 5 0	11 0 0	10 0 0	9 0 0
1800	15 10 0	15 0 0	14 5 0	21 0 0	19 5 0	17 10 0	20 0 0	19 0 0	18 0 0
3000	22 0 0	21 5 0	20 5 0	30 0 0 [28 0 0 in C & D]	25 0 0	22 0 0	28 0 0	27 0 0	26 0 0

Summary of Tenders for Maintenance, per Lamp per Annum (including Supply of Gas or Electricity for 3,940 Hours Burning).

Candle Power Units.		Gas. District A.	Gas. District B.	Gas. District C.	Gas. District D.	Electric. Districts A, C and D.	Electric. District B.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
90	Fitted to existing gas pillars	†0 7 6 ‡1 5 0	0 7 6 1 5 0	0 7 6 1 5 0	0 7 6 1 5 0	— 2 10 0	— 2 10 0
180	Do., with extension to 12 ft.	†0 12 6 ‡1 5 0 *3 10 0	0 12 6 1 5 0 3 10 0	0 12 6 1 5 0 3 10 0	0 12 6 1 5 0 3 10 0	— 2 15 0 6 10 0	— 3 0 0 6 10 0
300	Do., do to 15 ft.	†1 10 0 ‡4 0 0	1 10 0 4 0 0	1 10 0 4 0 0	1 10 0 4 0 0	4 0 0 7 10 0	4 0 0 8 0 0
1800	Special design pillar, 20 ft.	§— ‡10 0 0 *20 0 0	2 10 0 10 0 0 17 0 0	2 10 0 10 0 0 17 0 0	— 10 0 0 20 0 0	— — 30 0 0	— — 35 0 0
3000	Do do.	§— ‡10 0 0 *21 0 0	2 10 0 10 0 0 18 0 0	2 10 0 10 0 0 18 0 0	— 10 0 0 21 0 0	— — 35 0 0	— — 35 0 0

† Converting existing lanterns ‡ New lantern where necessary
§ New lantern on electric pillars * New pillars

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We have received the following correspondence on the above subject:—

To the Editor of Electrical Engineering.

Sir,—I have read your article in connection with the decision of the Westminster City Council to accept the estimate of the Gas, Light & Coke Co. for the lighting of Regent Street, Piccadilly, &c., by high-pressure gas instead of by electricity. The competition between high-pressure gas and electric flame arc lighting has during the past few years been very acute, in some cases gas has been awarded the contract, whilst in others electricity has been victorious. This is curious, for it has been shown over and over again that the cost of the candle-power from flame arcs is considerably lower than that from high-pressure gas, and electricity is generally more advantageous.

It is very often readily stated by our fraternity that because the gas people have succeeded in making a lower price than the electric company, that they have quoted under cost price for the advertisement. Personally, I do not think this is the case nine times out of ten. The conditions of the contracts under which tenders are made are generally, in my opinion, the prime cause of the high cost of electric lighting, for the capital outlay in expensive posts, line cables, and so forth, weigh heavily against us when the contracts are for comparatively short periods, and, unfortunately, the general tendency seems to be to shorten the lighting contracts further.

The arc lamp industry at present is deficient, inasmuch as it has not produced an arc lamp which can compete on even capital cost terms with the gas. Such a lamp for the purpose would be one of about 1,500 c.p., burning singly in parallel across the 200- or 400-volt networks without the use of transforming apparatus, total consumption of lamp 200 to 250 watts, at least 100 hours burning, and cost of carbons say a twentieth of a penny per lamp-hour. A lamp as this indicated on inexpensive pillars would reduce costs of running and capital outlay from a third to a half of present rates. As an arc-lamp maker I am disposed to think that such an almost ideal lamp is not outside the bounds of possibility. I think that we may see the fulfilment.

Cambridge Place, Yours faithfully,
Burrage Road, Woolwich. Charles Oliver.
April 22nd, 1910.

To the Editor of Electrical Engineering.

Sir,—It is now well known that arc lamps of 3,000 candle-power can be maintained for 4,000 burning hours per annum at from £14 to £24 each, according to the total cost of electrical energy, and electrical engineers would certainly welcome the assurance that the powerful London companies were realising the importance of their action in this matter with regard to the welfare of the industry at large, and not allowing themselves to be influenced by any hard and fast rule concerning the ratio of profit to outlay where work of such immense advertising value is concerned. In the absence of information it is only possible to assume that the estimates for electric lighting were based upon the lowest rate per unit which any private consumer would be quoted for a supply of similar load factor and value to the undertaking.

In the writer's opinion such work should not be carried out at a loss, but the usual profits might be sacrificed on all incidental outlay, and their amount debited to publicity account.

The satisfactory lighting of the busiest thoroughfares in the world would bring a better return than expenditure on posters, which seldom convey any clear message to the preoccupied crowds which stream past the coloured matter of a London street hoarding.

April 26th, 1910. W. B.

In response to some inquiries, the Mr. Jacques Abady, Chairman of the Works Committee of the Westminster City Council, who was referred to in the article of our last issue, is the same Mr. Abady who is a member of the firm of Messrs. Alexander Wright & Co., of Westminster, and is one of the inventors of the Simmance-Abady photometer. The firm is fairly well known to central station engineers as makers of CO_2 recorders, draught recorders, gas analysis apparatus, &c. Although it has been suggested to us that Mr. Abady, whose firm has, of course, large business relations with the gas interests, should not have taken so prominent a part with regard to the award of these contracts, yet we fail to see how his Committee could have done otherwise than award the contracts to the Gas Co. on the prices tendered. The injustice to the electric lighting companies lies, as we have already stated, in the manner in which the tenders were invited, and we presume that it was the Westminster City Engineer, and not the Chairman of the Streets Committee, who was responsible for drawing up the specification.

THE PHOTOMETRY OF ILLUMINATION

On Thursday, April 14th, a meeting of the Illuminating Engineering Society was held at the Royal Society of Arts, London, and the discussion on the subject of photometry was continued. A report of the discussion at the last meeting was given in Electrical Engineering, March 17th, 1910, p. 186. Dr. S. P. Thompson, who was in the chair, desired the members to confine their remarks, as far as possible, to the subject of illumination photometry.

Mr. A. P. Trotter (Electrical Adviser to the Board of Trade), referring to the question as to whether the surface on which the illumination of any space was to be measured should be horizontal or inclined, said that where many sources of light were concerned a horizontal surface was best, as it summed up all the lighting. A photometer should, in his opinion, have a horizontal screen with no obstruction, so that the light could come from all round. The screen should be free from glaze and angle errors. He had found an electric lamp most suitable, although in Germany a benzine lamp with the flame adjusted to a certain height was much in use. The total time an electric lamp was switched on was only one-half to three-quarters of an hour for one evening. It was very necessary, however, to check the lamp carefully before and after the tests. On one occasion he had found his lamp 15 per cent. out on returning from an evening's work, due possibly to a loose contact. For an outdoor photometer, a range of 1 to 10 was not enough; it should be capable of reading up to 4 foot-candles and down to 0·02 foot-candles, or lower. The lower limit was really the most important, as it was the minimum illumination which had to be measured most carefully in cases of dispute concerning lighting contracts. A photometer for ordinary use should be capable of comparing lights of different colours as met with in street lighting to within an accuracy of from 4 or 5 per cent. without the aid of any "flicker" arrangement. It was not necessary to attempt any greater accuracy on account of the variations due to reflected light from buildings and the fluctuation in gas pressure or in voltage. Mr. Trotter then demonstrated the use of his own illumination photometer made by Messrs. Everett, Edgecumbe & Co. (see Electrical Engineering, May 16th, 1907, Vol. I., p. 849). He preferred to work without a tripod. The instrument could be held horizontal with the aid of the level, but he had found that when measuring between two sources of light a slight inclination did not matter, as what was lost from one lamp was gained from the other.

Mr. Lancelot Wild (Westminster Electrical Testing Laboratories) gave the results of some experiments made to determine the relative sensitiveness of the various photometers. The results showed that the Bunsen was the most sensitive, while the Lummer-Brodhun came second. He also exhibited a modified photometer of the latter pattern, in which both eyes were used. In one form, with a mirror silvered on the front, the slightest movement of the photometer head threw the illumination out of balance.

Mr. Clarke (Gas Light & Coke Co.) said that he used the Bunsen photometer for testing gas mantles, and found it the only photometer he could work with for long periods without fatigue. With regard to the measurement of the candle-power of sources of light, he preferred to take a complete distribution curve than to measure the mean hemispherical candle-power by one observation, as in the Ulbricht globe test. It took some time to take a curve, but it was much more useful. When checking the illumination of spaces, he found it more convenient to measure the candle-power of the individual lights and to calculate the illumination. He then demonstrated the use of a portable Simmance-Abady photometer used for this purpose. The electric standard was enclosed in a globe with an adjustable aperture for varying the illumination of the flicker wheel. It was important that the wheel should run at a low speed for low illuminations.

Mr. Haydn Harrison emphasised the statements made by Mr. Clarke that a reading of mean hemispherical candle-power was no use, and that it was necessary to obtain a distribution curve. He did not agree with Mr. Trotter that an inclination of the screen some 2 or 3 degrees from the horizontal was unimportant. It might not matter exactly half-way between two lamps, but if nearer one lamp than the other there would be a big difference. When the illumination at any point was too low to measure on the horizontal, he took it nearer the source, and then calculated it for the further point. He had found a small tungsten lamp an excellent standard; it varied little with the pressure, and could be relied upon for an accuracy of within one per cent. By inserting a resistance, the candle-power could be reduced to one-tenth the normal value, and it

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was still accurate. It was certainly unnecessary to attempt a greater accuracy than 5 per cent. for street lighting work. Mr. Harrison then demonstrated the use of his "Universal" photometer, made by Messrs. Elliott Bros. (see Electrical Engineering, January 14th, 1909, Vol. V., p. 43). This was provided with a flicker wheel rotated by means of a blast of air from a rubber bulb. A special attachment enabled the angle of incidence of the rays on the screen to be easily read off, so that it was not necessary to adjust the screen exactly. A measurement was then made in the lecture hall, which showed that the illumination on the platform at the height of the table was 0·7 foot-candles. The electric lights were then switched off, and the original gas burner lighted. This gave an illumination at the same point of 0·08 foot-candles, thus affording a striking demonstration of the improvement effected.

Mr. B. J. Waldran called attention to the responsibility of the architect in providing efficient illumination, both daylight and artificial, and emphasised the importance of introducing the study of illumination into the training of architects. It was very difficult to measure the daylight illumination of a room, but the proportion of lighting in a room to that outside was always the same. If the illumination outside and inside were measured at the same time, a good idea of the efficiency of the lighting arrangements could be obtained.

In a written communication, Dr. W. E. Sumpner (Birmingham University) alludes to the possible sources of error in the method of measuring the mean spherical candle-power by the Ulbricht globe, and discusses whether it is possible to get equally good or even better results by using a rectangular box whitewashed or covered with matt white paper inside.

PARLIAMENTARY INTELLIGENCE

THE TROLLEY 'BUS.—The Bill of the Bradford Corporation, seeking powers to adopt the trackless trolley system of electric traction, was passed by the Local Legislative Committee of the House of Commons last week. We gave details of the scheme on page 269 of our last issue, and owing to the opposition of the local carriers, the proposal has been sanctioned under somewhat different conditions to those inserted in the Bill of the Leeds Corporation, which has already been passed by the same Committee. In the case of Bradford, the Committee have approved of the principle of the system for experimental purposes on one particular route. Its extension to other routes must be the subject of a further Private Bill or a Provisional Order, and the same procedure is to apply in the case of the Corporation desiring to convert the trackless trolley system to a tramway when the traffic develops. It is also a condition that the Tramways Committee are to keep separate accounts of the trackless trolley system. In regard to the tramway portion of the Bill, the Committee allowed the Corporation to carry parcels up to the weight of 56 lbs. over the whole tramway system. A few short tramway extensions were also authorised.

RHONDDA TRAMWAYS.—The Bill promoted by the Rhondda Urban District Council for the extension of the tramways in that district was considered by the Local Legislation Committee of the House of Commons last week, and passed. The tramways in Rhondda are run by a local tramway company formed by the National Electric Construction Co. under an agreement with the District Council. It is now proposed to extend the tramways in various directions at an estimated cost of £35,000, of which £29,000 is for construction, and will be repayable in thirty years. The only real opposition was from the Taff Vale Railway Co. from the point of competition, and the possible loss to them as ratepayers, should the proposed extensions prove unprofitable. Mr. Robert Hammond gave evidence in support of the Bill. The Committee agreed to the terms of agreement between the tramway company and Council, which was a rearrangement of the agreement entered into when the tramways were first constructed. The Council will now purchase the tramways as a going concern at the end of twenty-four years.

PROGRESS OF ELECTRICAL BILLS.—The Baker Street and Waterloo Railway Bill was read a third time in the House of Lords last week.

The North-East London Railway Bill and the London United Tramways Bill were read a second time, and the Wimbledon and Sutton Railway Bill a third time, in the House of Lords on Monday.

The Farnham Gas and Electricity Bill was ordered for third reading in the House of Commons on Monday.

The North and South Shields Electric Railway Bill was read a second time in the House of Commons on Monday.

The Handsworth Urban District Council Bill was read a third time and passed in the House of Lords on Tuesday.

South African Institute of Electrical Engineers.—The third ordinary general meeting of the South African Institute of Electrical Engineers was held recently at the University College, Cape Town. Mr. Elsdon Dew presided. Mr. A. E. Scott read a Paper on "Rotary Converters" and "Notes on the Erection and Maintenance of Electrical Plants on a Gold Mine." Prof. R. A. Lehfeldt exhibited some electrical measuring instruments.

WIRELESS TELEGRAPHY

THE total number of licensed wireless telegraph stations in the United Kingdom on December 31st, 1909, was 260; 241 of these are for experimental purposes only, of which 58 are in the County of London. In addition to these, 32 licences are held by shipowners in the United Kingdom, covering 116 ships, a list of which has just been published in a Parliamentary paper, obtainable from Wyman & Sons, Ltd., Fetter Lane, E.C., at the price of 1d. The total number of unofficial or non-departmental radio-telegrams exchanged between the shores of the United Kingdom and commercial ships at sea from March 31st to December 31st, 1909, was 54,496. No radio-telegrams embodying a general call for assistance were received at any of these stations, but in three cases vessels which were in distress communicated with their owners or agents through these stations. One of these was a damaged steamship, asking that a vessel might be sent to take off her passengers; in the second case, a steamship reported that she had been in collision with an unknown vessel; and in the third case a steamship had run short of coal and wanted to be towed. In addition to this, in sixteen cases (fifteen at the North Foreland and one at Caister-on-Sea station) vessels in distress were reported by lightships communicating with the stations by wireless telegraphy, and the local coastguard was informed in each case by the same method of communication. Between August 14th and September 17th, 1909, during salvage operations on the sunk submarine, H.M.S. *Vindictive* exchanged 172 messages with the Caister-on-Sea station.

On Saturday last, April 23rd, the Marconi wireless telegraph service between Ireland and Canada, which was stopped in August last owing to the destruction by fire of the Glace Bay station in Canada, was resumed, and it was announced that the Marconi Co. is prepared to accept public messages for direct transmission across the Atlantic at the low rates published in our last issue. The Clifden station in Ireland has also been re-equipped. According to the special correspondent of the *Times*, the area occupied by the buildings and aerials is 350 acres, and the total horse-power of plant installed is 1,100. It appears that there are three alternate methods of producing the high-tension discharge, and that in the event of the breakdown of one portion of the plant, one of the other two portions will be immediately ready for use. It is also stated that the plant includes an air condenser consisting of eighteen hundred plates of galvanised steel, 30 ft. by 12½ ft. The transmitting aerial comprises some 60,000 ft. of wire arranged on twelve poles in the form of a fan, so as to obtain a directive effect. For receiving a second and smaller aerial is used. We understand that the speed of transmission is about 20 words per minute.

The *Times* understands that the French Minister of Posts and Telegraphs has agreed to the erection of a wireless telegraph station at St. Lazare, to work in conjunction with the Marconi Company, which is to receive three-fifths of the receipts. The company is to take over and improve stations erected at Cadiz, Teneriffe, and Las Palmas by Spanish concessionary companies, and to construct others at Cape Finisterre, Barcelona, the Balearic Islands, and other points in Spain. High-power radio-telegraphic stations are also approaching completion at Coltarno in Italy, at Massowah on the Red Sea, and at Magadicio on the East Coast of Africa, and it is intended that all these stations shall communicate with one another by wireless telegraphy, and also directly or indirectly with Canada.

In a printed answer to a question in the House of Commons last week, the Postmaster-General (Mr. H. Samuel) stated that it was not true that instructions had been issued that Marconi messages were to be given priority at the Bolt Head station.

The Revolving Stage at the Coliseum.—A visit was paid last Saturday by members of the Institute of Marine Engineers to the London Coliseum, when an inspection of the arrangements for driving the revolving stage was made under the guidance of Mr. H. Crocker, the stage manager. The revolving part of the stage is 72 ft. 6 in. in diameter, and is in three concentric sections, which can be driven independently, or the whole mass of 160 tons can be locked together, up to a speed in the case of the outer ring of 20 miles per hour. Lately, however, the platform has only been worked at slow speeds for scene-changing. The revolving platform is driven by fourteen 14-h.p. motors, controlled from a platform at the side of the stage. There are three pillars, for the inner, middle, and outer tables, each with the necessary levers to rotate it at different speeds and in different directions, the orders from the stage manager being transmitted by a form of engine-room telegraph. The lighting switchboard is situated on the same platform a little distance from the driving apparatus. It contains about 85 distinct switches, some interlocked or fitted with automatic devices which reduce to a considerable extent the work of the operator. There are about 6,000 lamps in connection with the stage and the adjoining rooms, and those of the auditorium bring the number up to about 8,000 in all. In order to avoid risk of failure, there are two separate installations, supplied with current from different companies.

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LOCAL NOTES

BELFAST: *Tramway Accounts.*—The net revenue on the tramways for 1909 was £46,057. The sum of £22,975 has been paid over to sinking fund, £13,000 to depreciation, £5,000 towards cost of the Act of 1904, and £3,031 statutory reserve fund. The balance has been applied to clearing off the debit balance of net revenue from previous years.

Cavehill & Whitewell Tramways.—A poll of the ratepayers is being taken in connection with the proposal of the Corporation to purchase the Cavehill and Whitewell Tramways Co.

BURY: *Tramway Accounts.*—The net profit on the tramways for the year to March 31st was £2,636. It has been decided to place £2,500 to reserve and depreciation, and to place the balance at the credit of the borough rates.

GREENOCK: *Supply to Admiralty.*—An agreement has been signed between the Admiralty and the Corporation for the supply of electrical energy to the new torpedo factory by June 1st.

HUDDERSFIELD: *Extension of Area.*—The Board of Trade have granted a Provisional Order for the extension of the Corporation's electricity area to the South Crosland district.

LEEDS: *Tramway Receipts.*—The revenue from the tramways for the year to March 31st shows an increase of £15,600 compared with the previous year. It is estimated that the Tramways Committee will be in a position to contribute £55,000 to relief of rates.

LEITH: *Proposed New Plant.*—A deputation is visiting various places in England in connection with the proposed extension of the electrical undertaking.

LIVERPOOL: *Tramway and Electricity profits.*—The Tramways Committee propose to transfer £27,450, or £2,600 more than the previous year, towards the relief of rates out of the tramway profits for 1909–10. The electric lighting undertaking will make a contribution of £20,000 to relief of rates out of the profits of last year.

LONDON: *Bethnal Green: Electricity Supply.*—Bethnal Green has the distinction of being the only district in the County of London in which no electric supply is available, although reports and schemes have been prepared on numerous occasions. The Electricity Committee now report having had the question again under consideration. Before dealing afresh with the subject, the Committee communicated with neighbouring authorised undertakers inviting offers. No electricity company has made any proposal. The Poplar and Hackney Boroughs adhere to previous offers, and the Stepney and Shoreditch Borough Councils make slight modifications in their previous offers. The Committee are of opinion that the Council should enter into a contract with the Shoreditch Borough Council upon the basis of their alternative flat rate scheme for a period of seven years. The terms of this and all the other offers are contained in a statement which has been circulated only to members of the Council.

Hampstead: New Plant.—A report by Sir Alexander Kennedy recommends new plant at a total expenditure of £18,000. There would be an annual saving of £4,000. The money required will be borrowed from the reserve fund, which now amounts to £45,000. The report has been adopted. A number of tenders for the supply of the new plant have been received.

Marylebone: Electricity Undertaking.—The Electricity Committee report that, as far as can at present be ascertained, the total sales to private consumers for the year ended March 31st last will amount to 10,316,000 units, and the average price to 3·63d. (including meter rents). The units show an increase of 16 per cent. over the previous year, and the average price a reduction of 9 per cent. The General Manager is of opinion that the sales department will pay its way after debiting all expenditure properly chargeable against it. Finally, the report says that after reducing the capital liabilities by £37,915, they estimate that there will be a surplus on the year's working of £8,602.

MANCHESTER: *Tramway Receipts.*—The Tramways Committee propose to reduce their contribution in relief of rates out of the profits for 1909 to £60,000. Last year the Committee contributed £75,000, by the special request of the Finance Committee, which was an additional £15,000 to the usual contribution.

Electricity profits.—The accounts of the electricity undertaking for the year to March 31st show a surplus of £35,220, of which £12,000 has been transferred to relief of rates, and the balance added to renewals fund.

STOKE-UPON-TRENT: *The New County Borough.*—The new Stoke-upon-Trent County Borough Council held their first meeting at Hanley last week. Mr. T. Willett, of Burslem, was elected chairman, and Mr. J. Schofield, of Hanley, was elected vice-chairman, of the Electricity Committee. The question of the appointment of a chief electrical engineer was referred to a sub-committee, which will report to the next meeting. A proposal was made to appoint Mr. Ashton Bremner (Burslem) chief engineer pro tem., but it was not proceeded with.

WIGAN: *The Proposed Tramways Purchase.*—Mr. J. R. Salter, of the Lancashire United Tramways Co., has sent a long letter to the local Press in regard to the recent discussion by the Corporation of a so-called offer to purchase the municipal tramways. According to newspaper reports, the result of the meeting in question was that the Council would not entertain an offer of the Tramways Co. to purchase the tramways. Mr. Salter points out that this is erroneous, and also that, in his opinion, the Council acted with undue haste in coming to their decision. He states that the Council were merely asked if they were prepared to discuss the question of the transfer of the tramway and electrical undertakings. No figure was mentioned, nor was any basis of negotiation referred to. At the same time, the only basis upon which the transfer could have taken place was the reimbursement to the Corporation of the whole of the capital expenditure on the undertakings. In conclusion Mr. Salter corrects the opinions of some of the Wigan Councillors that the municipal electrical undertakings could be disposed of at a profit of £100,000 if the Corporation desired. It is now well-known that the policy of the Board of Trade is not to allow either a loss or profit to be made on any such transfer of a municipal undertaking.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ARBROATH.—The directors of the Arbroath Electric Light & Power Co. are considering the advisability of increasing the plant at the power station.

BRITISH COLUMBIA.—The Prince Rupert Electric Light Committee invite tenders for boilers, engines, condensers, pumps, and electrical apparatus by May 3rd. Copies of the specifications, &c., may be seen at the Board of Trade, 73 Basinghall Street, London.

ERITH.—It is anticipated that during the ensuing year some 300 kw. of additional plant will be required to meet the demand.

FELIXSTOWE.—A Local Government Board inquiry was held last week concerning a loan of £4,500 for electrical extensions.

HESTON AND ISLEWORTH.—A 250-kw. continuous-current generating set, together with boiler, condenser, &c., is required by the Council. Particulars to the Clerk by May 11th.

IRELAND.—It is proposed to install electric lighting, &c., in the County Antrim Infirmary. Messrs. Miller, Wilson & Pegg are the consulting engineers.

LEICESTER.—The Tramways Committee recommend additional plant being installed at the tramways power station, owing to the rapidly increasing demand for power. It is proposed to instal an additional 1,000 kw. turbo-alternator with two boilers, condensing plant, &c., at an estimated cost of £19,190.

RUSSIA.—The town of Baku has raised a loan of 27,000,000 roubles, and the new works proposed include an electric power station.

SOUTHAMPTON.—A Local Government Board inquiry was held on Tuesday concerning a loan in connection with the installation of a new steam generating set and motor-alternator. The gas company were represented in force, but got very little satisfaction out of the proceedings. There was not a ratepayer present, and Mr. H. R. Hooper, the Local Government Board Inspector, expressed entire satisfaction with everything that was placed before him by the electric supply officials.

SPAIN.—The Municipal Authorities of Salamanca invite tenders for an electrical installation for the town. Tenders should reach either the Dirección General de Administración Local, Madrid, or the Alcaldía Constitucional de Salamanca, Salamanca, not later than May 13th. Local representation is necessary.

Miscellaneous

AUSTRALIA.—The High Commissioner for the Commonwealth of Australia, 72 Victoria Street, London, has received tender forms, specifications, &c., in connection with the following: A main distributing frame for the Postmaster-General's Department, West Australia; tenders to the Deputy Postmaster-General, Perth, by June 7th. 100 C. B. switches for the Postmaster-General's Department, Victoria; tenders to the Deputy Postmaster-General, Melbourne, by June 14th. Subscribers' equipment at the Hawthorn Exchange, Victoria; tenders to the Deputy Postmaster-General, Melbourne, by June 14th.

BELFAST.—The Belfast Harbour Commissioners recommend mend the electric lighting of the new graving dock at an estimated cost of £2,115.

BELGIUM.—The Municipal Authorities of Antwerp invite tenders by May 9th for the supply of electrical apparatus to the town workshop at the new North Dock. Tenders to the Burgomaster, Hotel de Ville, Antwerp. The specification may be seen at 73 Basinghall Street, London.

BIRMINGHAM.—In consequence of the result of the recent

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ballot in favour of extending the tramways to the Harbourne and Quinton districts, the Tramways Committee recommend that this should be done. Should the recommendation be adopted by the Corporation a Bill will be promoted in the next session of Parliament.

CHILI.—A Reuter telegram from Santiago, Chili, states that the Chilian Government will in May ask for tenders for the electrification of the railway from Santiago to Valparaiso and its branches, the total length of line being about 156 miles.

LONDON: *London County Council.*—Tenders will shortly be invited for the supply of 250 bogey truck double-deck type cars.

TASMANIA.—The Launceston Council invite tenders by June 13th, for overhead equipment for tramways, and by June 27th for synchronous motor generators and battery, reversible booster, &c.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

W.C.—Rebuilding of Nos. 210 and 211 High Holborn, W.C. (£14,257). Architect, F. W. Foster, 26 Bedford Row, W.C. Builders, C. Allen & Co.

N.E.—Factory, 14 Ardleigh Road, De Beauvoir Town, Hackney, N.E., for J. Sleap.

W.—Hotel, Thurloe Place, Kensington, W. Architect, D. Joseph, 73 Basinghall Street, E.C.

E.—Cinematograph Theatre, Stratford, E. Architect, A. J. Gale, 4 Serjeant's Inn, W.C.

PROVINCES.

ASHTON-UNDER-LYNE.—Bank, Warrington Street and Old Street, for Ashton Savings Bank.

BLYTH.—Secondary school (£9,000). Architect, E. Cratney, Wallsend-on-Tyne.

CAMBRIDGE.—Rebuilding, Newton Hall (£12,975). Architect, F. W. Foster, 26 Bedford Row, W.C.

DARLINGTON.—Alterations and additions, workhouse (£2,183). Builder, T. Rogers, c/o Board of Guardians.

DUBLIN.—The Corporation invite tenders for the wiring, &c., of the Bolton Street Technical Schools. Particulars from the City Electrical Engineer, and tenders to the Chairman of Technical Education Committee by May 11th.

FINCHLEY.—Cooking and Manual Training Centres, &c., Finchley County School (£1,648). Builder, H. Stewart, West Green Road, Tottenham.

GATESHEAD.—School, Brighton Avenue (£5,500). Builders, Raven & Hitchen, Gateshead.

LOWESTOFT.—Parish hall (£5,000). Vicar, St. Margaret's, Lowestoft.

MANCHESTER.—Conversion of premises, Wilmslow Road, Rusholme and Stretford Roads, into electric theatres (1,000 and 650 places respectively). The Lancashire Cinematograph Theatre, Ltd.

RAMSGATE.—School (£5,431). Builder, W. J. Ballard, Ramsgate.

WIGAN.—Theatre. Heaton, Ralph & Heaton, architects, King Street, Wigan.

TENDERS RECEIVED AND ACCEPTED

ABERDARE.—The Council have received 36 tenders for the complete equipment of their new electric power station. These have been sent to Mr. Stephen Sellon, consulting engineer, and will be considered at a special meeting of the Council shortly.

BELFAST.—The Belfast Harbour Commissioners have accepted the tender of Messrs. Hind Bros. and Co. for the supply of castings of bases for arc lamp-posts; Messrs. James Allan & Sons, Ltd., for tubular posts; and Mr. Stanley Johnston for arc lamps.

DUNDEE.—The Public Health Committee have accepted the tender of Mr. T. C. Keay, of Dundee, for electrically-driven laundry machinery at the King's Cross Hospital at £162.

LONDON: *London County Council.*—The tender of Messrs. Buck & Hickman, Ltd., at £2,949, has been accepted for the supply of machine shop equipment for the second portion of the central car repair depôt.

The following tenders have been received for the supply of watt-hour meters for the central car repair depôt, car sheds, and sub-stations. The tender of the Electrical Co., Ltd., is recommended for acceptance. Electrical Co., Ltd., £364 9s.; Bat Meter Co., Ltd., £372 5s.; British Thomson-Houston Co., Ltd., £422 19s.; General Electric Co., Ltd., £450 12s.; Ferranti, Ltd., £544 12s.; British Westinghouse & Manufacturing Co., Ltd., £163 2s.; Chamberlain and Hookham, Ltd., £177 10s.

The tender of Messrs. P. & W. McLellan, Ltd., at £1,498 has been accepted for the supply of rails, fish-plates, and bolts in connection with the tramways.

Battersea.—The Council has accepted the tender of Messrs. Geipel & Co., for the annual supply of arc lamp carbons.

WEST HAM.—The Council have accepted the following tenders for electrical supplies:—House service A.-C. wattmeters, British Thomson-Houston Co. (new type of meter); house service cut-out boxes, Lucy & Co.; india-rubber-covered wires and cables, Messrs. Pirelli (six months, with option of extending for a further six months); electrical accessories, Baxter & Caunter, British Electrical Manufacturing Co., Feld Bros. & Co., Tucker & Co., Falk, Stadelman & Co., the General Electric Co., Edison & Swan Co., Siemens Bros. Dynamo Works, British Westinghouse Co., E. Dewhurst, W. T. Glover & Co., Accles & Pollock.

The Lea Recorder Co. have received the following orders recently for "Lea" recorders: Dublin (J. Jameson & Son, Ltd.), Stockholm (Nitroglycerin Aktiebolaget), Glasgow (Electricity Works), Stockport (Sewage Works), Norwich (Star Bleaching Co.), Huddersfield (J. B. Abbey & Son), Brighton (Electricity Works), London (General Post Office, three sets), Cardiff (Electricity Works), Newtownards (Glen Printing Co.), Australia (Ryde Pumping Station), London (London Hydraulic Power Co.), Halifax (Electricity Works), Adelaide (Municipal Tramways), West Bromwich (Electricity Works), Australia (Sydney City Council), Cheltenham (Sewage Works).

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 to £59 10s. per ton (last week, £59 15s. to £60 5s.).

DISSOLUTION OF PARTNERSHIP.—R. A. Dunt and E. N. Bedells, electrical engineers, 91 High Street, Southampton, have dissolved partnership. E. N. Bedells continues at 83 Above Bar, Southampton.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—W. H. Palmer, electrician, 7 Great Castle Street, Oxford Street, London, has been adjudicated bankrupt. The first meeting of creditors will be held at the Bankruptcy Building, Carey Street, London, to-day, at 11 a.m., and the public examination at the same place on May 6th at 11.30 a.m.

H. Barham, trading as the South of England Electrical Engineering Co., 16 Fratton Road, Portsmouth, has been adjudicated bankrupt.

The public examination of A. E. Felgate and W. Storey, electrical engineers, 10 Queen Victoria Street, Reading, was held last week. The assets were valued at £863, and the deficiency at £1,754. Bad trade, heavy rent, and loss at Oxford through the default of a manager were put forward as the causes of the failure. The examination was adjourned.

NEW ADDRESS.—Messrs. Ronald Johnstone & Son, mining and consulting engineers, of 190 West George Street, Glasgow, have opened a London office at No. 60 London Wall, E.C.

UNION CABLE CO.—Messrs. James T. Donald & Co., Ltd., 35 McAlpine Street, Glasgow, have relinquished the Scottish representation of the Union Cable Co., Ltd., in favour of Messrs. J. C. Fisher & Co. Mr. J. C. Fisher has had the management of Messrs. J. T. Donald & Co.'s electrical department for the past seven years, and has now opened offices at York Buildings, York Street, Glasgow, where all inquiries and orders for electric wires and cables may now be sent.

PRICE OF STEARN LAMPS REDUCED.—The Stearn Electric Lamp Co., Ltd., 47 Victoria Street, Westminster, announce reductions in the price of their "Leuconium" metal filament lamps of bulb form. The prices for 200-250 volt lamps now range from 3s. 9d. to 7s. (25 and 27 watt lamps 5s.); 100-120 volt lamps from 2s. 9d. up to 63 watts, and 6s. for 120 watts; the prices of lamps from 25-70 volts have also been reduced.

Robertson & Osram Staff Dinner.—The annual dinner of the Robertson & Osram Electric Lamp Works staff was held on Friday at Hammersmith, Mr. C. Wilson presiding. For the first time Mr. H. Hirst, the managing director of the two companies, found himself able to be present. Mr. Wilson proposed the toast of the allied firms, and alluded to the fact that he was within three months of his coming-of-age in regard to his service with the firm. He also mentioned that the Robertson & Osram works were, with one exception, the largest employers of labour in Hammersmith, their employees numbering 1,500, with a wages bill of £1,300. Their bill for electric light and power amounted to £6,000 per annum. Speaking of the relation of the staff with the directors, he said that no proposal of his on behalf of the staff was ever rejected. Mr. Hirst, in reply, recalled how Mr. Wilson had started on a month's probation nearly twenty-one years ago, as a shorthand clerk. With such a man in charge, the staff need not fear for the future. They were adopting the motto of "Don't put your headlights behind." A long and very enjoyable evening was spent as is usual at this annual event.

OSRAM·LAMPS

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COMPANIES' MEETINGS AND REPORTS

GREAT NORTHERN TELEGRAPH CO.—Owing to the increased receipts in 1909 from the company's participation in other telegraphic undertakings, and to the fact that there has been a profit on exchange during the year instead of a heavy loss as in the previous year, the board proposes, notwithstanding a considerable decrease in the ordinary traffic receipts, to distribute the same dividend and bonus for the year 1909 as for the preceding year, viz., 18 per cent. (of which 5 per cent. has already been paid), and to set aside the usual amounts to the reserve and pension funds, viz., £55,555 and £8,333 respectively.

BROMLEY (KENT) ELECTRIC LIGHT & POWER CO.—After meeting debenture interest, there is a balance of £8,993 for 1909. The dividend for the year has been made up to 5½ per cent., £2,096 has been added to reserve for renewal, £2,600 to general reserve, and carrying forward £172.

COVENTRY ELECTRIC TRAMWAYS CO.—The net profit for 1909, including £57 brought forward, was £6,996. The sum of £2,000 is added to reserve for depreciation, a 3½ per cent. dividend is recommended, and £446 carried forward.

CRAIGPARK ELECTRIC CABLE CO.—The net profit for the year to March 31st was £6,243. A sum of £500 is to be added to depreciation and £500 to reserve. A dividend of 6 per cent. for the year is recommended.

UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON.—Sir Edgar Speyer presided at the half-yearly meeting last week, and pointed with satisfaction to the fact that the company is now free of floating debt, while the net revenue for the half-year is sufficient to pay the full interest on the 4½ per cent. bonds. The good results obtained have been due to savings in coal consumption, and other reductions at the Chelsea power station. So far as the Underground Co. was concerned, he felt confident that the period of deficit was now at an end, and that they could look forward with some degree of confidence to some small distribution on the income bonds.

CORK ELECTRIC TRAMWAYS & LIGHTING CO.—The net profit for 1909 was £16,294, and, after meeting preference dividends and adding £3,500 to reserve, a dividend of 3 per cent. is declared on the ordinary shares, carrying forward £514. At the annual meeting last week Mr. A. R. Monks drew attention to the fact that, in spite of the strike of employees last May, the profits for 1909 were considerably in excess of those for 1908. Speaking of the strike, he stated that an Employers' Federation has since been formed for the prevention and combating of unreasonable strikes, and, as most of the leading merchants and manufacturers had joined, the company had also become a member. To meet the increased demand upon the company acquiring the Cork Rural District Lighting Order, it is proposed to install a new boiler and automatic stokers. During the year a 1,500-h.p. Belliss-B.T.-H. generating set has been installed. For the first three months of the present year, the receipts show an increase of £300 over the corresponding period of last year.

LA PLATA ELECTRIC TRAMWAYS CO.—At the meeting last week it was stated that the first section of the electric tramways was opened early this year, and that the second section, comprising 5½ miles of track, was opened on April 3rd.

LONDON UNITED TRAMWAYS.—Mr. C. J. Cater Scott, presiding at the annual meeting last week, said that the gradual shrinkage of the company's receipts during the past three years was partly due to the very bad weather, but largely to motor-'bus competition. During the past four years there had been an absolute revolution in conditions under which London passenger traffic was carried on, and concurrent with the very great increase in competition, was a considerable increase in the cost of maintenance. The fact was that many of their lines had been carrying heavy traffic for many years, and now began to show signs of wear and tear, and he could not say that the increase in maintenance was likely to be temporary. With regard to the purchase of the Hammersmith line by the London County Council, after the rejection of their Bill in Parliament to postpone this purchase they had asked the Board of Trade to hold an inquiry into the special circumstances of the case, but this has been refused, and the London County Council had now given notice to purchase. Beyond saying this, he would not discuss the matter further with the shareholders at the present time, as it was a most difficult and complicated question.

AUCKLAND ELECTRIC TRAMWAYS CO.—There is a surplus of £39,044 for 1909, after placing £15,000 to depreciation, and meeting debenture interest and other charges, a dividend of 6 per cent. is recommended on the ordinary shares, carrying forward £3,544.

DEVONPORT & DISTRICT TRAMWAYS CO. Mr. W. G. Bond, presiding at the annual meeting on Friday, made a lengthy reference to the recent proceedings in Parliament between the Company and the Corporation. He stated that on the present traffic receipts from the extension lines leased from the Corporation, there was a net deficit of £2,356, and it was the impossibility of coming to a peaceful arrangement with the Corporation which had led them to introduce their Bill (ELECTRICAL ENGINEERING, April 14th, p. 253). In spite of their failure with their Bill, however, he did not anticipate that the future of the company would be more marked by tame submission than had been the case in the past. They only wanted fair play, and this they had never had. The company would gladly come to terms with the Corporation upon any reasonable basis, but it had declined, and would continue to decline, to hand over the undertaking to the Corporation for a mere song.

APPOINTMENTS AND PERSONAL NOTES

Salford Electricity Committee require a superintendent of the hired motor and testing department, at a salary of £120, rising to £180 per annum. (See an advertisement on another page.)

The following appointments have been made in connection with the West Ham electricity undertaking:—F. J. Delves, motor superintendent, at £2 10s. per week and commission, in place of Mr. T. O. Wilton, resigned; Mr. J. Inglis, assistant motor superintendent, at £2 per week and commission, in place of Mr. W. L. Wreford, resigned; Mr. J. Turtle, lighting superintendent, at £2 per week and commission, in place of Mr. A. S. Tong, resigned; Mr. E. E. Smith, as canvasser, at £1 10s. per week and commission, in place of Mr. E. A. Broom, resigned.

Mr. H. M. Gill has resigned the post of engineer and manager of the Surbiton Electricity Works, and will be succeeded by Mr. T. M. Colson, late engineer at the Hamilton (N.B.) Electricity Works.

A junior designer is wanted for D.-C. and A.-C. motors. (See an advertisement on another page.)

A young engineer is wanted by a firm interested in turbine machinery, to take charge of publication work. (See an advertisement on another page.)

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED. Calcutta Electricity Supply Co., at the rate of 9½ per cent. per annum for the past half-year, placing £17,000 to depreciation and renewals. Tynemouth & District Electric Traction Co., 3¼ per cent. on the ordinary shares. Montreal Light, Heat & Power Co., 1¾ per cent. for the quarter to April 30th.

Telegraph Traffic and Movements of Cable Ships.—On the 19th inst. the repair of communication between Tangier and Mogador was successfully accomplished. The Malta-Tripoli cable failed on the following day. The El Arich route was down between Adana and Bayreuth and between Alep and Bayreuth on the 21st, and on the same day work stopped on the line between Bagdad and Bassorah. On the 24th inst. the Tangier-Mogador connection gave out, to be followed on the succeeding day by the cable between Lattaquil and Larnasa. The Tangier-Mogador connection was repaired on the 25th inst., while the cable between Para and Pernambuco failed on the same day. Telegrams for Para will be sent by the Brazilian land lines till the repair of the cable is effected. The Bagdad-Bassorah line has been restored.—The cable ships were not very busy during the month of March. The c.s. *Contre-Amiral Caubet* repaired the section between Brest and St. Pierre, and returned to Halifax, N.S., on March 4th. The c.s. *Mackay-Bennett* had to attend to the Rockfort-Canso section, and then proceeded to repair one of the cables to Coney Island. The c.s. *Menia*, of the Anglo-American Telegraph Co., was chartered by the Direct United States Cable Co. to repair the cable from Halifax to the States, which was successfully accomplished in two days.

Cables over London Bridge.—In the Chancery Division of the High Courts on Friday, before Mr. Justice Parker, the City of London Corporation asked for an injunction to restrain the County of London Electric Supply Co. from breaking up the surface of London Bridge for the purpose of laying electrical cables. Under the terms of the London Electric Supply Act of 1908, the company wished to link up its northern and southern areas, and for this purpose proposed to lay a main over London Bridge. The Bridge House Estates Committee claimed that the bridge was in no area of supply, and they refused to give their consent to the roadway being broken up. An appeal to the Board of Trade, as provided for under the Act, was then made, but it was thought that the Board of Trade had no right to appoint an arbitrator in relation to London Bridge, this not being a thoroughfare repairable by a local authority. Mr. A. J. Walter, K.C., for the City of London Corporation, as Trustees for the Bridge House Estates, said the only alternative seemed to be to promote a Bill in Parliament. Mr. Balfour Browne, K.C., on behalf of the Company, contended that the spirit of the Act of 1908 was to enable companies to break up streets outside their area of supply, subject to the consent of the proper authority, with an appeal to the Board of Trade. Mr. Justice Parker took this view of the reading of the Act, and made a declaration that the Company have the power, subject to the provisions of the Act, to break up streets outside their area, including London Bridge.

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GAS COMPANIES AND ELECTRICITY SUPPLY IN SMALL TOWNS

TWO Bills by gas companies, asking for powers to generate and supply electrical energy, occupied the attention of the Unopposed Committee of the House of Commons for a considerable time on Thursday. The detailed debate which took place was in strange contrast to the very cursory manner in which unopposed Bills were dealt with a few years ago, when the whole proceedings were a mere formality. Promoters of Bills are not represented by counsel before the Unopposed Committee, the matter being in charge of the Parliamentary agents, and whereas, until recent years, the Committee have been satisfied with a more or less bald statement of the objects of the Bills, the agents now find it necessary not only to provide facts and figures in support of the powers asked for, but even, as will be seen below, to be prepared with expert witnesses to prove their statements.

The Bills in question were the Bishop's Stortford and Epping Gas and Electricity Bill, and the Farnham Gas and Electricity Bill, and a curious fact is that in both cases the Council and a company have endeavoured to put an electric supply scheme into operation, but, after going closely into the question, decided that it would not be a profitable undertaking. In the case of the Bishop's Stortford Bill, this proposes the amalgamation of a number of small local gas undertakings, reaching as far as Ongar and Epping, but the limits of electric supply proposed do not extend far beyond Bishop's Stortford. The capital asked for in respect of electricity supply is £50,000. It will be remembered that Messrs. May & Hawes recently reported to the Council in favour of a municipal scheme, but the matter has remained in abeyance, and at the recent elections we understand that nine members were returned out of a Council of fifteen strongly against a municipal undertaking. The Gas Company, on the other hand, put forward as arguments in favour of their success, where others would fail, the fact that they had land upon which to install the plant, the gas with which to drive their generating plant, and to a large extent the office staff and collectors, &c., with which to carry on the business. Further, the company had retained no less an authority than Mr. J. F. C. Snell, who had calculated that with quite a small output, and prices ranging from 5d. to 5½d. per unit, the undertaking, under the conditions set out above, and without the necessity for raising capital in the open market, would become a profitable one, after meeting depreciation, at the end of the second year of working. It may be pointed out that the Bishop's Stortford Council at present possess an electric lighting provisional order, and the Gas Company is not to commence its electrical undertaking without the consent of the Council or until after the Council's order has been revoked by the Board of Trade. Furthermore, the company's undertaking, if and when established, is to be purchasable by the Council at the end of 21 years and recurring periods of seven years, on Electric Lighting Act terms plus a sum for goodwill, determined by arbitration, for the difference between the purchase period and the 42 years provided by the Electric Lighting Act of 1888. After probing into all these details, however, the committee were not absolutely convinced that the Bishop's Stortford Council yet knows its own mind in the matter, so to speak, and postponed a decision for a week in order that a resolution in favour of the company's scheme might be passed.

In the case of the Farnham Bill, such a resolution was forthcoming, and the Bill was passed. The promoters of this Bill, who ask for capital powers to the extent of £18,500, had called in Mr. A. H. Dykes, who has achieved success in a similar direction as consulting electrical engineer to the neighbouring Ascot & District Gas & Electricity Co. The arguments given above, in support of the theory that the Gas Company will make an electrical undertaking a success where an independent company or the Council could not, were again used, and, as stated, the Bill was ordered to be reported for third reading. The committee foresaw the difficulty that both companies might be asking for electric lighting powers, which would not be used, in order to keep out competition with their gas undertaking, but the fact that the Ascot Gas Co. had made a profit on its electricity appeared to satisfy the committee on this point.

Netherlands Electrical Exhibition.—An exhibition of applied electricity is to be held at Nymegen under the auspices of the "Maatschappij van Nyverheid" (Society of Industries) from July 2nd to August 15th next. Exhibits from foreign manufacturers will be received. Applications for space should be addressed to the Exhibition Offices, Kelfkensbosch 18, Nymegen. A copy of the general regulations, &c. (in English) may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

[Readers applying to any of the under-mentioned firms for copies of the catalogues or pamphlets referred to are requested to mention "Electrical Engineering."]

STORAGE BATTERIES FOR PRIVATE PLANTS.—We have received from the Chloride Electrical Storage Company, Ltd. (Clifton Junction, near Manchester), a leaflet on storage batteries for private plants. This draws attention to the advantages of several features of the construction of the well-known Chloride Cell for this class of work, particularly as regards the patented wood separator employed. A number of views of battery rooms in private installations are given, and full particulars and dimensions of the standard types of cell are contained in a table.

ELECTRIC HOISTS, &c., AND DRILLS.—A collection of leaflets from the Witton-Kramer Electric Tool and Hoist Co. (Witton, Birmingham), issued in advance of a complete catalogue now in preparation, illustrates the applications of Witton-Kramer lifting magnets for cranes, electric hoists, and transporters, and electrically-driven drilling and grinding equipments.

LIFTS.—A new illustrated eight-page pamphlet from Messrs. R. Waygood & Co., Ltd., contains representations of a large number of types of lifts and cranes for various purposes, including those driven electrically, as well as hydraulic belt-driven and hand-worked lifts.

AUTOMATIC PUMPING PLANT.—A leaflet published by the Allgemeine Elektricitäts-Gesellschaft describes an automatic pumping plant for country houses. The motor of the pump is controlled by a switch which, in turn, is closed automatically when the water pressure in the pipes falls below a certain amount. This occurs, of course, whenever a tap is turned on, there being no cistern to produce the pressure. The motor stops almost directly the tap or taps are closed.

MOTOR CONTROLLERS.—Another leaflet from the same company describes a new pattern of controller for heavy and severe work, such as cranes, transporters, and mining gear. The most important feature of this design is the use of stiff hinged contact fingers in place of spring contacts. The contact pieces can be readily renewed without removing the fingers. The current does not pass through the hinge, but is carried to the finger by additional copper strips.

ALUMINIUM.—A leaflet received from the British Aluminium Co., Ltd. (109 Queen Victoria Street, London, E.C.), gives dimensions and particulars of aluminium wire and strand.

ADVERTISING LITERATURE.—Mr. A. H. Seabrook, general manager of the Electricity Department of the Borough of St. Marylebone, has sent us a short explanatory pamphlet on systems of charging depending on the load factor of the consumer. This is an attempt to explain the maximum demand and "telephone" systems of charging, and is intended for non-technical consumers. A table is given to show the total candle-power equivalent (at the Marylebone pressure of 240 volts) to various values of current in amperes for both metal and carbon filament lamps. A diagram for estimating the number of units which have to be consumed before the lower rate is charged is also included. The annual charges for heating and cooking apparatus, taking current at 1d. per unit on the "telephone" system, are given. We are informed that £7,000 has been received by the department in annual charges since the system was introduced.

STORAGE BATTERIES.—An attractive little pamphlet from the D.P. Battery Co. (Lumford Mills, Bakewell, Derbyshire) contains an interesting discussion upon the *rôle* played by the storage battery in electric power traction and lighting schemes. The economies that can be obtained by employing a battery to shield the generating plant from the peaks of a variable load are explained, and some striking figures are quoted, showing the improved conditions brought about by the introduction of a battery in a certain traction station employing Diesel engines. Charts are also reproduced showing the working of a battery on an electric crane circuit, and the possibilities opened up as regards continuous-current colliery installations are dwelt upon. Finally, a quotation from an abstract of a Paper read in America, published in ELECTRICAL ENGINEERING, is given, showing the successful application of a battery in conjunction with split pole converters for regulating the load on the alternating current rolling mill circuit at the Gary Works of the Indiana Steel Co. The booklet is copiously illustrated, and some interesting discharge curves of D.P. cells are reproduced.

Iron and Steel Institute.—The annual meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, London, on May 4th and 5th. Among the Papers to be read, time permitting, are the following:—(1) "On the Girod Furnace and the Electric Smelting Works of the Paul Girod System," by Prof. Dr. W. Borchers; (2) "On the Progress of Electro-Smelting," by Donald F. Campbell; (3) "On the Developments in the Production of Electric Power; its Application and Bearing upon the Iron and Steel Industries," by D. Selby Bigge. The annual dinner will be held on May 4th at 7 for 7.15 p.m., at the Hotel Cecil.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 21st, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

2,147/09. **Storage Batteries on A.-C. Systems.** A. M. Taylor. Low-voltage storage battery units, each of a few cells of large capacity, are installed in a sub-station on a H.-T. alternating-current distribution system for the purpose of relieving the generating station of the peak loads, and for improving the power-factor of the system. Each set, comprising a battery, a synchronous motor-generator, and a transformer, is connected to the low-tension side of the main transformers. The excitation of one motor-generator is controlled automatically from current and pressure transformers on the outgoing feeders, so that it is over-excited, and (running as a motor) takes enough leading-current to compensate for the lagging-current of the load. Another motor-generator is automatically controlled so as to compensate for the lagging-currents on the H.-T. side. All the motor-generators are driven from the batteries to supply alternating current for the peak loads. A method of inserting a transformer (fed from a battery unit) into the H.-T. feeders to compensate automatically for the reaction or capacity of the transmission line is also described. Five claims, six figures.

11,135/09. **Insulated Cable.** British Insulated & Helsby Cables, Ltd., F. A. Cole, and J. Shaw. The insulation consists of the following in succession:—A thin layer of vulcanised rubber, a layer of vulcanised bitumen, another thin layer of vulcanised rubber, india-rubber coated tape, and, finally, the braiding or other suitable covering. By thus interspersing the materials each protects the other from deleterious chemicals, and the rubber increases the mechanical strength and flexibility, preventing decentralisation and cracking. Two claims, one figure.

13,142/09. **Motor Starters.** A. H. Curtis, J. T. Mould, and Adams Manufacturing Co., Ltd. A motor starter and an electrically-operated circuit-breaker are combined, and interconnected so that the circuit of the holding-on solenoid of the circuit-breaker is completed by a forward motion of the rheostat lever, or if the lever is held stationary, but is broken immediately any backward motion takes place. This prevents arcing on the main contacts due to re-insertion of resistance, and is particularly useful for starters for printing machinery, as when inching, any backward motion cuts off current instantaneously. One method of effecting this consists in providing a commutator with a limited movement, moving along a contact sector. Backward movement causes the roller to turn, and its conducting segment to break the circuit made through it and the sector. Six claims, eleven figures.

18,228/09. **Wall-plug.** J. F. and E. S. Conradi (British Central Electrical Co.). A connector plug is provided with a knob or handle for lifting it out of the socket. A disc or shield of insulating material protects the hand, and the flexible or cable passes out of the body of the plug at right angles to the axis of the pins and below the shield. The plug cannot be pulled out by means of the cable. A construction for a three-pin plug (*i.e.*, one earthing pin) for preventing the pins being inserted in the wrong contacts, is also described. To obtain a quick break on pulling out the plug, spring contacts are provided. Further, to enable the plug to be secured, it has a bayonet-locking device. Three claims, twelve figures.

19,368/09. **Cable Drying Apparatus.** J. E. Dane and Perks, Dane & Co., Ltd. An apparatus for drying out cables that have absorbed moisture (as, for example, after a long period at sea in a ship's hold), consists of a hollow metal drum heated by passing steam continuously through it. The cable is wound on the drum in one layer, and wound off on to another drum. The drying drum is jacketed. Nine claims, seven figures.

22,081/09. **Scenery Raising Gear.** E. F. Moy and P. H. Bastie. A gear for raising and lowering theatre scenery, comprises two continuously running shafts driven in opposite directions by a motor. These shafts transmit power to a number of sets of gearing, one for each of the sets of lines to be worked. Each set of gearing consists of two electrically-operated friction clutches, one on each main shaft, both geared to a pulley having one large groove for the hand-operating rope, and four smaller grooves for the wire ropes suspending the scenery. The controlling gear consists of a series of switches for working the clutches. Four claims, eleven figures.

229/10. **Photo-telegraphic Apparatus.** H. Carbonelle. In systems for transmitting photographs in which a stylus passes over the surface of a prepared metal cylinder making and breaking contact, the cylinder dips into a bath of petroleum or benzine, which causes the contact to be broken under a film of insulating liquid, thus preventing sparking. The whole apparatus may be immersed in benzine. The liquid also keeps the cylinder clean and free from dust. A blade of celluloid is attached to the stylus so as to brush and clean the cylinder before it reaches the stylus, and to limit the movement of the latter. Three claims, three figures.

1,292/10. **Commutator Construction.** Siemens-Schuckertwerke Ges. There is a tendency for the hard mica now used to project above the surface of the commutator and cause sparking. The mica has been placed between the segments below the radial wearing depth only, the remaining portion being fitted with a soft insulating material which wears away easily. In high-speed machines, however, this soft material is thrown out by centrifugal force, and accumulated carbon dust then causes a short-circuit between adjacent segments. According to the present invention, the hard insulating substance extends only over the inner part, and a gap is left between the adjacent segments; but to prevent short-circuiting by carbon dust, the sides of the segments are insulated with varnish or enamel, or a thin sheet of paper or mica glued to the segments. Three claims, two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Ges. für Elektrotechnische Industrie and Gyuris, 16,855/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Gray [Conductors] 8,419/09.

Dynamos, Motors, and Transformers: Hanna [Bearings for electrical machines] 8,382/09; Mavor and Mavor & Coulson, Ltd. [Enclosed machines] 9,133/09.

Electric Ignition: Burks [Magneto-machines] 8,489/09.

Incandescent Lamps: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Manufacture of metal filaments] 8,781/09; Heinrich [Manufacture of metal filaments] 16,065/09; Jaeger, 26,006/09.

Instruments and Meters: Siemens Schuckertwerke Ges. [Motor meters] 11,634/09; A.-G. Korting's Elektricitätswerke [Motor meters] 12,878/09.

Switchgear, Fuses, and Fittings: Simplex Conduits, Ltd., and Waterhouse [Fittings for surface wiring] 7,995/09; Lear [Suspension gear for incandescent lamps] 14,675/09; Thomas [Electrically-controlled brakes for cranes] 15,544/09; Hill [Electro-magnetic clutches] 16,095/09.

Telephony and Telegraphy: Rymer-Jones [Wireless telegraphy] 10,586/09; Tardieu [Breast-plate microphones] 1,794/10; Siemens & Halske A.-G. [Telephone exchanges] 2,608/10.

Traction: Westinghouse Electric Co. [Electro-magnetic brakes] 4,171/10.

Miscellaneous: Schneider [Electric clock] 8,123/09; Miller [Electric signs] 24,190/09; Alexander (*Reinhardt*) [Centrifugal separators] 27,582/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrochemistry, &c.: Schott and Gen [Electrolytic apparatus with liquid anode] 6,596-7/10; Elektrochemische Werke Ges. [Improving mechanical properties of metal articles] 7,657/10.

Incandescent Lamps: Madden and Houskeeper [Filaments] 7,331/10.

Telegraphy, &c.: Juillac [Mast for wireless telegraphy] 7,082/10.

Traction: A.-G. Brown, Boveri et Cie., 6,403-4/10.

Miscellaneous: Grundy [Insulated shaft-couplings] 4,093/10; Houskeeper [Contact devices] 7,332/10.

The following amended Specification can now be obtained.

3,604/09. **Deposition of Metals.** A Sang. See Electrical Engineering, January 6th, 1910, p. 16.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: L. Hackethal [Insulators] 577/02; M. B. Field [Armoured cables] 319/04.

Electrometallurgy, &c.: W. Wright [Electrolytic apparatus] 490/97.

Switchgear, &c.: A. P. and G. C. Lundberg [Wall-plug] 367/01; G. Harrison (*Anderson Manufacturing Co., U.S.A.*) [Time switches] 400/05.

Telephony, &c.: S. P. Thompson [A.-C. signalling systems] 525/98.

Traction: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Pneumatically controlled overhead collector shoe] 401/05.

Miscellaneous: A. E. Salivén [Magnetic separator] 365/02; W. L. Wise (*Thomson Electric Welding Co., U.S.A.*) [Chain welder] 123/05; R. J. W. Grasset [Electro-magnet governor for marine engines] 410/05.

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ELECTRICAL ENGINEERING

No. 175 [Vol. VI., No. 18] THURSDAY, MAY 5, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

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Small Advertisements and Official Announcements, *Wednesday first post.*
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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

Our monthly supplement, "Electrical Engineering in Mines," is included in this issue. It opens with a letter from a correspondent on the desirability of employing competent men as colliery electricians, and contains reports of a number of discussions in various parts of the country of the Institution of Mining Electrical Engineers. The Papers discussed include one on the relative merits of continuous and alternating currents for colliery work by Mr. C. R. M. Young, read at Newcastle. Mr. J. Glynn Williams handled some aspects of the same subject in a Paper on storage batteries for colliery work at Whitehaven, and the question of earthing was introduced for discussion by Mr. Routledge at Nottingham. A report of a discussion before the Mining Institute of Scotland on Mr. Nelson's Papers on electricity in mines; an abstract of a further contribution on the subject of electricity and coal-dust explosions by Prof. W. M. Thornton and Mr. E. Bowden are also given. We have also included in our supplement reports of the discussions at the Newcastle and London meetings of the Institution of Electrical Engineers on Mr. W. W. Wood's Paper on earthing of the neutral of three-phase colliery installations. Although he advocates earthing in the case of collieries supplied from power companies' mains, his arguments were mostly in favour of an insulated neutral. In the discussion, however, most of the speakers recommended earthing. A summary of electrical mining patents which have been published in April is given, and notes explaining the circumstances of one or two colliery accidents are included.

At the meeting of the Westminster City Council, on Thursday, a proposal was made that the Council should reconsider the decision arrived at at the previous meeting in regard to the lighting of Regent Street, Piccadilly, &c. A long letter from the St. James & Pall Mall Electric Light Co., complaining of the manner in which the specification was drawn up, was referred to, and the company made an offer to continue the present electric lighting at a price lower than the accepted tender of the Gas Light & Coke Co. After a speech by Mr. Jacques Abady, the Chairman of the Works Committee, it was decided that the previous decision of the Council to accept the tender of the Gas Light & Coke Co. should stand. (Page 293.)

Judgment was given on Saturday in the action by the Electrical Co., Ltd., against Messrs. Oliver Thomas & Co., in regard to electrical plant for unwatering the Llynvi mine in South Wales. The Electrical Co. claimed payment on the contract amounting to £1,150, but Messrs. Thomas counterclaimed for £31,000 damages alleged to have been sustained through delay in completing the work. The Official Referee, who heard the action, held that the Electrical Co. properly completed their contract, and that the estimate of damages of the counterclaim had been grossly exaggerated. He gave judgment for the Electrical Co., with costs, and allowed Messrs. Thomas £50 damages only on the counterclaim. (Page 295.)

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A LETTER in our correspondence columns calls attention to an example of the use of metal filament lamps of high candle-power on high standards formerly used for arc lamps.—Mr. H. H. Harrison answers some criticism of his article on central battery circuits.—An announcement is made referring to tickets for admission to the Tariff Reform discussion to be held by the National Electrical Manufacturers' Association. (Page 295.)

AMONG the specifications published by the Patent Office on Thursday last was one by R. K. Gray for a method of protecting loading coils of telephone cables. A brass cylinder is placed round the coil, and its ends are cut and bent down in a conical form.—Messrs. Bertram and E. Thomas protect an electrically controlled mechanical brake for cranes. The brake is released in steps by increasing the excitation of a solenoid opposing the weight or spring.—An electromagnetic clutch, in which a starting torque is obtained by currents induced in short-circuited coils, but which eventually drives with magnetic pull only, is described by C. W. Hill.—The Westinghouse Electric Co. describe magnetic track brakes, in which the coils are excited from the trolley circuit alone in cases of emergency.—Opposition has been entered to the grant of a patent to the Westinghouse Metal Filament Lamp Co. for a process of decarbonising metal filaments.—Among the expiring patents is one by C. P. Steinmetz for a three-phase distribution system, in which a fourth neutral wire is used on the secondary side. (Page 296.)

THE Bournemouth Tramway Manager suggests the replacement of the conduit system of electric traction by the ordinary trolley system.—The Bath Electricity Committee propose to substitute 108 100-c.p. metal filament lamps for arc lamps in a number of main streets.—The dispute with regard to the assessment of the Glasgow tramways has been settled by it being placed at £258,853, instead of £278,070.—Newcastle Tramways Committee suggest the use of trolley omnibuses in outlying suburbs.—The Nelson Tramways Manager attributes the loss of £771 to ½d. fares, and recommends their abolition.—The Barking Tramways and Electricity Committee express the opinion that the tramways undertaking will not be a financial success until through-running is arranged with neighbouring Councils.—Owing to the tramway track in Linthwaite, which should be maintained by the Council, being in such a bad state, the Huddersfield Corporation are reducing their tramcar service to that district. (Page 297.)

SOUTHAMPTON Corporation require a 1,000 kw. generating set; Belfast Corporation, motor boosters and switchboard extension; Bray Council, cable and A.-C. meters; Eccles Corporation, motor-driven centrifugal pump and switchgear; and Radcliffe Corporation, a 300 kw. continuous-current dynamo.—A £4,000 loan been sanctioned at Cheltenham for meters, services, and mains.—Rangoon Electric Tramway & Supply Co. propose to install a 1,500 kw. turbine set.—West Ham Corporation require condensing plant, boilers, and switchgear. (Page 299.)

THE accounts of the British Westinghouse Co. show a deficit of £798, after setting aside large sums for depreciation and meeting all debenture interest. The amount required by the Urban Electric Supply Co. to meet the 5 per cent. guaranteed dividend for 1909 falls short by £3,622; this has been provided by Edmundsons Electricity Corporation. (Page 300.)

Association of Electrical Engineering Students.—An association has been formed among the electrical engineering students of the L.C.C. School of Engineering, Poplar. At the first meeting on Saturday last, Mr. H. A. Garratt read a Paper on James Watt. The next Paper will be read on Wednesday, May 25th, by Mr. W. W. E. Ibbetson, on "Hydro-electric Power Stations."

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MAY 5TH.

Institution of Electrical Engineers.

8 p.m. At Royal Society of Arts. "A Telephone Relay," by S. G. Brown.

Institution of Electrical Engineers: Dublin Section.

8 p.m. Annual Meeting at Royal College of Science.

Röntgen Society.

8.15 p.m. At 20 Hanover Square, London. "Quantitative Measurements of the Conversion of Cathode Rays into Röntgen Rays by Antikathodes of different Metals," by J. H. Gardiner.

SATURDAY, MAY 7TH.

Birmingham and District Electric Club.

7 p.m. At Colonnade Hotel. "The South Staffordshire Mond Gas Distributing Plant," by W. Dudley.

TUESDAY, MAY 10TH.

National Electrical Manufacturers' Association.

2.30 p.m. Committee meeting at Balfour House, Finsbury Pavement, London.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street, Glasgow. Annual meeting.

WEDNESDAY, MAY 11TH.

Junior Institution of Engineers.

7.30 p.m. At Royal United Service Institution, Whitehall. "Notes on the Running of an Electricity Works," by L. N. Jockel.

THURSDAY, MAY 12TH.

Tramways and Light Railways Association.

10 a.m. Dublin Congress: (1) "Short History of the Dublin United Tramways Company," by R. S. Tresilian; (2) "Should the Act of 1870 be revised?" by Fred Coutts (Engineer and General Manager, Paisley District Tramways Co.); (3) "Railless Traction," by H. England (General Manager, Wakefield & District Light Railways Co.); (4) "Standardisation of Brake Blocks," by J. A. Panton (Superintendent, Rolling Stock, Liverpool Overhead Railway); (5) "Tramway Economics," by J. R. Salter (General Manager, Lancashire United Tramways, Ltd.).

Institution of Electrical Engineers.

8 p.m. At Royal Society of Arts. "Street Lighting by Modern Electric Lamps," by Haydn Harrison.

FRIDAY, MAY 13TH.

Tramways and Light Railways Association.

Dublin Congress. Visits to works, &c.

Institution of Civil Engineers' Premiums.—Among the list of awards made by the Council of the Institution of Civil Engineers for Papers read during the session 1909-10 are Telford premiums to Messrs. J. Dalziel and J. Sayers for their Paper on "Single-Phase Traction on the Midland Railway," and Mr. J. Shaw for his Paper on "Comparison of Costs with Steam and Electricity on the Mersey Railway."

The Institution of Civil Engineers' Council.—At the annual meeting on Tuesday, April 26th, the result of the ballot for the election of officers was declared as follows:—President, Mr. Alexander Siemens; Vice-Presidents, Dr. W. C. Unwin, Mr. R. Elliott-Cooper, Mr. A. G. Lyster, and Mr. C. A. Brereton; other members of Council, Mr. J. A. F. Aspinall (Liverpool), Mr. B. Hall Blyth (Edinburgh), Mr. J. A. Brodie (Liverpool), Mr. W. B. Bryan, Col. R. E. B. Crompton, C.B., Mr. W. Davidson (Australasia), Mr. E. B. Ellington, Mr. Maurice Fitzmaurice, C.M.G., Mr. J. P. Griffith (Ireland), Sir Robert A. Hadfield (Sheffield), Dr. C. A. Harrison (Newcastle-on-Tyne), Mr. W. Hunter, Mr. G. R. Jebb (Birmingham), Mr. H. E. Jones, Sir Wm. Thomas Lewis, Bart., K.C.V.O. (Aberdare), Mr. H. D. Lumsden (Canada), Sir Thomas Matthews, Hon. C. A. Parsons, C.B. (Wylam-on-Tyne), Mr. A. Ross, Mr. J. W. Shores, C.M.G. (South Africa), Mr. F. J. E. Spring, C.I.E. (India), Mr. J. Strain (Glasgow), Sir Frederick R. Upcott, K.C.V.O., C.S.I., Sir Philip Watts, K.C.B., Mr. W. B. Worthington (Derby), and Mr. A. F. Yarrow (Glasgow). This Council will take office on the first Tuesday in November, 1910.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting of the Institution of Electrical Engineers on Thursday:—*Associate Members:* Lieut. E. D. Carden, R.E., J. H. Edwards, E. Harriss, J. R. Henry, R. Hills, G. J. Hollyer, F. H. Horner, R. Hunter, E. S. Hurlbatt, A. W. Isenthal, H. J. Jones, D. N. Keith, F. J. Launchbury, Capt. H. P. Lefroy, R.E., B. T. McCormick, F. C. Osborne, W. J. Richards, G. W. Richardson, R. J. Roberts, G. Rosenbusch, F. P. Sexton, J. S. Smyth, J. Thomson, G. H. Vaughan, J. A. Woods. *Students:* Singh Anant, J. H. Asdell, D. D. Barber, H. E. Betts, A. E. Boon, W. M. Cranston, H. E. Crowcroft, R. Davies, G. M. Doubleday, G. E. Graham, F. S. Heywood, E. Hughes, W. Inglis, S. N. Jackson, G. T. Levinge, R. E. Livesley, J. H. Lough, D. W. McIntyre, R. A. Mack, T. F. Phillips, E. A. Riordan, J. J. Savant, P. W. Scholefield, B. G. Spendiff, F. P. Swann, J. L. Thompson, M. S. Vernal, W. A. Ward.

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STREET LIGHTING IN THE WEST-END OF LONDON

AS we anticipated in our article upon this subject last week, an effort was made at the meeting of the Westminster City Council to reopen the question of the street lighting in Regent Street, Piccadilly, and the neighbouring streets, the contract for which had been given to the Gas Light & Coke Co. at the meeting on April 14th. Unfortunately, however, the effort was unsuccessful.

The matter was discussed in connection with a report of the Works Committee recommending the various streets in which high-pressure gas lamps should be installed. In the above-mentioned streets the gas will displace the existing electric lighting, and Councillor Pullman moved that these streets be deleted from the recommendation. Personally, he said, he was satisfied that the new light would be as satisfactory as the old, but the residents of Piccadilly and Regent Street seemed to see some sort of fetish in electric light, and thought they were going to be done some injury by the installation of gas. As a representative of the Regent Street Ward he felt it his duty to put forward the views of his constituents.

During the subsequent discussion, reference was made to two letters which had been circulated by the St. James & Pall Mall Electric Light Co. These complained that the company had been prevented by the form of the specification and tender from submitting the price at which they could continue to supply to the existing lamps.

Under the contracts expiring this year, the St. James & Pall Mall Company maintain at the uniform charge of £17 per lamp per annum, a total of 66 arc lamps, consisting of 16 660-watt flame arc lamps in Regent Street which give an illumination according to the tests of the City Engineer of 3,575 candle-power, 4 440-watt flame arc lamps in St. James's Street which give an illumination of 1,800 candle-power, and 46 660-watt white arc lamps in Piccadilly, St. James's Street, Pall Mall, &c., which give an illumination of 900 candle-power. The company now offered to continue the supply to these lamps. As no further capital expenditure for mains, &c., is involved, the price would be £1,122 per annum inclusive, to cover the installation and maintenance of 16 flame arc lamps in Regent Street to the 3,000 candle-power standard, and the installation and maintenance of the other 50 flame arc lamps in Piccadilly, St. James's Street, Pall Mall, &c., to the 1,800 candle-power standard. This compares with the cost of £1,127 for the equivalent candle-power derived from gas lighting, to which must be added the further costs of installation of £140 per annum, making a total of £1,267 for gas as compared with £1,122 for electric light. These figures are on a five years' contract, with the option to the Council to renew for the ten- or fifteen-year period.

It may be mentioned that the decision of the Council on April 14th to accept the tender of the Gas Light & Coke Co. was immediately communicated to the company, and at the same time the Electric Light Co. was reminded that their contract expires on November 10th.

Councillor Abady, the chairman of the Works Committee, claimed that these letters were full of misleading statements, but he referred principally to the allegation of the company that the form of tender precluded them from submitting a separate price for continuing the present electric lighting. This he contradicted, and said that it was the Town Clerk's opinion that the company could have sent in a special tender for this lighting originally. In support of this contention, Councillor Abady read the two following clauses from the specification and form of tender. Clause 2 of the general conditions of contract is as follows:—

Scope and Acceptance of Tenders.—The contractor may tender for the lighting of all or any of the districts mentioned in the form of tender, and may either treat each district as a separate unit and/or may make an inclusive tender for any area formed by the amalgamation of two or more of the said districts, and where the contractor shall tender in respect of more than one of the said districts as separate units, the Council may accept such tender as to any one or more of such districts to the exclusion of any other or others. The Council may accept any tender in respect of any part of any district to the exclusion of the remainder of the same district, and for this purpose may subdivide any district; and the contract may, at the option of the Council, be extended to any other or others of the said districts in which the contractor may have powers of supply. . . .

Among the conditions to be observed in tendering appeared the following:—

The tender must be accompanied by a full description of the scheme submitted, and drawings of lamps and columns.

Reading these two together, Councillor Abady emphatically stated that he saw nothing to prevent the Electric Light Co. from making a separate offer for continuing the present electric lighting of Regent Street, Piccadilly, &c. Instead of doing this, they waited until they knew the Gas Company's price, and then naturally tendered lower. The Electric Light Co. said that they had to put in a high price to provide for their tender being accepted for streets in which they had no mains, but he described this simply as "fudge," because the contract was in two parts, viz., "maintenance" and "installation." Councillor Abady also pointed out that all comparisons had to be made on a five years' basis, because the Works Committee, in spite of his urging them, declined absolutely to enter into a longer contract. In conclusion, reference was made to the three leading electrical papers, in which it was admitted that on price the Council could not have done otherwise than accept the Gas Co.'s tender, and finally, Mr. Abady read triumphantly a note in the *Electrical Review*, which charged the Electric Light Co. with having quoted too high prices. This appeared to convert a number of councillors who were wavering, and Councillor Pullman seemed very glad of the opportunity to withdraw his amendment to the report.

While we agree with Mr. Abady that the St. James & Pall Mall Electric Light Co. would have been well advised originally to have tendered separately for the continuance of the present electric lighting in Regent Street, Piccadilly, &c., in addition to tendering for the whole contract, we are bound to say that, after a careful perusal of the specification (which Mr. Abady has been good enough to send us), we are convinced that there is nothing in it authorising the company to tender for lighting a part of a district. The whole area to be lighted under this contract was divided into four districts, A, B, C, and D, and the electric lighting in Regent Street, Piccadilly, &c., about which the complaint has been, represents a portion only of area D. Had the company tendered under the general conditions and specification for these streets at a lower price than for the remainder, they would have been liable to have their tender accepted at this price for the whole of the four districts in which the company have Parliamentary powers to supply. This is evident on reading the last sentence of the quotation of the general conditions under the heading "Scope and Acceptance of Tender" quoted above, and also from the following clause in the general conditions which Mr. Abady did not quote in his speech.

Increasing Number of Lamps.—The lamps will be in number approximately as stated in the schedule hereto annexed, but the

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Council, within the limits of the specified lighting area, shall have power to increase the number of lamps, as and when they may deem desirable, such additional lamps being provided and maintained at the prices in the accepted tender.

We have received the following letter on the subject:—

To the Editor of ELECTRICAL ENGINEERING.

SIR,—The information now to hand *re* the comparative tenders for electric lighting and gas show most conclusively that the gas tenders have been put forward below cost. The gas tender is for a light of 3,000 c.p., burning 3,940 hours per annum, at a price of £21 5s. for a ten-year contract.

Taking the most efficient gas lighting at present in Westminster, namely, the Whitehall lamps, Mr. Bradley's report gives the average candle-power as 985 for the consumption of 28 cu. ft. per hour, or 35 c.p. hours per cu. ft. of gas.

The statements of gas consumption are given by the gas company. On the above basis the cost of gas alone, at 2s. 6d. per 1,000 ft., will be £45 per annum. The cost of gas only leaves a deficit of £23 5s. per annum, apart from the cost of mantles, attendance, and fines.

I am aware that new mantles under laboratory conditions, with the most careful attention to the pressure and quality of the gas, have given results stated by the gas journal, as good as 95 c.p. per cu. ft., but this figure cannot be maintained in practice, even if the mantles are renewed daily, and an efficiency of 95 candles per foot would not allow a profit on the prices quoted.

Very high pressure lamps are often quoted by gas people as the latest development in street lighting, and the candle-power of these mantles is stated not to fall appreciably. I quite admit this, as the mantles apparently fall off instead, the lamps being often attended to by a man and a ladder both morning and evening.

The gas companies appear to be following the example of the man who gradually reduced his horse's food to one straw a day, but when the minimum of consumption was reached, the mantle (I mean the horse) unfortunately expired. But the consumer who buys his gas does not always realise the unfortunate sequel until his mantle bill is more than his gas bill. Apart, however, from the advertising value of the Westminster contract to the gas companies, it is certainly unfortunate that the tenders were considered only on the basis of cost and candle-power, and not on a basis of useful illumination.

Sickly green gas lamps dotted at intervals on the roadway may give a good effect when measured by the photometer, but they cannot compare for traffic purposes with the mellow light of flame arc lamps placed well above the line of vision on 25 to 30-ft. poles. So far, the gas people have not produced a 3,000-c.p. lamp in Westminster, and it is possible that this new competitor may prove to be a dark horse in more than one sense. The gas people seem of this opinion, as they have asked for the fine to be reduced from 5s. to 6d. when the candle-power falls below the guaranteed minimum.

Yours faithfully,

Hartham Road, Holloway, N., May 2nd, 1910. A. DENMAN JONES, *Manager*, *Jandus Arc Lamp & Electric Co., Ltd.*

CATALOGUES AND PAMPHLETS, &c., RECEIVED

METAL FILAMENT LAMPS.—We have received from Messrs. Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston), an illustration showing the various applications of tantalum lamps aboard ship, a purpose to which they are particularly adapted owing to their ability to stand vibration. The illustrations range from a view of an Atlantic liner, on which over 1,000 tantalum lamps are installed, to a small pleasure yacht.

TWO-RATE METERS.—A well got up pamphlet from Messrs. Ferranti, Ltd. (Hollinwood, Lancashire), describes the Ferranti two-rate continuous-current meter, in which one of two alternative trains of wheels is put into action by means of an electromagnet controlled by a time switch. The armature of the magnet swings over a rocking arm carrying a gearwheel, which can engage in either of two wheels on either side of it. Otherwise the meter is of the same construction as the well-known Ferranti-Hamilton instrument.

CABLES, &c.—A card with ornamental coloured cover, from the St. Helens Cable & Rubber Co., Ltd. (Warrington), forms a "summary catalogue" of their rubber and electrical goods, including cables, wires, tape, insulating gloves, mats, &c., and ebonite articles.

GLASGOW MAIN DRAINAGE.—We have received from Mr. Wm. D. Hamilton, M.Inst.Mech.E., 59 Bath Street, Glasgow, an illustrated description of the Shieldhall outfall works of the Glasgow main drainage system. An account of the electrical equipment of the works was given in ELECTRICAL ENGINEERING, April 28th, p. 280.

STEAM TURBINES.—A booklet is to hand from the A.E.G. Electric Co., Ltd. (121 Charing Cross Road, London, W.C.), describing the A.E.G. impulse steam turbines. An illustrated description of this turbine appeared in ELECTRICAL ENGINEERING, November 4th, 1909, Vol. V., p. 951. We understand that some 800 turbines of this type, aggregating over 1,100,000 b.h.p. have been installed. The outputs range from 2 to 15,000 kw.

DYNAMOS, MOTORS, AND STARTERS.—We have received from the Braulik Engineering Co. a price list of "Eclipse" continuous-current dynamos and motors up to 25 h.p. These are provided with interpoles on the Ziehl system, and are listed in the open, ventilated, and enclosed patterns for 110, 220, and 440 volts, for both continuous and intermittent running. A separate list deals with starters of the metal and liquid types, speed regulators, dynamo shunt regulators, reversing starters and controllers, and three-phase starting and controlling gear.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

INSTRUMENTS.—Messrs. Crompton & Co., Ltd. (Salisbury House, London Wall, E.C.), have issued a new catalogue, containing full particulars and illustrations of their moving-coil continuous-current instruments, which include voltmeters and ammeters of the round sector, illuminated dial, and edgewise switchboard patterns, as well as portable instruments, paralleling voltmeters, with plug contacts, leakage indicators, and combined instruments for motor-cars, launches, &c.

ADVERTISING ELECTRICITY IN LONDON.—We have received from the Electricity Supply Publicity Committee of London one of the new coloured showcards which are to be circulated and exhibited in London and the suburbs with the idea of encouraging the use of electric light. The card measures 20 in. high by 15 in. wide, and has in its centre a bird's-eye view of London by night under the rays of a boldly outlined incandescent lamp. Suitable wording referring to the reductions in cost of electric lighting is placed above and below the illustration. The whole is artistically printed in attractive colours, and a blank white space is left at the bottom for the name and address of the local supply authority.

ALTERNATING-CURRENT INDUCTION MOTORS

A BOOKLET on induction motors, intended for buyers and users of such machines, and issued by Messrs. T. Harding Churton & Co. (Atlas Works, Water Lane, Leeds), contains a great deal of useful information as to the action and construction of these, together with their selection and use. Commencing with a *résumé* of principles of alternating currents so far as necessary, the construction of the ordinary induction motor is dealt with, and the various methods of starting short-circuited and slip-ring machines are explained by the aid of numerous illustrations. Another section treats of heating and rating of induction motors, including a discussion of "crane" ratings for intermittent loads. After a few words on speed control and reversibility, there is a useful section on the selection of motors for particular purposes, including a list of requirements that should be specified with inquiries and hints on choosing the most suitable style of machine. A description follows of the Churton induction motor, which has several interesting points in its construction, and typical curves of efficiencies, power factors, &c., are given. Another part of the booklet contains diagrams for connecting up, and notes on the management of motors, and other sections deal with fuses and circuit-breakers and the planning of private three-phase power transmission schemes. We have no doubt that Messrs. Harding Churton & Co. will be glad to send copies of this booklet to those of our readers who apply to them, mentioning this notice.

Birmingham Local Section of the Institution of Electrical Engineers.—The following list of officers to act during the session 1910–11 has been prepared by the committee:—Past Chairman, R. A. Chattock, Gisbert Kapp, and R. K. Morcom; Chairman, M. Railing; Vice-Chairman, A. M. Taylor; Present Ordinary Members of Committee (remaining in office), J. H. Barker, J. P. Kemp, M. Kloss, J. F. Lister, F. J. Moffett, W. E. Sumpner; Ordinary Members of Committee (new nominations), W. C. Goodchild, W. J. Larke, F. M. Lea, D. K. Morris, C. E. C. Shawfield, R. Threlfall; Hon. Secretary, H. B. Matthews. The committee invite other nominations, which must reach the Hon. Secretary not later than Saturday, May 7th.

"The Central."—The April issue of this magazine, published by the Central Technical College (London) Old Students' Association, has, as a frontispiece, an excellent photograph of Mr W. Duddell. Among the contents is an article on main drainage by H. G. Lloyd, some notes on the water-power, electric generating and distribution undertakings of America, by E. W. Marchant, and a description by H. L. Armstrong of various processes carried out in iron works. The new accelerometer brought out by Messrs. Elliott Bros. is described in an illustrated article by the inventor, Mr. H. E. Wimperis. Several pages are devoted to the doings of old students of the college, and many have interesting experiences to record.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203-206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

OWING to exceptional pressure on our space this month, we have been obliged to hold over several articles of special interest, including our report of the annual meeting of the South Wales Branch of the Institution of Mining Electrical Engineers, held at Cardiff last Saturday, when Mr. W. J. Richards read a Paper on "Colliery Cables."

CORRESPONDENCE

COMPETENT ELECTRICIANS FOR COLLIERIES.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Kindly allow me a little space in your supplement to draw the attention of colliery managers to the disadvantages of employing incompetent electricians on their collieries. Much has been said in the electrical Press on the employment of competent electricians, but little or no practical headway has been made in that direction. I feel confident that if colliery managers would only look into the matter more seriously, and employ none but competent and skilled men, there would be less accidents put down as "caused through faulty electrical work." Turning to the rules for the installation of electricity in mines, Section 1, Rule 2, we find:—"A competent person shall be on duty at the mine when the electrical apparatus or machinery is in use." Is this so at every colliery? Perhaps it is to a certain extent, but is the so-called "electrician" employed competent? He may be a person that has worked there all his life as a handy man, and was put in charge of running a small lighting plant, when he accomplished some repairs more by accident than skill, and finally he was called an "electrician." He may then answer an advertisement for a colliery electrician, and he may get the job because he has been at So-and-so colliery for so many years as electrician, the employers never inquiring into his abilities, which they usually find out later on. How many cases does this "go home" to. Then what does competent mean? It means, in the case of a colliery electrician, that he must be used to all branches of electricity as applied to collieries. He must be able to do all repairs and keep the plant in order and up to every letter of the Rules. He must have had at least three years' experience at a colliery, of which half has been spent underground, and such a term must be spent where the greater part of the colliery is dependent on the electrical plant for power and light. A man is no use on a modern colliery if he has had to do with nothing larger than a small portable fan motor running on the manager's desk. A competent person knows what is required for a certain job, the type design, capacity for various conditions of motors and plant. He also knows what class of cable to instal for a certain job, and the way to fix it for safety. He knows where to look, and what to do, at various breakdowns. To employ a competent electrician means to the owners pounds in their pockets, but to employ an incompetent electrician means pounds out of pocket, and a wrecked plant. The incompetent person has no idea what to do or where to look when there is a breakdown; he usually sends his assistants to put it right, while he keeps out of the way until it is in order; then he goes to the manager and tells him the tale that all is right. He has no idea of insulation tests; all he troubles about is the plant running either well or badly, and receiving his wages on Friday. He is usually known by his rough work and old-time methods. The question arises, What wages should a competent electrician demand? This depends upon the size of the plant. No matter how small the plant, he should not be paid less than 45s. a week, with free coal. The custom of asking in advertisements for applicants to state wages required should be abolished. Testimonials from applicants should be ignored. It is much more satisfactory to the employer to write to the applicant's previous employers for his character. He should be employed for three months on trial, and then if satisfactory an agreement should be drawn up and signed by both parties. Of course, men can be got cheaper, but they rarely stay long. They are, as a rule, wanting in experience. An electrician to have had sufficient experience must have been at the trade from 15 or 16 years of age, and wants a proper wage in return for the expenses of years spent on acquiring his skill. The colliery manager does not get his certificate without great expense, and so it is in the electrician's case; he does not get to competency without expense, and therefore he has an equal right with the manager to demand a proper wage. In conclusion, I must say that the colliery electrician should be looked upon as an official. Does he not hold as much, if not more, responsibility as the engineer? The electrician should be in charge of his department, and should receive orders only from the manager. No engineer should have control of the electrician. The electrician is looked upon too often as a common workman. One great fault in colliery managers generally is, they think they know all about electricity, and an electrician has no chance to suggest anything for the welfare of the plant. Finally, give your competent electrician full charge of his department, and pay him well, and it will pay you.

Yours, &c.,

Wakefield, April 20th, 1910. "UNLUCKY."

RELATIVE MERITS OF CONTINUOUS AND ALTERNATING CURRENTS FOR COLLIERY WORK

AT a meeting of the Newcastle branch of the Institution of Mining Electrical Engineers on March 23rd, a Paper on the above subject was read by Mr. C. R. M. Young. He thought that the tendency for the centralisation of power supply was at the root of the preference which was generally felt for the alternating system, and he admitted that for a large new power scheme it would be folly to consider using any system other than three-phase.

Considering first the question of reliability, the general tendency was to regard three-phase plant as more reliable than direct-current. In the case of a scattered installation with a large number of small motors there was much to be said in favour of three-phase plant. In collieries, however, which required a large quantity of power about the shaft for winding, hauling, pumping, and other purposes, the direct-current system had a good deal to recommend it. In such a case, the motors would be sufficiently close to each other to receive ample attention, and provided a direct-current motor is kept reasonably clean it is in every way as reliable as a similar motor of the three-phase type. A direct-current motor has the advantage that dirt is not so likely to lodge in its armature as in the stator of a three-phase motor, and these are, of course, in both cases the most vulnerable parts.

As regards safety from shock, opinions seemed to be pretty evenly divided, but from Dr. Thornton's recent experiments (see ELECTRICAL ENGINEERING IN MINES, March 3rd, p. xxv., and April 7th, p. xlix.) it would appear that the danger due to direct current in this connection is greater than that due to alternating.

Turning to considerations of first cost, Mr. Young works out an estimate for a typical self-contained installation of moderate size, which goes to show that for all practical purposes there is no difference in first cost on a plant of the kind considered between direct-current and three-phase plant at 500 volts, and that even when the voltage in the case of the three-phase system is raised to 3,000 the difference is only small

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in favour of the alternating system. As regards running cost also, although it is difficult to make a fair comparison, there does not seem to be any reason why the costs should not be practically the same on both systems, provided that in both cases the plant is given reasonable attention.

The Paper then repeats the summary of argument in favour of three-phase working given in a Paper read in January by Mr. R. Nelson, H.M. Electrical Inspector of Mines (see ELECTRICAL ENGINEERING IN MINES, February 3rd, p. xiv). In commenting on these Mr. Young pointed out that the lower cost of three-phase motors claimed as an advantage by Mr. Nelson did not necessarily mean lower cost of the whole system. He did not think that the simple starting gear required by squirrel-cage motors was of much account, as it was only in exceptional cases that induction motors without slip-rings could be used. Nor did he agree with Mr. Nelson's contention that induction motors could be used satisfactorily on higher overloads than direct-current machines when the latter were provided with commutating poles.

The principal advantages of direct current were summarised as follows:—

(*a*) Cables for direct-current installations for the same power and voltage are cheaper than those required for three-phase work.

(*b*) A direct-current motor is more readily and economically started up than is the case with a three-phase motor.

(*c*) In the case of a motor which requires to be started and reversed frequently there is less liability to break down on a direct-current than on a three-phase motor.

(*d*) The speed of a direct-current motor can be controlled within very wide limits economically.

(*e*) A direct-current motor, especially when series wound, has a greater starting torque for a given power than any other type of motor without taking excessive power. It also has a very large overload capacity. A direct-current motor can be arranged to run at any reasonable speed, and is not tied down to synchronous speeds.

In view of these considerations, the author considers that there is no reason why collieries having existing direct-current installations should not carry out their extensions on the same system. Even in cases of groups of collieries where extensions are more economically supplied from a new central three-phase station, the existing direct-current machinery may be retained and worked through motor generators.

In the case of a small isolated colliery, the author would favour direct current, especially where haulage forms a large proportion of the load, as the direct-current motor is much superior to its rival for starting heavy loads and the controlling gear is less complicated and less costly. In the case, however, of a large group of collieries with no existing electrical plant, the three-phase system is to be preferred.

In conclusion, the author says:—It would appear that the chief difference between the merits of the two systems is the existence of the static transformer. If it were possible to transform direct current from one voltage to another with the same ease and efficiency with which alternating current can at present be transformed, there seems little doubt that direct current would be the more useful of the two. But as it is necessary to take things as they exist, it must be acknowledged that the three-phase alternating system has many advantages which are of the greatest importance in many instances, but whilst admitting this it must be remembered that the direct-current system has many very good features which cannot be claimed by its rival, and that under suitable conditions it can be employed with advantage.

DISCUSSION.

Mr. W. C. MOUNTAIN (Messrs. Ernest Scott and Mountain), who was in the chair, opened the discussion by pointing out that in small installations where alternating current was used, the generator plant had to be of excess capacity in order to cope with one or two large haulages, if these were installed with squirrel-cage motors. Some years ago he quoted to a direct-current specification for a colliery equipment, and then offered to do the same work by means of alterating-current plant at the same price, which offer was accepted. The excellence of continuous-current plant in mines, moreover, had been shown in the way that plants had been running for many years without trouble. He knew of one case where a commutator had not been touched for seven years.

Prof. W. M. THORNTON (Armstrong College, Newcastle) referred to ignition of coal-dust and gas, and pointed out that the question resolved itself into an investigation of which system was most subject to sparking. As regards coal-dust, alternating current was in certain cases three times as safe as direct current. With regard to shock there was not much difference of risk, as the danger from the extra 40 per cent. of maximum pressure above normal in alternating current was compensated by the clutching effect of continuous current in systems above 480 volts.

Mr. FIELD considered that the installation of small transformers on alternating-current systems was inadvisable, because it would be necessary to install an earth-detector, and to keep records on every secondary circuit. He had installed a 50-kw. Crompton "C.B." converter in one of his pits, for reducing from 500 to 250 volts, with 93 per cent. efficiency, and this was giving every satisfaction. He thought the difficulty of switching on squirrel-cage haulage motors was over-estimated, as this would only occur once in a shift, the rest of the operations being done on the clutch. He had been strongly warned against using high-voltage alternating-current machinery in a mine on account of the question of voltage front, and understood that modern practice was now to discard high-tension machinery in the pit, and to go in for transformers and 500-volt motors. From quotations which had recently been received for controller gear for a 300-h.p. direct-current haulage and a 500-h.p. alternating-current haulage, he had found that the direct-current controller, which was of the metal type, came out to double the price of the liquid alternating-current controller. With regard to the working conditions of the two systems a very important point was the question of air-gaps in induction motors; he only knew of one firm at present which allowed for wear on the brasses by lowering the stator in the frame in order to follow this wear.

Dr. Thornton here remarked that potential front, although usually described as an effect of switching on, was, he believed, really due to switching off a circuit, although the effect was not, of course, discovered until the next switching on. Mr. Mountain said that in his experience voltage front troubles had been eliminated in some 350-h.p. motors running on 3,000 volts by switching on through auxiliary water resistances. Mr. WOOD pointed out that the effect was confined to a difference of potential across the first few turns of the windings and not to earth.

Mr. H. J. FISHER (Electrical Engineer, Lambton Collieries) confirmed this by saying that in motors which he had seen after breaking down from this cause, the trouble was confined to the first few turns, and the insulation had been pierced between turns and not to earth.

Mr. H. W. CLOTHIER (Messrs. A. Reyrolle & Co.) drew attention to the fact that this had been discussed at the last meeting, and that the remedies there described had been the heavier insulation of the first few turns or the use of choking coils. He thought that it was a wrong idea to put a water resistance on the switch, as it complicated the switch, introduced water on the switchboard, and although operating on switching in or out, would not be any precaution against surges produced by switching operations elsewhere.

Mr. TENNANT pointed out that several collieries had used turbine pumps, which required high-speed motors for large horse-powers, up to, say, 500, and it was difficult to obtain such high speeds from direct-current motors. A point with regard to direct-current switchgear was that oil-break switches were useless, owing to the fact that they could not break at zero potential, as on alternating-current supply, so that heavy surges were produced in the system.

In reply to a question asked by Mr. BAXTER, Mr. G. RALPH (Messrs. J. H. Holmes & Co.) said that a great many ball bearings had been used in mining machinery. He knew of one high-speed turbo-pump of 350 h.p. which had been running for two years on ball bearings without any trouble. In this case there was no sidepull. Mr. Fisher thought that dirt caused more breakdowns on direct current than three-phase gear. He had running three squirrel-cage haulage motors of 500, 450, and 350 h.p. respectively without any trouble, the supply being obtained in bulk from a power system. He thought the future of mining supply might lie in single-phase alternating current, 15 or 20 periods per second.

Mr. Clothier, discussing the question of switchgear, said that he had always found that alternating current was more easily controlled than direct current, as the arc from the latter appeared to be more violent than in the former case. Moreover, alternating-current switchgear can be better enclosed than direct-current gear. He doubted whether alternating current was more dangerous than direct current from the point of view of shock, as an absolutely instantaneous contact with alternating current would not be sufficient to kill. He was beginning to hope that it was possible to design a good oil-break switch for direct-current systems, although this was a prospect rather for the future than for the present. With proper protection, the prices of switchgear for controllers would be about the same, both for direct current and alternating current, but at present in practice 500 volts direct-current plant was not so fully protected as in alternating current. The point mentioned by Mr. Field as to putting leakage detectors on every sub-circuit would be obviated by earthing the neutral of the sub-circuits. This was a point in favour of alternating currents, and in his opinion lighting sub-circuits should not be operated at a higher pressure than 50 volts.

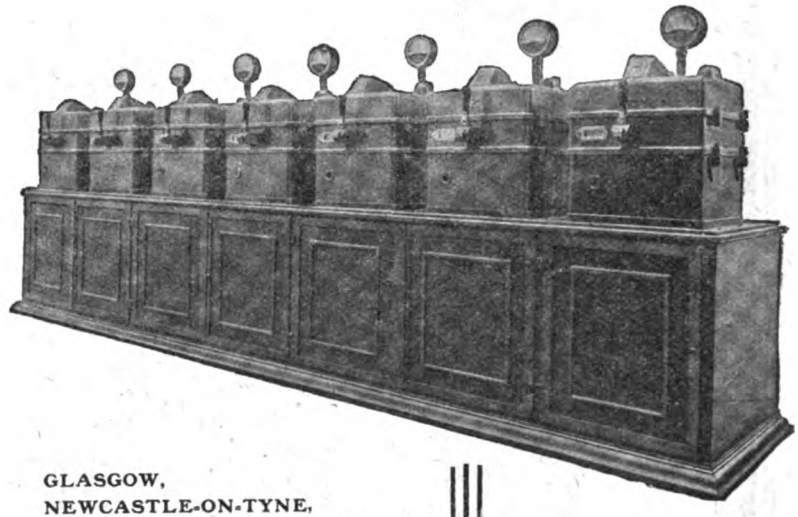
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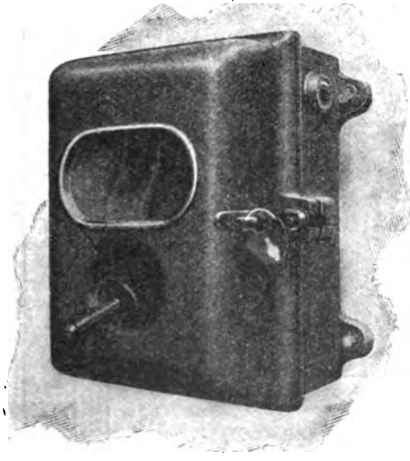


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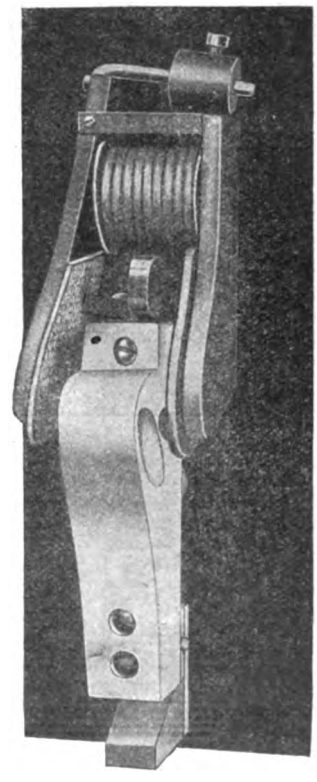
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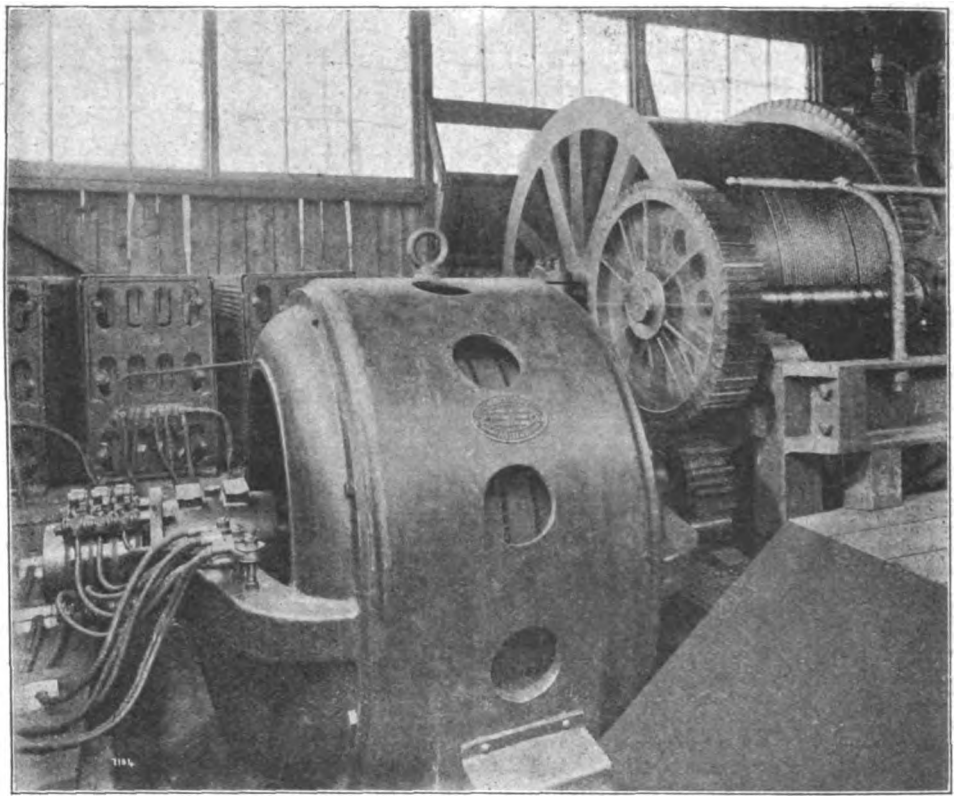
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Mr. SIMPSON, Mr. HUNTER, and Mr. PARK also spoke, and after a brief reply from Mr. Young, the discussion was adjourned.

The Paper was further discussed on Wednesday, April 6th, when two written communications were read. In one of these Mr. E. MUDD pointed out that as the majority of shocks are obtained between one phase and earth, the advantage of safety appeared to lie with alternating current when the neutral was earthed. The use of large squirrel cage motors with auto-starters was possible, especially with a three-phase supply taken from a power-in-bulk system, and saved cost in motors and switchgear, as well as cutting down costs of attendance.

Mr. W. W. WOOD pointed out that an advantage of a continuous current compound-wound motor over three-phase machinery for haulage work was that it would automatically slow up on the heavy gradients, at the same time giving a greatly increased torque, while on the flat parts of the road its speed automatically increases, keeping up a high average speed, and equalising the power demand on the generating plant.

Mr. SNAITH said that three-phase machinery, saturated with oil, did not, in his opinion, give much trouble compared with the dust difficulty in direct current work. He also referred to the question of protection on alternating current mains, and thought that the time element device was a very important factor in the system of protection. One was required which could be used at any time for any load and capable of variation from 20 per cent. to 100 per cent. overload in a few seconds by simple adjustment.

Mr. C. S. VESEY BROWN thought that direct current work did not require such a high standard of technical training on the part of the engineers in charge as did alternating current. The possibilities of high-tension continuous current such as employed in the Thury system had not been referred to in the Paper. He objected to the prevalent practice of asking for heavy overload capacity in motors. Manufacturers in tendering simply rated their motor at a lower capacity than that for which it was originally designed. This could be done equally well with direct or alternating current machinery, so that it was not an exclusive advantage of the latter, as claimed by Mr. Nelson. He did not like the idea of using transformer sub-stations inbye.

Mr. TENNENT said he had had recent information of a new three phase repulsion motor, started by a simple three-pole switch, and working on varying speeds by shifting the brushes. Full particulars had not yet come to hand, but he believed that the information was authentic. Objections to the Thury system were that it was necessary to insulate the engine from the generator, and to have an attendant in every sub-station. As regards machinery, direct current appeared to be freer from accident than alternating current, because of the larger clearances between fixed and moving parts, but he thought that better protective appliances were available in the case of large powers with alternating current. Alternating current supply also lent itself more readily to leakage detection and isolation.

Mr. YOUNG, in replying to the discussion, pointed out that what he had attempted to show was not that direct current was superior to three-phase systems, but that there were cases in which it could be used with advantage. It was true that the shock pressure on an earthed three-phase system would be lower than the working pressure between phases, but in a direct current system, providing that insulation was good, a man touching one pole would receive no shock at all as he would reduce that pole to earth potential. His own experience with regard to squirrel cage motors had not been satisfactory. He thought that the most of the arguments brought forward to show the superiority of the three-phase system from the point of view of protection were based on the assumption that the neutral point of a three-phase supply would be earthed; he did not think that this was the time to enter into such a wide field of discussion, but he was not prepared to admit that either for theoretical or practical reasons a neutral point of such a system should be earthed.

Sandwell Park Colliery Fatality.—On April 6th, a sinker, T. W. Ward, was killed at the Jubilee Pit of the Sandwell Park Colliery Co., Ltd., West Bromwich. At the inquest, held on April 9th, evidence was given to the effect that the deceased and two others were engaged in shifting a set of 550-volt cables in a new shaft some 250 yards from the bottom. These cables supplied power to the pumps at the bottom, and the latter were supposed to be worked only between shifts. Deceased was in the cage and the other two men were on the top, and all three were removing the wooden covering from the casing, when the former drove his chisel into a cable and, receiving a shock, fell down into the sump. Before he fell, one of the other men attempted to save him, and in doing so received a slight shock. There was a rule posted up at the shaft top and generally observed that current should be cut off before anything was done to the cables, but the deceased, who should have given the order for the current to be cut off, had not done so. The other men also knew the cables were alive. The coroner concluded that the deceased might have been killed either by electric shock or by falling down the shaft, as the body was badly mutilated. A verdict of accidental death was returned, and no blame was attached to anyone.

STORAGE BATTERIES FOR COLLIERY WORK

A PAPER on "Storage Batteries for Colliery Work" was read by Mr. J. Glynn Williams at a meeting of the Cumberland Branch of the Institution of Mining Electrical Engineers on April 16th, at the Scientific Institute, Whitehaven.

He believed that the only colliery where a battery is used in conjunction with a three-phase transmission and D.C. distribution was the Hucknall Torkard Colliery, Notts. In this installation the main generator is a Rateau exhaust steam turbo-generator, having an output of 110 kw. at 500 volts, and the spare power from this is stepped up to 3,000 volts through a 90 kw. transformer, and transmitted across the town to another pit, and delivered to a 80 k.v.a. 3,000-volt synchronous motor direct coupled to a 500-volt 100 amp. direct current generator and a Lancashire Dynamo Company's booster. At the same time there is a transformer to step down from 3,000 volts to 500 volts, so that either A.C. or D.C. can be used as required. The battery comprises 240 "Tudor" cells of 400 ampere hours capacity, and the conversion plant is so arranged, that in case of full load, part of the current is supplied by the transmission lines, and the balance by the storage batteries, whilst in cases of the working load being less than the power transmitted, the balance of transmitted power is used to recharge the batteries. Some of the motors are run from the A.C. circuit and some from the D.C. circuit. The lighting is also divided up between the two.

In the case of a group of collieries supplied from one three-phase generating station, conversion to D.C. and the use of batteries would make each pit to some extent independent in case of breakdowns at the station or on the transmission lines, as work can still proceed up to the limit of the batteries while repairs are carried on. With this in view, it is advisable that in such a system the surface and ventilating machinery should be worked from the D.C. circuit, as well as the lighting and signals. Should it be desirable to use three-phase machines in some of the places underground, of course it would be an easy matter to take some of the power transmitted without conversion, or say during the light load period, if transmission is cut off, the current from batteries could be re-converted to three-phase A.C.

Mr. Williams then proceeds to work out comparisons of costs of the following schemes. (1) Transmitting to colliery B from colliery A, with a battery to meet the case when the load at B is greater than the power available at A. (2) Separate plant at colliery B, including a battery. (3) Separate plant at B without battery. The collieries are supposed to be three miles apart.

A certain schedule of power requirements is assumed, under which in scheme (1) for 300 h.p. required at colliery B during the day shift, there is only spare power available for transmission from colliery A of 150 h.p. The storage battery is therefore employed to help the peak. The arrangement suggested is to give the A.C. supply to colliery B at about 300 volts direct to a rotary convertor giving 500 volts on the D.C. side with a reversible booster on the same shaft. The actual cycle of operations is investigated by load curves on the basis of a battery of 240 of the D.P. Battery Co.'s L.S. 33 type cells, giving 2,048 ampere hours at the 8-hour rate. The total cost of the plant is worked out as follows. Battery, £2,500; converter and booster, £510; switchboards, £290; transformers, £570; transmission line, £1,157; total, £5,027.

Scheme (2) is based on a 240 h.p. steam-driven generating plant at B, and a battery to give 720 h.p. hours, consisting of 240 L.S. 19 D.P. cells. The total cost for this scheme is given as £6,704, not including spares for the generating plant. Scheme (3) provides simply for a 300 h.p. generating plant, costing £5,625. The author then works out fixed charges on a basis which he gives as follows:—3 per cent. interest, 2 per cent. sinking fund, 5 per cent. repairs on generating plant; 7 per cent. battery maintenance rate for 10 years, in 12 years at 7 per cent. compound interest, the capital expenditure on the battery will have been replaced; 5 per cent. is allowed for transmission line. These charges come out as follows:—Scheme (1), £615; Scheme (2), £690; Scheme (3), £563.

Mr. Williams does not consider running costs, so no real comparison can be made, but he points out, in comparing schemes (1) and (2), that with the higher fixed charges in scheme (2) would be to some extent balanced by the avoidance of the transmission and transmission losses of scheme (1), but that the labour charge in (1) would be much less than with (2). Scheme (2) might entail a slight saving in labour over scheme (3), owing to it being possible at times to let the battery take the load without running any plant, but the saving would only be small. Mr. Williams discusses these schemes in a general way, but does not arrive at any very definite conclusion as to which is the best scheme. Scheme 1, he says, could be adopted on the same lines as at the Hucknall Torkard Collieries, in Notts. In this case, a motor generator would be employed instead of a rotary converter. The voltage would be transformed from 3,000 volts down to 500. The load then could be taken down the pit from the alternating current side at 500 volts, and the surplus current would be used for charging the batteries during that part of the day when the load was light,

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and during that part of the day when the load was heavy the accumulators would be switched in to help it.

Speaking generally, the author appears to recommend the use of batteries for loads of the order of magnitude considered, but not in case of much heavier loads.

A few questions were asked by members, but the main discussion was adjourned.

SAFETY PRECAUTIONS IN MINES

THE Paper on "Electricity in Mines," which was read by Mr. R. Nelson (H.M. Electrical Inspector of Mines) before the Institution of Mining Engineers about a year ago (see ELECTRICAL ENGINEERING, Vol. V., p. 527), was discussed by the Mining Institute of Scotland at Glasgow on April 13th.

Mr. FRANK ANSLOW (Messrs. Walter Dixon & Co., Consulting Engineers, Glasgow), while in hearty agreement with the major portion of Mr. Nelson's Paper, regretted that Mr. Nelson had recommended practically only one type of supply and one type of cable. Mr. Anslow was of opinion that A.C. was the more satisfactory supply for fiery mines, besides possessing advantages with regard to economical transmission, but at the same time D.C. supply was often more adaptable for driving colliery machinery. He agreed that the power supply companies might have been a boon to collieries in isolated districts, but it was not clear that the companies could always supply at as cheap a rate as the larger collieries could themselves generate, taking into account the growing use of exhaust steam turbines and the fact that the collieries were often able to use coal which has little or no commercial value. The use of armoured cable usually insured the work being carried out in a proper manner. He thought that the protective system described in Mr. Nelson's Paper had not had a sufficiently prolonged trial under the conditions existing in collieries to enable them to come to a final decision. One disadvantage in his opinion was that a temporary interruption of supply at one point might lead to the shutting down of the whole system, and would consequently hamper the work to too great a degree.

Mr. C. A. ATCHLEY (Messrs. Harland, Bowden & Co., Glasgow) was of opinion that A.C. supply in general was more satisfactory, but he admitted that in thin seams D.C. supply was preferable as smaller motors could be used for a given power, thus reducing the necessary head-room for a coal-cutter. While he agreed that A.C. motors generally were more robust, he thought that the sparking from slip-rings was as potentially dangerous as that from commutators. A prime objection to the concentric system was the great difficulty in securing quick repair of faults. He did not think that lead-covered cables should be recommended for mining work, as his experience had been that lead covering would not last in a mine. He was of opinion that vulcanised bitumen cable was the most satisfactory, with the possible addition of armoured cable in the main roads. A copper earthing sheath was unnecessary in any but the very large pits with long in-bye roads. Mr. Atchley emphasised the dangers to be anticipated from the use of armoured cable without proper supervision to ensure perfect metallic continuity. His experience was that automatic cut-outs and similar devices tended to get out of order so rapidly owing to the dust and damp found in a mine interfering with the necessarily fine adjustments, that fuses were in many cases preferable.

Mr. S. MAVOR (Messrs. Mavor & Coulson, Glasgow) protested against Mr. Nelson's somewhat curt dismissal of the claims of D.C. supply to the mine manager's notice. The principal advantages of three-phase supply were the additional economy of transmission and the possibility of using motors without moving contacts. The latter advantage was qualified by the fact that many operations required slip-ring motors, which were as objectionable with regard to sparking as D.C. motors. In a large number of the Scotch mines which had relatively short cable-runs, economy in transmission had comparatively little weight. These mines also were usually not of the fiery type, and therefore even the second advantage claimed did not generally require consideration. He admitted that A.C. motors were preferable for the high speed turbo pumps now so much used. With the bar type of cutter squirrel cage motors can be used, but with both other types it is necessary to use slip-ring motors.

Mr. ANDERSON (Messrs. Anderson & Boyes, Motherwell) was of opinion that D.C. coal-cutters were preferable to the A.C. type. He did not agree with the opinion of one of the previous speakers that the use of armoured cable leads to good work, but rather thought the contrary. He was of opinion that only one earthing point should be used, and that it should be at the surface. An entirely separate earth lead should be run to earth, and for this purpose he recommended an old wire rope—pipe returns should on no account be used.

Mr. ROBERT MCLAREN (President of the Institute) remarked on the great difference of opinion existing among mining and electrical men on the subject of earthing. He thought that the method proposed by Mr. Anderson of running separate earth leads to only one point was open to the objection that a large proportion of the plant might be made potentially dangerous by a fall of roof severing the earth wire at a point at which the damage would not be easily noticed. It had been the practice in some mines to carry cables on either side of the main roads and haulage ways, which meant that there was nearly always one cable in close proximity to the signal wire, and this was a dangerous practice. An objection to armoured cable was that when twisted, the armouring tended to leave the cable.

Mr. DAVID MARTIN (Messrs. Reyrolles, Ltd.) remarked that the protective gear to which Mr. Nelson referred had had an extended use in the coal mines of the N.E. coast of England.

Mr. J. T. FORGIE (Messrs. W. Baird & Co., Glasgow) said that although the D.C. system had been found perfectly satisfactory for a large number of small mines in Scotland, for the large and fiery mines more common in England it was probably more satisfactory to use three-phase supply.

Mr. G. L. KERR (Scottish Mine Owners' Association, Glasgow), in a written communication expressed the opinion that for mines where firedamp was given off in dangerous quantities, alternating current, particularly three-phase, was the safer system. In the Scottish coalfields the percentage of fiery collieries was not really very great, for many of the mines which were worked with safety lamps were practically free from fire-damp in dangerous quantities. There would be no risk in 80 per cent. or more of the Scottish mines using direct current. With regard to shocks alternating current seems to be the more dangerous. In his opinion armoured cables were all right in the shafts, but possessed serious disadvantages in underground roadways, and along working faces there was a danger of heavy falls of roof driving the armouring into contact with the cores. With regard to Mr. Nelson's contention that a proper system of earthing and cut-out gear made that contingency remote, Mr. Kerr was of opinion that no system of earthing or cut-out gear could be said to offer absolute safety in underground work, as the conditions were quite different from surface installations, and even with good earthing it seemed to him that there was considerable danger with armoured trailing cables. Another serious drawback to the use of armoured cable was the difficulty of locating faults, allied with the difficulty of repairing them or the making of joints. Trip-gear was apt to cause trouble in acting when not required on momentary overload, and he questioned whether a time-limit apparatus did not allow the very danger to arise which it was designed to avoid.

Newcastle Branch of the Institution of Mining Electrical Engineers.—By kind permission of the Newcastle-upon-Tyne Electric Supply Co., Ltd., arrangements have been made for members to inspect the electrical plant at their Carville power station, Wallsend-on-Tyne, on Saturday, May 14th. Members meet at the power station not later than 2.30 o'clock. It has also been decided to hold a picnic at Fountain's Abbey, Ripon, on Saturday, June 11th.

Lancashire Branch of the Institution of Mining Electrical Engineers.—A meeting of this branch was held at the Grand Hotel, Manchester, on Saturday, April 16th, when a discussion was held on the subject of the special rules for electricity in mines. All the members joined in the discussion, raising some very interesting and instructive points with regard to the safe application of electricity to motive power in mines. The next meeting will be held at the above hotel on Saturday, May 28th, at 6.30 p.m., when a Paper will be read by Mr. Bolton Shaw on "Colliery Cables."

Coal-cutter Accident.—On April 20th, a miner, H. T. Calladine, was killed by electric shock at the Wingfield Manor Colliery, Derbyshire. The inquest was held on April 23rd. At the time of the accident the deceased was working an electric coal-cutter, in conjunction with his brother. The latter was some distance from the machine, and on hearing the deceased cry out, he switched off the current. On returning to the machine, however, he found the deceased lying across the haulage rope. Artificial respiration proved ineffective. It appears that the colliery supply is on the D.-C. 500-volt concentric system with unarmoured cables and earthed negative. The coal-cutter in question was connected by a flexible twin-core unarmoured cable to a single-pole gate-end switch-box. The positive core of the trailing cable and the positive inner core of the main cable were taken into the box. A short length of 7/16 cable was connected by means of a clamp to the negative outer of the main cable, and this was bolted to another length of 7/16 cable jointed to the very flexible second core of the trailing cable. The continual connecting and disconnecting at the bolt had apparently weakened the latter joint, because the length of 7/16 cable must have broken away from the trailing cable core. This caused the motor to stop, but as the negative core of the trailing cable (and therefore the negative terminal of the motor) was connected to the frame, the whole machine and frame was raised to the full potential of the positive. As the negative core was severed, the connection to earth was broken. Mr. R. Nelson, H.M. Electrical Inspector of Mines, who was present at the inquest, suggested that the system would be improved by the use of proper connecting plugs between the trailing cables and gate-end boxes. The jury returned a verdict of accidental death, attaching no blame to anyone.

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EARTHED v. INSULATED NEUTRALS

ON Thursday last, a Paper was read before the Institution of Electrical Engineers, in London, by Mr. W. W. Wood, dealing with the question whether a three-phase colliery installation should work with an earthed or insulated neutral. The Paper was read before the Newcastle Section on the previous Monday. The author points out that there are a number of examples of each system at work, and that conditions vary so greatly that what is suitable in one case may be dangerous in another. When power is taken direct from a supply company, an earth on the company's mains will have the same effect as an earth on the installation, and under such circumstances it is better to earth the neutral. Where the supply is transformed, however, the colliery circuit is insulated, and this does not apply. The earthing or insulating of the neutral makes little difference to the generating plant, as trouble with triple-frequency currents in the former case may be got over by only earthing the neutral of one generator, or by the introduction of choking coils. (See ELECTRICAL ENGINEERING, Vol. V., pp. 411, 432.) As far as the transmission lines are concerned,

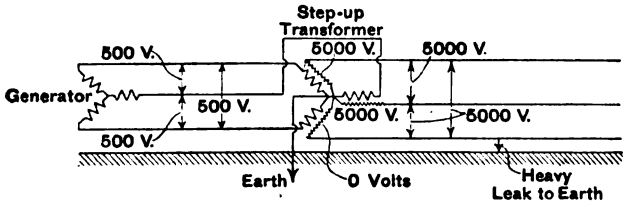


FIG. 1.—EFFECT OF ONE PHASE ON SECONDARY SIDE OF TRANSFORMER GOING TO EARTH; *i.e.*, PRESSURE PER PHASE IN OTHER TWO PHASES NEARLY DOUBLED.

the question is a very open one indeed, and very diverse opinions have been expressed. Under certain conditions it is possible to get the full line-voltage to earth in two phases, even with the neutral earthed and connected on both sides of the transformers, if the generator neutral is insulated. This is due to the instability of the neutral-point, and is illustrated in Fig. 1.

Turning to the underground plant, the author asserts that though it is possible to get a severe shock from the capacity effect alone, on an insulated system, there is no doubt that a system with earthed neutral presents greater dangers. On medium-pressure insulated systems, however, the neutral-point is often connected to earth through a leakage indicator, which will pass several hundred milliamperes, sufficient to give a fatal shock. This danger can be reduced by using electrostatic indicators, or the Nalder instrument, which only passes a few milliamperes. With an earthed system the voltage between any point and earth cannot exceed 58 per cent. of the line pressure, but this is not of any great advantage. The best protection against shock lies in properly enclosing all live parts, and in efficiently earthing all motor frames, switch-cases, &c. The earth wire should be large enough to carry the current which will blow the fuses of the plant it protects, and should be frequently tested for continuity. In a dry pit it is often necessary to employ a separate earthing cable or core, but this may be a source of danger unless the system is also earthed underground. Fig. 2 shows a three-phase system with the neutral earthed at

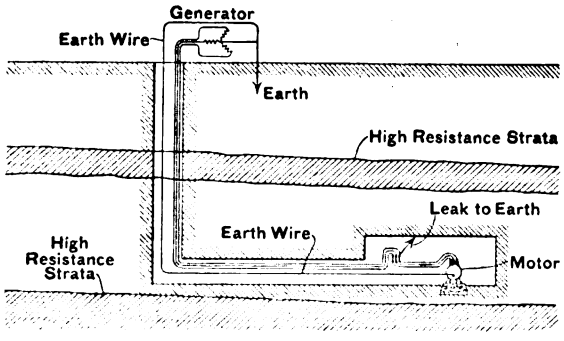


FIG. 2.—MOTOR RAISED TO HIGH POTENTIAL ABOVE EARTH BY HIGH RESISTANCE STRATA INTERVENING BETWEEN EARTH PLATE AT BANK AND SEAM IN WHICH MOTOR WORKS.

the generating station. Suppose a leak takes place on one of the outers near a motor situated between high-resistance strata. The resistance from the ground to the earthplate at bank (except through the earth wire) is very high. If the motor makes bad contact with the ground, anyone touching the motor-case may get a fatal shock. If the neutral is insulated it is necessary to have a leak on one of the other phases at bank before the same conditions can apply. A non-fatal shock due to the same causes occurred recently in a colliery in Scotland, and on measuring the resistance between an earthplate at bank and an earth connection at the bottom of the shaft, this was found to be 100,000 ohms. Messrs. J. G. and R. G. Cunliffe have shown that the resistance of an earthplate is often very considerable. (See ELECTRICAL ENGINEERING, Vol.. V., p. 261.) Thus, it was shown that the resistance between two plates each 1½ ft. square, and arranged 200 ft. apart, may be about 30 ohms, so that a leakage current of a few amperes would cause a big P.D. Further, nearly 50 per cent. of this drop occurs within 3 ft. of the plates. It was further shown that no great advantage was gained in making plates more than 4 sq. ft. in area. It appears necessary, therefore, to provide several earthplates distributed over the installation.

Danger of shock by coming in contact with an unarmoured damaged cable cannot, however, be guarded against in this way. With an earthed system shock is certain; with an insulated system it is likely to be less severe. With armoured cables this danger cannot occur as long as the armouring is efficiently earthed and electrically continuous. If this is not the case, however, the conditions are more dangerous than before, as an earth will cause a considerable length of armouring to be alive.

Recent experiments show that an arc will ignite either gas or coal dust in suspension, if present in suitable proportions. It is, therefore, doubtful whether many managers would instal electric plant in places where inflammable gas or much dust are constantly present. With an earthed neutral failure of the insulation of one phase to earth will produce an arc. With an insulated system, an earth on one phase shows on the leakage indicator, and there is a chance of isolating the section before any arc occurs. An advantage of the earthed system is that an earth on one phase isolates the faulty part, and does not increase the stress elsewhere, while a similar occurrence on an insulated system doubles the stress on the other phases, and is likely to cause further breakdowns.

Devices have been recently introduced to cut off current as soon as the leakage exceeds, say, ¼ ampere. They are only for use on a system with earthed neutral. By the use of these with armoured cables, danger from shock and explosion is said to be largely avoided, and Mr. Wedmore, of the B.T.H. Co., had described experiments showing that with armoured cables and leakage trips, external arcs do not occur, even if the cable is badly damaged by a fall of roof. These devices depend absolutely, however, on the continuity of the armouring or earthing being maintained, and if this is not done, they afford little protection against explosion and shock. A motor on concrete is well insulated, and if the earth connection is broken insufficient current would flow to operate the leakage trip in case of leakage to the frame. As long as earth connections are kept in good order there is no danger of shock from motors or switch casings or armourings, so that while there are cases in which a leakage device may be of use, there are also others where it would not justify the increased expenditure.

It is sometimes desirable to run plant in a damaged condition. Thus the stoppage of a main haulage gear will disastrously affect the day's output of coal, and if the plant can be kept going till the end of the shift, the fault can be remedied without disorganising the working of the pit. For this reason an installation with earthed neutral is likely to give more trouble than an insulated system. If leakage trips are indiscriminately used, there may be many unnecessary interruptions.

In the author's opinion it is better to rely upon having good men to look after the plant, and see that small details, such as earthing, &c., are properly attended to than on automatic appliances.

Dealing with the question of cost, the author points out that where automatic oil switches are used, three relays, one in each phase, are needed with an earthed neutral, and only two with an insulated neutral. The cost of armoured cable is nearly double that of unarmoured, so that if there is no danger of mechanical damage or explosion, armouring is an unjustifiable expense. The cost of maintenance is of greater importance than first cost, and thus simplicity is of primary importance. Concluding, the author states that an insulated neutral is better for standing plant when the cables are not liable to mechanical damage. Where coal-cutters are used, or where cables are liable to hard usage, it may be worth while to use automatic devices. If a separate transformer were used in the latter case, its neutral could be earthed (preferably through a resistance), without interfering with the remainder of the system. Where small lighting transformers are used, it is desirable to limit the secondary pressure to 110 volts, and earth the neutral. Finally, the author disclaims any sympathy with the present scare in regard to the use of electricity in mines. The number of accidents that occur is, he says, extraordinarily small considering the widespread use of electricity, and the

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insufficient staff employed. The average number of deaths caused electrically in mines appears to be about 1 per cent. of all the accidental deaths, and many of these have been due to pure accident or wilful carelessness.

Discussion in Newcastle.

Prof. W. M. Thornton (Armstrong College, Newcastle), suggested that the reason why insulated delta connected systems were so common in America was that they did not think it necessary to take such precautions against shock, as men were cheap. An American engineer had told him that to earth the neutral was to put a premium on breakdowns. With regard to the effect of a high-resistance stratum, he thought that it would have to be many square miles in area to insulate the upper and lower conducting layers. Further, geological faults would occur in the area and pierce the insulating stratum. He had known of fatal shocks at 80 volts, but he thought that under mining conditions about 150 volts would be the limit for fatal shocks. It would be interesting to know if the large drop near the earth plates was due to electrolytic effects. The author had described a case where the trip-gear would not work, on account of the failure of the earth connection; a new rule for mines might provide that motors should be earthed by two or three flexible wires, so coiled that they could not be easily broken. He had once acted as Referee on the question of earthing the neutral. The contractor had objected, and a compromise was effected by installing a switch in the earth connection; this was closed only when tests were made several times every day. He did not think there was a scare with regard to the use of electricity in mines, but more care was being taken than formerly. Referring to Fig 2, he suggested that it was advisable to make an efficient earth in every seam, and to put in as many earth-plates as possible.

Mr. J. G. Wilson (Waste Heat and Gas Electrical Generating Stations, Ltd.), pointed out that on large three-phase systems with an insulated neutral, there was practically always sufficient leakage from motor windings, &c., to make it dangerous to touch any phase. The amount of danger was fluctuating, and variation of danger in collieries was the last thing desirable. With an earthed neutral it was thoroughly understood that touching any phase was dangerous. Armoured cables were, in the general opinion, correct practice, and with such there was a strong argument for earthing. A good armoured cable would stand considerable mechanical stress, but in the event of a very heavy fall of roof it might happen that the armouring would be brought into contact with one core. If the neutral were not earthed there would be no certainty of the cut-out operating, but if it were earthed, the supply would be cut off instantaneously. In the latter case, the cut-off could be secured either by a balanced system of relays, or by a trip-coil in series with the armouring. In the case of an unearthed system, the supply would not be cut off unless one core were forced into contact with another. On the other hand, it was conceivable that a D.C. 500-volt installation, with a neutral wire, was a case for not earthing the neutral.

Mr. H. W. Clothier (Messrs. A. Reyrolle & Co.), said he was a strong advocate of earthing the neutral in three-phase installations. He thought that a damaged circuit should be instantly isolated. With an earthed neutral it was not necessary to have a leakage detector, a device which was a nuisance in practice, and this far outweighed the advantage of the insulated system, that one trip-coil was saved. Further, it was not necessary to have earthing devices, as were necessary on insulated systems, as, for example, the Cardew earthing devices to prevent the L.T. windings of transformers being raised to the pressure of the H.T. side. In this respect the earthed system was simpler than the insulated system. The author seemed to admit that in the case of collieries supplied from supply companies' mains, it was best to earth the neutral. He assumed that the author would be of the same opinion in the case of large collieries with their own generating plant and sub-stations. Mr. Clothier continued that he was in favour of 50 or 25 volts for lighting circuits in mines. Auto-transformers with one terminal connected to a common earthed neutral conductor should be employed. He agreed with Mr. Wilson on the importance of armouring cables. The keynote of safety was that the system should be thoroughly iron-clad from generator to load. Given a complete armouring throughout, it was then necessary to have proper protective devices. In the case referred to by the author of a tripping device on the balanced system not operating, due to a broken earth connection, if the cable were armoured it would be necessary for the armouring to be discontinuous also before the device would fail to act. Referring to Fig. 2, he agreed with the necessity of numerous earth-plates, but the argument could not be directed against earthing the neutral; similar trouble could occur on an insulated neutral system under certain conditions.

Mr. F. O. Hunt said that the severity of a shock from an insulated system depended on the size of the system; with a large enough capacity it might be a fatal shock. With regard to leakage indicators, the electrostatic type did not involve connection to earth, and did not, therefore, provide a path for a shock curent on insulated systems. The limitation of voltage obtained by earthing was of little advantage; experiments had shown that labourers with wet hands were unable to let go of a conductor at a pressure as low as 30 volts at ordinary frequencies. On an earthed-neutral system, failure of one phase to earth was practically certain to produce a flash, even with automatic devices. He did not see why leakage trips should not be applied to insulated-neutral systems. With regard to the increase of stress on insulation when one phase of an insulated-neutral system went to earth, Mr. M. B. Field had shown that the condenser effects fixed the potential with reference to earth as when earthing through a high resistance. He did not agree that the elimination of the leakage indicator was an unmixed blessing, as a good instrument would give warning of a leak before it caused a stoppage of supply.

Mr. C. S. Vesey Brown said that an earthed neutral was a good fault finder. Personally, he always earthed, but had had much difficulty in finding really good earths.

Mr. Porter suggested that the concentration of the drop near earth-plates was due to the restricted cross-sectional area of the current path near the plates, and not to electrolytic effects. Leakage trip-gear on the balanced system could not be used indiscriminately on a network. With a main distributor with branches, the gear could be placed on the branches, but not on the main; *i.e.*, it could not be placed in series as duplicate tripping would occur.

Mr. W. Wood, in reply, emphasised the fact that each case had to be considered on its own merits. In reply to Dr. Thornton, he had noticed electrolytic action on earth-plates. He agreed that H.T. cables should be armoured, probably in all cases. With regard to danger due to leakage on insulated systems, he only claimed that there was less danger with insulated neutrals. The question of false confidence was not, he thought, a serious point. Capacity current could kill, but only a large system would have enough capacity. It was good practice to use leakage indicators even on an earthed system. With balanced trip-gear, and a non-earthed motor on insulating foundations, the gear would not work on the motor winding failing if the armouring were not continuous. With continuous armouring there would be no fear of shock, whether the trip-gear were there or not.

Discussion in London.

Mr. J. G. Wilson (Waste Heat & Gas Electrical Generating Stations, Ltd.) repeated the arguments he had given at the previous meeting at Newcastle in favour of earthing the neutral, and quoted in support of these an original communication by Mr. M. B. Field, published in Vol. 41 of the Institution *Journal* (p. 200). Referring to danger from falls of roof, he said that in the case of an unearthed system the supply would only be cut off if one core were forced into contact with another, and even then the current had to rise to a value probably double the normal, and considerable heating and arcing might occur. On the other hand, with an earthed system, the supply could be cut off instantaneously. Reliability of supply was, of course, most important, especially in the case of winding and blowing, both of which are done at Bank. Temporary cutting off of the supply underground to haulage, pumping, or even coal-cutter motors, while objectionable, ought not to be considered where there was danger of explosion.

Mr. H. W. Clothier also employed similar arguments to those he used at Newcastle in favour of earthing the neutral. He emphasised the danger of not isolating a damaged circuit, and advocated armouring throughout. Contact between core and earthed armouring due to a heavy fall of roof would, with proper protective devices, result in instantaneous isolation of the cable before any external flame could occur; he had known cases where after such damage the place of contact could not be found. The cost of the leakage protection system was little, if anything, more than ordinary overload protection. He disagreed with the author's comparison of the cost of armoured and unarmoured cables. With small cables the extra cost of armouring might be 40 to 50 per cent., but with larger cables it was only 20 per cent.

Mr. W. H. Patchell emphasised that they should have efficient men to look after the plant. It would pay to put less money in providing mechanical safeguards and more money on the staff. The possibilities of flashing due to falls of roofs were very remote; he had never had one. With regard to earthing, each case ought to be dealt with on its merits. Neither earthing nor non-earthing could be laid down as a principle to be universally adopted.

Mr. W. C. Mountain (Messrs. Ernest Scott & Mountain) said that 99 per cent. of breakdowns in mines were due to earths on the systems. There was always an accumulation of damp in a mine, and this acted upon the motor windings, which eventually —especially with coal-cutting machines—broke down the insulation. Whilst everything that could be done to promote the safety of the miner was necessary, he did not think this object would be attained by the protective gear only. An essential for colliery work was strength and simplicity. Armouring should be used wherever possible; at the same time, with portable apparatus, armoured cable was unwieldy and more likely to cause trouble than unarmoured cable. All motor frames, switchgear, &c., should be as permanently and efficiently earthed as possible, for nearly all the troubles in collieries from shock had arisen through defective earthing. He did not know of a

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single accident through the armouring of a cable being broken by a fall of roof. The scare in connection with the use of electricity in mines was not warranted, and would never have existed if efficient men had been employed to look after the plant.

Mr. J. F. C. SNELL said that after the very careful investigations which he and some others had made on behalf of the Institution in connection with the Home Office Committee now considering the mining regulations, he had come to the conclusion that it was imperative that the neutral of three-phase systems should be earthed. This did not interfere with the simplicity of the system if they coupled with it a complete system of armouring. All cable joints should be bonded, and all frames of fixed machines should be bonded to the armouring. It was necessary, however, to protect cable armouring against acidulated water, but this was a question for the cable makers. Personally he would like to see complete armouring made compulsory in collieries, in order to avoid armouring here and there and thus getting patchy systems.

Mr. E. B. WEDMORE entirely agreed with Mr. Snell's remarks. He thought the percentages of deaths due to electricity in mines given in the Paper, viz., 1 per cent. of all accidental deaths, would be much higher if only mines in which electricity was used were taken into account. The author's arguments against earthing the middle point were in many cases weak, because they referred to defective systems. The author seemed to suggest that it was usual abroad to allow a system to continue working with one phase earthed where the middle point was not earthed, but this threw unusual stress upon the other phases and was liable to cause a very serious short. The author advocated earthed metal cases for switches, motors, &c., and the only logical conclusion was to continue this and provide a continuously armoured system, earthed at one or more points. He did not think that introducing a relay into the armouring circuit would be effective, because on calling on the wire to carry the leakage current there was a drop of potential, and the armouring and other metal parts were raised materially above earth potential.

Mr. H. M. SAYERS advocated the earthed neutral, which, he claimed, afforded distinct economy in cables, machines, and apparatus. Further, it provided a constant watch upon the insulation of the whole system, without which faults might remain undetected. He disagreed with the author that under the conditions given in Fig. 1 it was possible to get the full line voltage to earth in two phases. The distribution of voltage on the high-tension side of the transformer in the author's diagram was impossible. The use of local earth plates might produce very serious accidents in connection with signal wires; he believed that fatal shocks had taken place from signal wires due to their picking up the leakage currents. The present scare was due to the electrically ignorant man who came up against something which he did not know was dangerous, and this was the main thing they had to contend with.

Mr. H. BRAZIL said that if the neutral were earthed, it should be earthed through a resistance, which would limit the current flowing in the event of a fault. This resistance could take the form of the carbon powder device, described by him on a previous occasion, which decreased in value when a fault occurred until the current which flowed was sufficient to operate the cut-outs.

Mr. C. H. WORDINGHAM strongly endorsed the safety of earthing, but emphasised that it should be a real earth. He regarded the practice of inserting resistances in the earth connection to be undesirable, as it might cause a dangerous potential and risk of shock. The difficulty of finding an efficient earth was one of the points which the committee of the Institution was dealing with.

Mr. S. Z. DE FERRANTI reiterated his opinion that it was desirable to thoroughly well earth the neutral point and also to substantially cover with earthed metal all parts carrying a potential high enough to do any damage. Above all, the work should be done thoroughly.

Mr. WOOD, in reply, said that in America the conditions shown in his Fig. 1 were frequently met with, and the transformer did not burn out. Armouring, if it could be relied upon, gave the greatest protection, but it could not always be relied upon. In some parts of Yorkshire the armouring had been known to last only three weeks. With an earthed neutral they were relying upon one set of insulation, whilst with an insulated neutral there were two sets, and there was means of seeing that the insulation was in fair condition. It had been suggested that a leakage indicator might not show a leak in non-conducting strata, but the earth plate should be put in the non-conducting strata; an earth wire should be used in addition.

Coal-cutters in Shallow Seams.—Messrs. Mavor & Coulson have recently supplied to the Glenclelland Colliery of Messrs. Horns, Ltd., Glasgow, a coal-cutter for working in a 19-in. seam, driven by a three-phase 25-cycle motor running off the mains of the Clyde Valley Electric Power Co. This machine is only 18 in. high, and is normally rated at 30 h.p., but is capable of working up to 60 h.p. Another coal-cutter for the same pit, rated at 33 h.p., but with the same stalling point output, is being supplied by Messrs. Hunter & Jack, of Glasgow.

REVISION OF THE SPECIAL RULES FOR ELECTRICITY IN MINES

THE special departmental committee appointed by the Home Secretary to inquire into the working of the existing special rules for the use of electricity in mines, and to consider the advisability of their amendment, is still continuing its sittings at the Home Office, Whitehall. Considerable progress has been made; we understand that over thirty witnesses have already been heard, and that the hearing of evidence is nearly completed. It will be remembered that the committee consists of three members, namely:—Dr. R. A. S. Redmayne, H.M. Chief Inspector of Mines; Mr. C. H. Merz, and Mr. R. Nelson, H.M. Electrical Inspector of Mines. The proceedings, which commenced on March 8th last, are strictly private.

ELECTRICITY AND COAL-DUST EXPLOSIONS

A PAPER entitled "The Ignition of Coal-Dust by Single Electric Flashes," by Prof. W. M. Thornton and Mr. E. Bowden, was read before the North of England Institute of Mining and Mechanical Engineers on April 9th. The same series of experiments were detailed that Prof. Thornton has already referred to at meetings of the Newcastle Local Section of the Institution of Electrical Engineers and the Institution of Mining Electrical Engineers (see ELECTRICAL ENGINEERING IN MINES, March 3rd, p. xxv, and April 7th, p. xlix). The authors summarised their conclusions as follows:—

Coal-dust, although an insulator when dry, becomes a conductor if wet enough for carbonisation to take place. The necessity for keeping commutators clean, especially the small gap between live copper and the frame, is obvious. There appears to be no danger of flashing over on 480 volts between live parts 1¼ in. apart, unless the deposit of dust is entirely conducting, as from carbon brushes. Distributing-boxes should be dust- and flame-tight, and should be in compartments, so arranged that the main terminals cannot be short-circuited by a flash. Cartridge fuses should be always used where possible. Momentary arcs produced by break of cables or conductors can ignite dust; but the current required to do so is very much greater when the voltage is low, and at moderate voltages is greater for alternating than for direct current. This suggests that the arrangement most satisfactory from the point of view of safety, both for flashes and for shocks, is high-tension transmission to a sub-station or transformer-house, probably with cables well enough armoured to prevent any external flash, and quite low-tension local transmission for power and lighting. Series lighting with incandescent lamps is not to be recommended. Although it has been shown that a cloud of coal-dust can be ignited by small single flashes, and the degree of probability has been found for most cases likely to occur in practice, it does not follow that the use of electricity in collieries is dangerous. Electricity is no more dangerous than the supply for domestic use of highly-poisonous and explosive coal-gas. An efficient leakage-indicator is equally necessary for both. No indicator will prevent risk from sudden breakage of either pipes or cables; but in the electrical case there is the advantage that the main supply can, if desired, be cut off by a small leakage current.

NOTTINGHAMSHIRE AND DERBYSHIRE BRANCH OF THE INSTITUTION OF MINING ELECTRICAL ENGINEERS

AT a meeting at University College, Nottingham, on Saturday, April 30th, the Secretary's quarterly report, showing a steady increase in membership, was read. The Chairman appealed to members for practical papers for discussion.

The concluding few minutes of the meeting, after the discussion of general business, were occupied by Mr. L. Routledge (Eastwood), who read extracts from his Paper (in course of completion) on "Earthing." He described several experiments relating to the testing of earths, and found that the average resistance of the armour came out at about 0·87 ohm. The tests were made with switchboard type instruments on an A.-C. supply. He would like to have figures for similar tests on a D.-C. supply on account of electrolytic and polarisation effects which might occur.

The Chairman agreed that the question of earths was an important one, and hoped members would be prepared at the next meeting to discuss it thoroughly.

The recent electrical fatality at Wingfield Manor Colliery, Derbyshire, was also mentioned as likely to provide interesting discussion, and it was arranged to discuss this matter along with Mr. Routledge's Paper on "Earthing" at the next meeting.

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ELECTRICAL MINING PATENTS OF APRIL

AMONG the patents published last month of especial interest to mining electrical engineers was one (No. 7,141 of 1909) by W. B. Durant and R. W. Durant for a safety lamp consisting of an aluminium case lined with vulcanite and containing an accumulator. The lamp is attached to the side of the case in a suitable reflector, and the whole is constructed so that no contacts are exposed. Patent No. 7,151 of 1909, by Messrs. Mavor & Coulson, Ltd., describes a trough conveyer of the reciprocating type consisting of a number of interchangeable sections mounted on wheels, so that the conveyer can be readily advanced along the working face. This has no special features from an electrical point of view. A device for throwing out of gear the cutter-bar or other cutting arrangement in electric coal-cutters when it is desired to move the machine by means of the driving motor is described in Specification No. 8,694 of 1909, by T. Thomson. In one arrangement the bevel pinion is mounted loose on the driving spindle, and a clutch block sliding in a tongue on the spindle is moved into or out of contact with the bevel pinion. In another arrangement the driven crown bevel wheel and mitre wheel are lifted out of gear with the driving bevel pinion and the cutter-bar mitre wheel. Patent No. 9,133 of 1909, by H. A. Mavor and Mavor & Coulson, Ltd., describes the methods of air-cooling totally enclosed motors for mining work, which were described in ELECTRICAL ENGINEERING, Mining Supplement, March 3rd, page xxix. Another specification (No. 10,334 of 1909), by T. Thomson, describes a method of slewing the gear head and cutter-bar of an electric coal-cutter by its own motive power by means of ratchet-wheel gear and a rod connection between the haulage and slewing mechanisms.

Power Station Fatality.—On April 15th, W. Liddle, a joiner in the employ of Messrs. G. Wardropper & Sons, contractors, of Penshaw, was killed by electric shock at the Durham Collieries' power station. The deceased was found dead, with one arm severely burnt. It appeared that he had to fit a wooden framework round some connections, and was doing so while they were alive. The pressure was 575 volts A.-C.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during April.

April 7th.—Supplement on "Electrical Engineering in Mines," opening with a practical article by a colliery electrician, including notes on the maintenance of colliery electrical plant, and proposed modifications of the special rules. Reports are given of further discussions on Mr. W. Maurice's Paper on "Electric Shocks" at four branches of the Institution of Mining Electrical Engineers. A summary is given of mining patents which have been issued by the Patent Office during March, including one relating to a short face coal cutter by Messrs. Mavor and Coulson. The principal article is a long illustrated description of the electrical equipment of the Ashington Collieries. Reports are also given of two meetings of the Newcastle branch of the Institution of Mining Electrical Engineers, on a Paper by Mr. H. J. Fisher on causes and prevention of electrical accidents in collieries, and on a demonstration by Prof. Thornton and Mr. H. W. Clothier on electrically-caused coal dust and gas explosion. A signalling system for winding plants is also described.

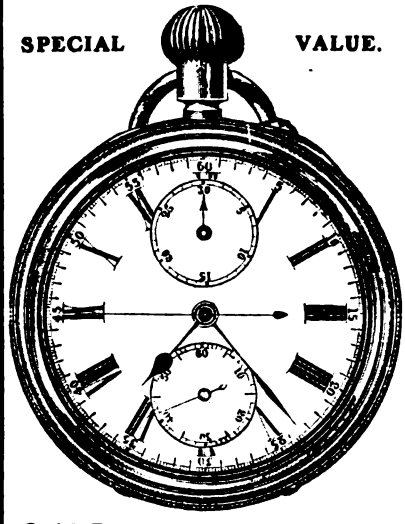
April 14th.—Special illustrated article on fans and ventilation; description of some new types of motor control gear; an article on jointing aluminium; report of a Paper and discussion on switch and transformer oils.

April 21st.—Illustrated description of the new 12,000 ampere-hour central station battery with boosters and switchgear at Manchester.

April 28th.—Description of the electrical equipment of the Shieldhall sewage works, Glasgow.

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DISPUTE WITH REGARD TO PUMPING PLANT IN A MINE

JUDGMENT was delivered on Saturday in an action in which the Electrical Co., Ltd., sued Messrs. Oliver H. Thomas, Son & Co., Ltd., for the recovery of £1,150, balance due on a contract entered into in November, 1905, for the installation of electrical pumping plant, to replace certain steam plant, for the unwatering of the Llynvi Valley Colliery. Messrs. Thomas entered a counterclaim for a sum exceeding £31,000, the value of the loss which they alleged they had sustained by reason of the delay in the erection of the plant, and the failure to accomplish the unwatering of the mine. The judgment by Mr. E. Pollock, the Official Referee, who has been hearing the case, was delivered on the fortieth day of the action, and occupied three hours in delivery. It is said that the legal costs amount to over £10,000.

In November, 1905, an agreement was come to by which the Electrical Co. was to install certain electrical plant in the mine, but numerous delays took place, and instead of the plant being in position by December 23rd, 1905, it was not until February, 1907, that the contract was actually completed. During this period a voluminous correspondence took place between the parties, and, having perused this, the Official Referee has come to the conclusion that the blame for this delay rests mainly, if not entirely, with Messrs. Thomas, who had not been in a position to receive the electrical plant; the Electrical Co. admitted some delay on their side, but not, in the opinion of the Referee, sufficient to cause serious results. On February 7th, 1907, Mr. Oliver Thomas admitted that the contract of November, 1905, had been completed, and that the company were entitled to payment. On the other hand, the counterclaim was set up by reason of the allegation that the work ought to have been completed within a much shorter time, and that it should have been possible to get at the coal in the mine by April, 1906. For a certain period before 1907, the pumps kept the water out of the mine, and coal was mined, but apparently further flooding took place, and no further coal could be procured. This flooding is held to have been due to a strike of workmen and not to the incapacity of the plant. The Official Referee, in the course of his judgment, dealt in detail with some of the causes of breakdown in the plant, and, in view of recent complaints as to incompetent men in charge of electrical plant in mines, the following remarks made by him are noteworthy:—"The chief difficulty in regard to the exciter was due to the improper attention bestowed upon it by those in the employment of Mr. Oliver Thomas. There was obviously nobody there who knew anything at all about this electrical plant; there was no expert of any sort or kind. Whenever an expert went there on behalf of the plaintiff company, the exciter was put in order and worked perfectly well."

He blamed Messrs. Thomas for prolonging the case to such a length, and also charcterised the particulars of damage as "grossly exaggerated," and the only damage, he said, to which Mr. Thomas could directly point was some wear and tear of the steam pumps before the electrical plant was completed, amounting to about £50, and this he was willing to allow. It was quite clear that the damage due to the mine remaining unwatered must be very small, owing to the difficulties other than water, which had to be overcome before the coal could be reached.

He therefore found for the Electrical Co., with costs on the claim and counterclaim, but allowed defendants £50 damages on the counterclaim, with a further sum of £151 agreed.

CORRESPONDENCE

STREET LIGHTING.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In view of the recent prominence that has been given to the question of street lighting, it may be of interest to you to know that we have recently installed two metallic filament (Osram) lamps (400 c.p.) on an elevated arc lamp-post in Westbourne Terrace, Paddington. Specialy designed brackets and globes have been used in order to produce the best effect, which, in our opinion, is so successful that we venture to suggest that it would be worth while for your representative to inspect them some evening after dark. We think that you will agree that these lamps compare very favourably with arcs, though, of course, the candle-power is far less, and it may be stated that although they have been in use for a month, the globes have not once been cleaned.

The post is situated at the Bayswater Road end of Westbourne Terrace, and I may add that at the other end of the Terrace, on the bridge crossing the Great Western Railway, we have installed three ordinary street gas pillars with 100-c.p. Osram lamps, also in special globes, which your representative might also like to see at the same time.

Yours faithfully,
E. CUNLIFFE OWEN, *Secretary.*
(*Metropolitan Electric Supply Co., Ltd.*)
16 Stratford Place, W.

[We have inspected the lamps in question, and can fully substantiate the claims made above. There is no doubt also that comparisons will be still more favourable to the metal filament lamps in foggy weather. It is interesting to remember that Westbourne Terrace was one of the first residential streets in London to be lighted electrically, although the old open arcs were removed some time ago, when the gas mantle came to the fore. It is one of the original posts that is being utilised by replacing the old and rather unsightly lyre from which the arc lamp was hung by a much more artistic arrangement, from which the two new lanterns hang on either side of the post.—ED. *E.E.*]

CENTRAL BATTERY OMNIBUS TELEGRAPH CIRCUITS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Your correspondent, Mr. P. J. Ridd, is in error in asserting that I have neglected to take into account the effect of line leakage in my article of March 17th under the above heading. In this article it is distinctly stated that r and R are the *measured* conductor and insulation resistances respectively. r is thus the true conductor resistance of the whole line diminished by the conductivity of the leakage paths, while R is the joint resistance of the total elementary portions of the line and the leakage paths. Mr. Ridd's method does not, therefore, give the theoretically correct result for x, which is that set forth in my article. r and R are obtained by standard methods of calculation, which Mr. Ridd will find in Kempe's Handbook or J. Elton Young's "Testing for Telegraph Engineers."

I am, Sir, yours faithfully,
H. H. HARRISON.
British Insulated & Helsby Cables, Ltd.,
Lennox House, Norfolk Street,
Strand, W.C., May 3, 1910.

DISCUSSION ON TARIFF REFORM.

To the Editor of ELECTRICAL ENGINEERING.

DEAR SIR,—With reference to the meeting which this Association is convening on May 23rd next at Caxton Hall to consider the effect of Free Trade or Protection on the Electrical Industry, I have received many communications regarding this, and should be glad if you can intimate to your readers that the meeting will be a ticket meeting, and that tickets will be sent by this Association to all its members, also to all the members, associate members, and associates of the Institution of Electrical Engineers.

I am, sir, yours faithfully,
Balfour House, Finsbury Pavement, F. B. O. HAWES,
London, E.C., April 29th, 1910. *Secretary.*

Parliamentary Intelligence.—The Bishops Stortford and Epping Gas Bill was passed by the Unopposed Committee of the House of Commons on Thursday. As mentioned on page 289 of our last issue, the Committee had called for a resolution by the Bishops Stortford Council in favour of the Bill, and this being forthcoming, the Bill was ordered to be reported for third reading.

The Yorkshire Electric Power Bill has been read a second time in the House of Commons.

The Mersey Railway Act received Royal Assent on Friday.

Telegraph Traffic.—The cable between Lattaquie and Cyprus was restored to working order on April 27th, while on the following day the Para-Maranham cable was working again. The Bagdad-Bassorah line was down on 2nd inst. The cable between Malta and Tripoli has not yet been repaired; telegrams are still being posted from Malta at sender's risk. The Argentine Administration has announced that telegrams for the Pacific coast of South America can be sent *viâ* the Andes with advantage until the end of June.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 28th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

8,419/09. **Loading Coils for Telephone Cables.** R. K. GRAY. Pupin induction coils inserted in telephone cables to neutralise the capacity effects are protected by a metal cylinder deeply serrated at the ends, and bent down to a conical form. The cylinder is of brass, and may be inclosed in a second cylinder of steel. Rings are placed over the serrates at each end, and wooden blocks are placed at either end of the cylinder to prevent flattening and damage to the coils during sheathing. If there are two circuits, the wires of the other circuit are laid side by side outside the coil, but inside the metal cylinder. Five claims, three figures.

8,781/09. **Metal Filaments.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). A plastic mass containing tungsten is produced by precipitation from a solution of tungstate of ammonia or other alkaline compound, and a cyclic hydrocarbon derivative, such as gallic acid. The precipitate can be squirted, and a shrinkage in section of 75 per cent. is said to be obtained, thus rendering possible the production of very fine filaments. Finely divided tungsten may be added to the mass previous to squirting; this makes it conductive, and renders baking previous to sintering unnecessary. Six claims.

15,544/09. **Crane Control.** BERTRAM and E. THOMAS. A mechanical brake, such as a band brake, is provided with a solenoid acting against the weight or springs. By shaping of the core or by suitable mechanism, the pull is made equal for all positions of the core. When lowering, resistance is gradually cut out of the solenoid circuit, and the braking effect is removed in steps. The final step may apply a lowering current to the motor. The device may also be arranged to remove the brake entirely when current is applied for raising the load. Four claims, two figures.

16,095/09. **Electromagnetic Clutch.** C. W. HILL. This clutch transmits the power by magnetic pull only, and not by the friction of surfaces drawn together by electromagnetic action. On the driving shaft are mounted two concentric rings of laminations, the outer periphery of the inner ring and the inner periphery of the outer ring being provided with a large number of small teeth. Between these two rings is another ring mounted on the shaft to be driven and provided with teeth on both peripheries to correspond with those on the outer rings. An exciting winding, supplied from slip-rings, is provided on the driving rings, and the teeth of the inner ring have short-circuited coils. On switching on the current with the driving rings rotating, currents are induced in the short-circuited coils, and a large starting torque is obtained. When the inner ring has run up to speed, the two run absolutely synchronously, so long as the torque does not exceed the magnetic pull exerted by the teeth. One claim, two figures.

26,006/09. **Metal Filament Lamps.** H. J. JAEGER. Elastic anchors for supporting filaments at the bend of the loop consist of a metal wire support with a glass bead fused on to the end. The filament passes through the glass bead and does not come in contact with the wire. Volatilisation of the wire is thus avoided, and the supports of the different loops may be twisted together. The glass may be in a fused condition during the operation of the lamp. Four claims, four figures.

4,171/10. **Electromagnetic Railway and Tramway Brakes.** WESTINGHOUSE ELECTRIC Co., LTD. Magnetic wheel or track brakes are provided with series and shunt windings. For ordinary service applications, the series winding is supplied with current from the motors acting as generators. If necessary, the shunt winding can be excited at the same time through a resistance direct from the trolley-wire through one or more contacts on the controller. For emergency applications, the shunt winding only is employed, but all resistance is cut out so that the full trolley-wire voltage is applied to the winding. Three claims, one figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: TANNER and CLAREMONT [Distribution system and cables] 27,858/08; BRITISH THOMSON-HOUSTON Co., WEDMORE, and WHITCHER [Distribution systems] 8,979/09.

Dynamos, Motors, and Transformers: FELTEN & GUILLEAUME-LAHMEYERWERKE A.-G. [Motor control] 9,338/09; SCHWERIN [Generator] 10,793/09; ALLDAYS & ONIONS PNEUMATIC ENGINEERING Co. and JOSELIN [Electrically-driven centrifugal fans] 16,476/09; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Regulation of load equalisers] 20,055/09; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [Polyphase commutator machines] 21,540/09; BRUSH ELECTRICAL ENGINEERING Co. and PORTER [End connections of rotor and stator bars] 27,641/09.

Electric Ignition: DE POORTER [Sparking-plugs] 19,082/09.

Electrometallurgy and Electrochemistry: IMRAY (*Soc. of Chemical Industry in Basle*) [Continuous electrolysis of aqueous solutions] 25,118/09.

Incandescent Lamps: HORVATH, 9,318/09; RAWLINGS [Candle-lamp] 10,288/09.

Instruments and Meters: BRITISH THOMSON-HOUSTON Co. and D'ARCY [Bearings for spindles of instruments] 2,031/10.

Switchgear, Fuses, and Fittings: RAWLINGS, HANDCOCK, and DYKES [Wiring fittings] 5,891/09; STEVENSON and WILLIAMS [Switch movements] 8,620/09; ROSE [Switch mechanism] 8,692/09; HATRY [Fuse carriers] 11,954/09; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Enclosed fuse indicators] 19,209/09; LUNDSTEEN and AKTIESELSKABET INTERNATIONAL ELEKTRISK TRAPPEAUTOMAT [Switches] 19,826/09.

Telephony and Telegraphy: FESSENDEN [Wireless telegraphy] 6,008/09; GOTTSCHALK [Telephone transmitters] 17,368/09; KIESSLER [Recording telephone calls] 23,742/09; STILLE [Telephone relays] 65/10.

Traction: MICHEL [Air brakes] 8,446/09; COCKSHOTT [Trolley heads] 15,147/09; BAXTER [Rails] 20,075/09.

Miscellaneous: WISKOTT [Light diffusing device] 2,125/09; LEA [Meter] 9,723/09; PINSON [Current distributors] 11,413/09; PARKER [Electrically-driven models] 12,063/09; SUNDHEIMER [Burglar alarm] 13,955/09; HENNAH and RISSEL [Ship's course recorder] 17,389/09; KENNEDY [Bending metal conduit] 25,044/09; HALL & KAY, LTD. [Centrifugal fans] 29,657/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: SIEMENS-SCHUCKERTWERKE GES. [Search lights] 8,411/10.

Dynamos, &c.: AKT.-GES. BROWN, BOVERI ET CIE. [Single-phase motors] 645/10.

Telephony, &c.: EGNER and HOLMSTROM [Cooling heavy-current telephone transmitters] 7,656/10; KAJIURA [Semi-bridge duplex telegraphy] 8,141/10.

Traction: GOLDSCHMIDT [Rail joints] 21,750/09; GIBSON [Air brakes] 25,910-1/09; BATCHELDER [Electric vehicles] 8,363/10.

Miscellaneous: DUTHEIL and CHALMERS & Co. [Magnetic clutch] 8,294/10; BOMBORN [Centrifugal blowers] 8,454/10.

The following amended Specification can now be obtained.

21,580/08. **Flywheel Load Equaliser.** AKT.-GES. BROWN, BOVERI ET CIE. See ELECTRICAL ENGINEERING, March 3rd, 1910, p. 154.

Opposition to Grant of Patents

6,956/09. **Metal Filaments.** THE WESTINGHOUSE METAL FILAMENT LAMP Co., LTD. (*A. Lederer, Vienna*). Opposition has been entered to the grant of this patent, which covers a process of decarbonising tungsten filaments. (*See* ELECTRICAL ENGINEERING, March 10th, 1910, page 172).

5,638/09. **Ventilation of Ships.** J. KEITH (James Keith & Blackman Co., Ltd.) This patent has been granted in spite of opposition. (*See* ELECTRICAL ENGINEERING, December 30th, 1909, p. 1104.)

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

9,993 of May 11th, 1896. **Ammunition Hoist.** A. G. HADCOCK and C. W. HUTCHINSON. This patent covers an electrically-driven ammunition hoist for warships, &c. The lifting ram is worked up and down continuously, waiting at the bottom for a short period after the downward movement.

10,124 of May 12th, 1896. **Distribution System.** J. DEVONSHIRE (*C. P. Steinmetz, U.S.A.*). In a three-phase distribution system, the primaries of the transformers are connected in delta and the secondaries in star. A fourth wire connected to the neutral point of the secondaries is used in distribution.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: J. H. SUTTON and L. GREGSON [Cable conduits] 786/04; E. E. BUTT [Manhole cover] 760/05.

Dynamos, &c.: A. ZANI [A.C. commutator motors] 513-4/05.

Instruments, &c.: R. S. WHIPPLE [Resistance pyrometer] 918/02; O. T. BLÁTHY [Motor meters] 493/05.

Storage Batteries: T. PESCATORE [Plates] 1,056/04; P. MEUSNIER and G. MOUNIER [Plates] 521/05.

Telephony, &c.: G. DRAPER and W. J. MURPHY [Grapnels for submarine cables] 725/99; L. T. BASSOMPIERRE and L. J. DARDEAU [Telephone microphone] 552/04.

Traction: J. HOLDEN [Sanding device] 708/03; E. A. CAROLAN (*General Electric Co., U.S.A.*) [Petrol-electric drive] 1,063/03.

Miscellaneous: J. MACLEAN [Electric curling-tongs] 540/05.

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LOCAL NOTES

ACCRINGTON.—The Electricity Committee have quoted terms to the Haslingden Corporation for a supply of electricity in bulk for seven years.

BACUP: *Light Railways.*—The Light Railway Commissioners have submitted to the Board of Trade for confirmation an order authorising the construction of a light railway in Bacup.

BARKING: *Electricity and Tramways Undertakings.*—The units delivered during the past twelve months were 1,374,960, against 1,337,344 in the previous year. The comparatively small increase is accounted for by the fact that one of the largest works in the district has for several months been on short time owing to slackness of trade. Partly owing to the cost of the mechanical stokers being met out of revenue, the department will not show a profit for the year. During the twelve months, 1,292,146 passengers were carried on the tramways, the receipts being £3,099, the figures for the previous year being 1,280,420 and £3,130. The financial result of the undertaking is, however, still far from satisfactory, and in this connection the chairman of the Committee does not see hope for much improvement until arrangements had been made for inter-running with neighbouring authorities.

BATH: *Street Electric Lighting.*—The Council have decided to substitute 108-100 c.p. metal filament lamps for the present arc lamps in Bridge Street, Argyle Street, Pulteney Street, and Sydney Place, 10 in number, and for 54 of the gas lamps in the adjoining streets, at a total annual charge of £522 16s. 6d. (such charge amounting to the same as is now paid for the present lighting), and a capital outlay of about £300 for columns.

BELFAST: *Cavehill and Whitewell Tramways.*—The result of the poll of ratepayers concerning the purchase of the undertaking of the Cavehill & Whitewell Tramways Co., is a majority of 18,516 in favour of the purchase.

BOURNEMOUTH: *Proposed Discontinuance of Conduit System.*—The Manager of the Corporation tramways has presented a report in which he recommends the discontinuance of the conduit system of electric traction and the substitution for it of the overhead trolley system. He estimates a saving of £3,000 per annum by this proposal.

BRAUNTON: *Electric Lighting.*—A circular is to be issued to the ratepayers in connection with a proposed scheme of electric lighting.

BURTON-ON-TRENT: *Electricity Accounts.*—The surplus on the past year's working is £1,473, in addition to a rebate on income tax amounting to £190. It is proposed to add £1,155 to renewals fund, plus the £190 referred to above. The revenue from lighting for the year is actually lower than it was seven years ago, although during this period the lamp connections have increased by 47 per cent. The average price received for electrical energy for power purposes was 0·953d. per unit. The total costs, exclusive of capital charges, are now 0·918d. per unit, or 1·726d. per unit, including capital charges. No less than 79 per cent. of the units sold for power purposes are supplied to consumers working on the restricted hour supply. The number of units sold for the year is practically stationary, against an increase last year of 9·3 per cent., and 20 per cent. for the two previous years.

CANADA: *Government Transmission Line.*—It is announced that the Ontario Government's loan of £700,000 for the purpose of the long-distance electric power transmission scheme which they have in hand has been fully subscribed.

DARWEN: *Electricity and Tramway Accounts.*—Last year there was a profit of £573 on the electricity undertaking, but official figures are not yet available concerning the loss on the electric tramways. The reduced charge for current to the tramways has accounted for a reduction in receipts to the electricity department of nearly £400, compared with the previous year.

DUNDEE: *Price for Tramway Energy.*—The dispute as to the price which should be paid for electrical energy by the Tramways Department has ended by the Electricity Committee making a reduction in the price for lighting, but maintaining the price for traction. The electrical engineer pointed out that, owing to the economies of the tramway manager, the consumption for traction is being reduced, yet the Electrical Department still had to keep the same amount of plant available for the maximum demand. The Tramway Department paid less for energy last year, and for the present year it was calculated that the bill would be reduced by £1,000. If the proposed reduction of ⅛d. per unit were made, there would be a still further diminution in the amount received for tramway supply of £1,300.

Electric Lighting.—On Saturday evening a splendid system of electric lighting extending the whole length of the High Street and Bank Street, Lochee, was inaugurated. The lamps are of the "Duplex Excello" type, and number sixteen. Lochee, a busy town in itself, adjoins Dundee, being about two and a half miles distant, and linked up with a service of cars. It has hitherto been quite a common thing to hear the place referred to as "Lochee and nae licht," but as the convener of the Electricity Committee very aptly remarked at the inauguration ceremony, the citizens need have no fear of ever being chaffed on this score again, as the position was now entirely reversed, and if they liked to put it that way they may say that it was now "Lochee and a' licht."

FLEETWOOD: *Electricity Undertaking.*—For the first six months of the Council's working of the electric supply undertaking, which was taken over from the company last September, there was a gross profit of £2,164, and a net profit of about £1,000.

GLASGOW: *Tramways Valuation.*—Judgment has been given in connection with the appeal of the Tramways Committee against the increased assessment of the tramways undertaking for the year ending Whitsuntide, 1911. The new assessment has been placed at £278,070, whereas it is claimed that it should be £230,573. The valuation is based on revenue, and in previous years the assessor has allowed as a deduction from the gross revenue not only one-half of the cost of maintenance of the permanent way and electrical equipment of the line, but also one-half of the sum annually set aside for renewal thereof. He now proposes to allow no deduction whatever in respect of such renewal, but to continue to allow one-half of the cost of repairs. As one-half of the sum set aside for renewals amounted last year to over £57,000, the alteration proposed is a very serious one. In the event of a distinction being drawn between the larger and the smaller repairs, it was submitted that the undertaking was entitled to the whole cost of the latter as a deduction, instead of one-half. The valuation on this basis would be £269,059. The Appeal Court in Glasgow has placed the valuation at £258,853.

HUDDERSFIELD: *Linthwaite Tramways.*—Owing to the dispute between the Corporation and the Linthwaite Council as to the maintenance of the track in Linthwaite, which should be maintained by the Council, the tramway manager's recommendation to reduce the service on account of depreciation to the cars has been adopted by the Corporation. The manager also reports that the condition of the track is a public danger.

LANCASHIRE: *Electric Driving of Cotton Mills.*—The Acme Spinning Co., of Pendlebury, Manchester, which was the first spinning company in England to adopt electric driving, and is one of the few large spinning mills in England without a chimney, have just entered into another contract with the Lancashire Electric Power Co. for a supply of current for power and lighting purpose, the contract to cover a considerable number of years. The supply will also include a portion of the adjoining Albion Mill.

LONDON: *Stepney: Electric Power Charges.*—Some large firms have approached the Electricity Committee with a view to getting a uniform charge for lighting and power purposes. At present a number of firms will not take electrical energy in the absence of a single rate for both purposes. After discussion with the Electrical Engineer, the Electricity Committee recommend that contracts should be entered into with power users, who are willing to guarantee a minimum half-yearly bill of £200, at a rate of £3 per annum per e.h.p. demanded, divided into twelve monthly payments, and ½d. per unit for electricity consumed, whether for lighting or power purposes, provided that the total lighting demand does not exceed 25 per cent. of the whole. The committee also recommend that fixed charges calculated on the above scale should be charged when the load factor is guaranteed.

MANCHESTER: *Tramways.*—The Audenshaw District Council have leased to the Manchester Corporation three sections of tramways within their district.

NELSON: *Tramway and Electricity Accounts.*—According to an official report, a loss of £771 has been sustained during the past year on the working of the local tramways. Mr. Helme, the manager, advocates the abolition of the halfpenny fare system. The accounts for the electrical department show a loss of £132, against an estimated profit of £268.

NEWCASTLE: *The Trolley Omnibus.*—The Tramways Committee have under consideration the adoption of trolley omnibuses for linking up a number of the more or less isolated suburbs.

PENMAENMAWR: *Public Lighting.*—The Council are discussing a proposal to illuminate the promenade by electricity.

PONTYPRIDD: *Tramway Accident.*—In an action recently taken by a Mrs. Lever against the Urban District Council for damages in respect of the death of her husband in a tramway accident, the jury awarded £275 damages. A point of law was subsequently argued as to whether there was any evidence of negligence upon which the jury could give a verdict for the plaintiff. Mr. Justice Pickford, in the King's Bench Division, has decided that there was not, and entered judgment for the Council.

STIRLINGSHIRE: *Rating of Telephones.*—The Stirlingshire Parish Council has suggested that the Postmaster-General should make a contribution in one sum, in lieu of annual rates on the telephone undertaking in the district. The matter is now under the consideration of the Lords Commissioners, who have not yet come to a decision owing to the questions of principle raised being of great importance.

TASMANIA: *Electric Lighting.*—A large quantity of electrical machinery has been landed for the Hobart Gas Co. The contractors are Messrs. Siemens Bros. & Co., Ltd.

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TELEPHONES:
893 Westminster (Three lines),
P.O. 1218 Victoria.
3700 City (Two lines) Manchester.
3858 Corporation and
2198 Argyle, Glasgow.

BELFAST—Grosvenor House, Wellington Place (Mr. F. W. Parkes); **BRISTOL**—6, Bristol Bridge (Mr. W. H. R. Cleave); **CARDIFF**—4, Church Street (Mr. H. Nance); **DUBLIN**—Norwich Union Chambers, Dawson Street (Mr. D. J. Doolan); **LEEDS**—11, Upper Mill Hill, Boar Lane (Messrs. Casperson Bros.); **MIDDLESBROUGH**—22, East Street (Messrs. J. T. Bell & Co.); **NEWCASTLE-ON-TYNE**—1, St. Nicholas Buildings (Messrs. Reed & Foggin).

TANTALUM LAMPS

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TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BELFAST.—The Tramways and Electricity Committee require motor boosters and switchgear; and also an extension of the lighting switchboard. (See an advertisement on another page.)

BRAY.—The Council require cable and A.-C. meters. (See an advertisement on another page.)

CHELTENHAM.—A Local Government Board inquiry was held last week concerning a loan of £4,000 for meters, services, and mains.

ECCLES.—Tenders are to be invited for an additional 10-in. motor-driven centrifugal pump and switchgear, also for a high-tension feeder.

JAPAN.—The British Acting Vice-Consul at Dairen reports that a loan of £4,000,000 is to be floated by the South Manchuria Railway Co. for the following, among other purposes:—Electric power-house at Dairen; electric tramway at Dairen; and electrical plants at various places.

LONDON: *Fulham.*—The Finance Committee of the L.C.C. recommend a loan of £3,868 for boiler extensions at the electricity works.

Hackney.—Mains are to be extended at an estimated cost of £554 10s.

RADCLIFFE.—The Council invite tenders by May 14th for a 300-kw. continuous-current dynamo. Particulars from the Borough Electrical Engineer.

RANGOON.—The directors of the Rangoon Electric Tramway and Supply Co. state, in their annual report, that they have decided to extend their power station, and to instal an additional 2,500-kw. turbine.

SOUTHAMPTON.—The Corporation require a 1,000-kw. steam alternator, boiler, and motor alternator. (See an advertisement on another page.)

SWEDEN.—H.M. Legation at Stockholm reports that it is intended to expend a sum of £80,000 upon additional electrical works at Trolhätten.

WEST HAM.—Tenders are invited for condensing plant, boilers, and switchgear in connection with the new Rateau turbine which is being installed by the British Westinghouse Co.

Miscellaneous

BATH.—The Corporation are re-arranging their public lighting (see Local Notes).

HOLLAND.—The municipal authorities of Gouda have granted to J. H. Muller, of The Hague, a concession for the construction of electric tramways between Gouda and Rotterdam.

NEW ZEALAND.—H.M. Trade Commissioner for New Zealand (Mr. G. H. F. Rolleston) reports that a Wellington firm desire to obtain quotations from British manufacturers for solid drawn steel conduit and fittings, screwed with standard gas thread; also for C.M.A. insulated cable or equal thereto. Manufacturers interested should send catalogues, with the latest discounts and trade terms, quoting preferably c.i.f. and e. Mr. Rolleston also reports that another Wellington firm wish to get into touch with manufacturers of electric cable of all descriptions. Communications regarding both the foregoing inquiries should be addressed to H.M. Trade Commissioner, 9 Grey Street, Wellington, New Zealand.

PERTH.—Some small extensions of the tramways have been decided upon by the Council.

RIPON.—It has been decided to spend a sum of £200 upon electrical appliances for medical purposes at the Spa Baths.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

AYR.—Pavilion, Low Green (£6,000). Architect, J. K. Hunter, Ayr.

BOLTON.—School (£7,000) for St. George's Road Congregational Church.

BOOTLE.—Balliol Road, Schools (£12,000). Architects, Medcalfe & Medcalfe, Dale Street, Liverpool.

BRIGHTON.—School, Coombe Road (£9,000). E. Hackforth, Secretary, Education Committee, Brighton Town Council. The Royal Pavilion is to be re-wired for electric light.

BURY.—Wesleyan School (£2,000). Architect, W. E. Gill, 6 Fleet Street, Bury.

DONCASTER.—Technical School (£10,000). Architects, Schofield & Berry, Leeds.

DUBLIN.—The Cattle Markets Committee have under consideration the electric lighting of the markets.

DUMBARTON.—Academy Buildings (£3,000). Architects, McWhannel, Rogerson & Reid, 58 West Regent Street, Glasgow.

DUNDEE.—Academy for West End (£2,000). Architects, J. J. Langlands, 81 Murraygate, Dundee.

FARNWORTH (Lancs.).—Secondary School (£17,500). Architect, Mr. Littler, Ribblesdale Place, Preston.

GLASGOW.—Royal Exchange buildings (£20,000). Campbell, Douglas & Patterson, architects, 266 St. Vincent Street, Glasgow.

NEWCASTLE.—Extension Union Hospital (£5,000). E. Bowman, County Chambers, Westgate Road, Newcastle.

SOUTHEND-ON-SEA.—Additions, school (£4,115). Architect, W. J. Wood, 26 Alexandra Street, Southend. Builder, A. H. Fryd.

TENDERS RECEIVED AND ACCEPTED

ABERDARE.—Eighteen tenders were received by the Council for generating plant for their new power house, and that of the Lancashire Dynamo & Motor Co. at £3,312 was accepted. Nine tenders were received for the battery, but the acceptance of one has been left in the hands of the Consulting Engineer, Mr. Stephen Sellon. Of the seven tenders for cables, that of Messrs. Callender's Cable & Construction Co. was accepted at £8,247.

AUSTRALIA.—According to *Commercial Intelligence*, no tender has been received from any Australian manufacturer for the supply of 20,000 telephone instruments for the Australian Post Office, which were recently advertised for. Every possible effort is being made by the Australian Government to induce firms to manufacture the instruments in the country. Three complete tenders were submitted; one from an English firm offering to make the instruments in Australia, or to make the parts in England and assemble them in Australia. Another English tenderer is prepared to do the work in Australia if he can make the necessary arrangements. The third tender is from a Continental firm.

BEDFORD.—The tender of Messrs. W. H. Allen, Son & Co., Ltd., has been accepted, at £3,706, for a 750-kw. generating set.

DERBY.—The Midland Railway Co. have decided to extend their electrical generating station at Derby, and have placed an order for two 1,250-kw. Willans "Impulse Disc and Drum" type turbines with Messrs. Willans & Robinson, Ltd.

DUBLIN.—The Electricity Committee recommend the acceptance of a tender by the British Insulated & Helsby Cables, Ltd., for the supply of cable at £17,532.

LONDON: *London County Council.*—The following tenders have been received for three-phase motors for the second section of the central car repair depôt of the tramways department:—Bruce, Peebles & Co. (recommended for acceptance), £575 5s.; Lancashire Dynamo & Motor Co., Ltd., £611 10s.; Electric Construction Co., £624 10s.; the British Westinghouse Co., Ltd., £677 16s.; British Thomson-Houston Co., Ltd., £741; and Dick, Kerr & Co., Ltd., £849 5s.

Hackney.—The Electricity Committee report having examined eleven tenders for 80,000 yellow flame arc lamp carbons, and the prices ranged from £5 15s. to £4 5s. per thousand pairs. The highest price in the past has been £3 12s. 6d. per thousand pairs. This rise would mean an increase of £50 per annum, or practically 10s. per lamp per annum on the cost of maintaining the flame arc lamps. The Committee go on to say that an attempt appears to have been made to force up the price of flame carbons, and that they have therefore decided for the present to instruct the Borough Electrical Engineer to buy in the ordinary market from time to time to meet requirements.

Poplar.—The Council have accepted the tender of the Worthington Pump Co., at £218 10s., for a motor-driven feed pump.

SALFORD.—The Lancashire Dynamo & Motor Co. have, for the ninth successive year, received the contract for high- and low-speed motors (20 to 50 h.p.) for the Corporation.

WARRINGTON.—The Council have accepted the following tenders: J. Howden & Co., Ltd., 1,000-kw. turbo-alternator, £4,255; British Westinghouse Electric & Manufacturing Co., 750-kw. rotary converter, £1,850; Cowans, Ltd., switchgear, £506 5s.

The following tenders have been accepted by the Government Departments named:—War Office: Conduit fittings, Barton & Sons, Ltd.; Credenda Conduits Co.; General Electric Co.; Nettlefold & Sons, Ltd.; Profecta Seamless Steel Tube & Conduit Co., Ltd.; motors, Lancashire Dynamo & Motor Co., Ltd.; motor-generators and switchgear, Electric Construction Co., Ltd.



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India Office, Store Department: Insulators, Bullers, Ltd.; Manganese blocks, Siemens Bros. & Co. General Post Office: Indiarubber and cotton core cable, Western Electric Co.; paper-core cable, Johnson & Phillips, Ltd.; Western Electric Co.; British Insulated and Helsby Cables, Ltd.; submarine cable, Indiarubber, Gutta-percha & Telegraph Works Co., Ltd.; loading coils, Western Electric Co.; flexible cords, British Insulated & Helsby Cables, Ltd.; earthenware ducts, Stanley Bros., Ltd.; telephones, British L. M. Ericsson Manufacturing Co., Ltd.; four electric lifts at the Head Post Office, Newcastle-on-Tyne, A. and P. Steven; local and telephone exchange equipment installation at the post office premises in Dalrymple Street, Kirkintilloch, Western Electric Co., Ltd.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 15s. to £58 5s. per ton (last week, £59 to £59 10s.).

D.P. BATTERY AGENCIES.—The D.P. Battery Co., Ltd., have appointed representatives in Argentina and in Turkey. In the first-named country, Messrs. Milne, Makein y Cia., of Suiphaca 88, Buenos Aires, represent them; and the firm of Messrs. Wm. Sprowson & Son, of Constantinople, has accepted their agency for Turkey, Greece, and the Balkans.

"TANTALUM" ATHLETIC CLUB CONCERT.—The first annual concert of the "Tantalum" Athletic Club, connected with Messrs. Siemens Bros., Dalston Works, was held on Monday, April 25th, at the Assembly Hall of the Dalston Central Mission. The Hall was illuminated by "Tantalum" and "Onewatt" lamps, which shed their brilliance on the "brilliant passages" of the artists. A novel feature of the affair was a singing competition, open to all employees of the firm. Prizes were offered, the audience acting as judge.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—The Grasse & Cannes Electric Tramways Syndicate, Ltd., is to be wound up voluntarily. Mr. H. R. Green, 37 Conduit Street, London, is liquidator.

R. E. Joy, trading as the Bristol Electrical Co., 143 Cheltenham Road, Bristol, has been adjudicated bankrupt.

A meeting of creditors of the late Mr. F. H. Medhurst, electrical engineer, 13 Victoria Street, London, was held yesterday at Bankruptcy Buildings, Carey Street, London.

The trustee in the bankruptcy of L. W. de Grave, electrical engineer, 19 Queen Street, Derby, has been released.

A meeting of Amalgamated Dry Batteries, Ltd., will be held at 394 Moorgate Station Chambers, London, E.C., on May 26th, at twelve noon, to hear the liquidator's account of the winding-up.

A meeting of the City of Wellington Electric Light & Power Co., Ltd., will be held at 180 Dashwood House, Old Broad-street, London, E.C., on May 23rd, at twelve noon, to hear the liquidator's account of the winding-up.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—City of Buenos Aires Tramways (1904), 1s. 3d. per share, less tax for the March quarter.—Airdree and Coatbridge Tramways Co., 3 per cent. on the ordinary shares for 1909, placing £250 to depreciation.—Wemyss & District Tramways Co., 6 per cent. for 1909 on the ordinary shares.—Colombo Electric Tramways & Lighting Co., 6 per cent. for 1909 on the ordinary shares, adding £5,300 to general reserve.—Eastern Telegraph Co., 7 per cent. on the ordinary shares for 1909.—Greenock and Port Glasgow Tramways Co., 1 per cent. on the ordinary shares for 1909.

Dudley, Stourbridge & District Electric Traction Co., 2 per cent. on the ordinary shares for 1909, placing £998 to depreciation.

Yorkshire Local Section of the Institution of Electrical Engineers. The candidate nominated by the committee to hold office for the ensuing session, of whom a list was given on p. 207 of ELECTRICAL ENGINEERING of April 21st, have been duly elected.

The South London Single-Phase Railway.—It was announced at the annual meeting of the London, Brighton & South Coast Railway Co. that, owing to the success of the single-phase railway between London Bridge and Victoria, the directors were considering the extension of the system. It is now definitely announced that the first of the new lines selected for conversion is the important section running to the Crystal Palace *viâ* New Cross, Brockley, Honor Oak Park, Forest Hill, and Sydenham, on the London Bridge side, and Battersea Park, Clapham Junction, Wandsworth Common, Balham, Streatham Common, Norbury, Thornton Heath, Selhurst, Norwood Junction, Anerley, Penge, Streatham Hill, West Norwood, and Gipsy Hill, on the Victoria side. The change over is expected to be complete in about eighteen months. The time taken to reach the Crystal Palace will then be little more than half that occupied at present.

COMPANIES' MEETINGS AND REPORTS

ROTHESAY TRAMWAYS CO.—The revenue for 1909 was £10,568, a slight increase over the previous year, and the working expenses were £5,689, a slight decrease. There is a balance of £1,306, after transferring £400 to renewals and £100 to depreciation. A dividend of 1 per cent. on the ordinary shares is recommended.

LISBON ELECTRIC TRAMWAYS.—There was a net profit of £107,146 for 1909. From this, £35,000 has been added to depreciation, and £5,000 to exchange reserve. The sum of £5,000 has also been invested for the establishment of an employees' pension fund. A final dividend of 3 per cent., making 5½ per cent. for the year, is recommended on the ordinary shares.

RANGOON ELECTRIC TRAMWAY & SUPPLY CO.—After adding £5,000 to reserve for renewals, there was a net profit of £5,930 for 1909. A dividend of 3 per cent. is recommended on the ordinary shares, carrying forward £621. The power station plant is to be extended (see Tenders Invited). Both tramway and lighting receipts show considerable increases over 1908.

ELECTRIC SUPPLY CORPORATION.—After meeting debenture interest, &c., there was a surplus of £3,780 for 1909, compared with £2,397 in 1908.

LISBON ELECTRIC TRAMWAYS CO.—The annual general meeting was held last week, when a dividend at the rate of 5½ per cent. per annum for the year was declared. The general manager in Lisbon is now engaged in the preliminary work of the conversion to electricity of the most important section of the Ascensores line, which, it is anticipated, when completed, will add considerably to the company's revenue.

BRISBANE ELECTRIC TRAMWAYS INVESTMENT CO.—At the meeting last week the 5 per cent. preference dividend, and a dividend of 8 per cent. on the ordinary shares, were declared. During the Brisbane anniversary celebrations in August last year, the receipts amounted to no less than 18·18d. per car mile. The company have several extensions under consideration, and a commencement upon these is only delayed pending the approval of the local authorities.

URBAN ELECTRIC SUPPLY CO.—The accounts for 1909 show that the profit falls short by £3,622 of the amount required, namely, £32,500, to meet the 5 per cent. guaranteed dividend. This deficit has been duly provided by Edmundson's Electricity Corporation under their contract.

BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO.—The trading profits for 1909 amounted to £84,156, but after deducting depreciation on machinery (£6,480); reserve for general depreciation (£10,262); expenses on surplus lands and buildings (£5,673); interest on 6 per cent. prior lien debentures (£14,700); and interest on the 4 per cent. mortgage debentures (£49,654); there is a balance of £7,647, which has been absorbed by the amount required for the prior lien redemption fund, expenditure on contracts of previous years, &c., leaving a debit balance of £798. The total debit balance now amounts to £7,319. Whilst the output for the home market during the year has decreased, the export business shows an appreciable improvement. Orders to date are substantially in advance of the corresponding period of last year.

WELSBACH INCANDESCENT GAS LIGHT CO.—After paying 3 per cent. on the 6 per cent. preference dividends for 1909, the accounts show a net balance of £5,966, which it is recommended should be carried forward. A circular has been issued dealing with the proposed reorganisation of capital. The capital at present is £1,344,000, of which £600,000 is in preference shares and £744,000 in ordinary shares. The proposal is to reduce the capital to £500,000, which will be a common stock, of which £450,000 will be allotted to the preference shareholders, and £50,000 to the ordinary shareholders, the former abandoning all claims for arrears of the cumulative preferential dividend.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. W. Hame, Electrical Engineer to the York Corporation, has been voted an increase in salary of £100 per annum in view of his duties as Tramway Manager.

Warrington Tramways Committee have decided to increase the salary of Mr. J. F. Cameron, the electrical engineer, from £170 to £180 per annum, rising to £200 per annum.

Mr. J. M. Smyth, the Borough Electrical Engineer at Keighley, has tendered his resignation on account of ill-health. The Electricity Committee have accepted this with regret, and recommend that a successor be advertised for at a salary of £250 per annum.

There have been 100 applications sent in for the post of Borough Electrical Engineer at Torquay.

Electrical Equipment of the Shieldhall Sewage Works, Glasgow.—In our article describing these works last week, the size of the dredger elevator motor was given by a misprint as 1 h.p. instead of 15 h.p.

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ELECTRICAL ENGINEERING

No. 176 [Vol. VI., No. 19] THURSDAY, MAY 12, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

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The Engineering Journal of the Electrical Industry

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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On account of the lamented death of His Majesty King Edward VII. there will be no meeting of the Institution of Electrical Engineers to-night.

The Congress of the Tramways and Light Railways Association, which was to have been held in Dublin to-day and to-morrow, has also been postponed as a mark of respect to the Royal Family.

His Majesty was the Patron of the Royal Institution, and it has been decided that the lectures and evening meetings be discontinued until further notice.

SUMMARY

Special reduced railway fares have been arranged for members and visitors attending the forthcoming convention of the Municipal Electrical Association at Glasgow in June. (Page 302.)

In our monthly illustrated article on new electrical supplies and accessories, we describe a new house fuse box for concentric wiring, several new patterns of wall-sockets and plugs, a bell-ringing transformer, and a new line of motors. (Page 303.)

A series of fittings specially designed for an Eastern hospital is described on page 304.

In a Paper read before the Institution of Electrical Engineers in London on Thursday, Mr. S. G. Brown described a telephone relay, consisting of two osmium iridium contacts about half a millionth of an inch apart, one of which is mounted on a steel reed. The latter is supported over an electromagnet, and is set in vibration by the variations in the field produced by the telephone currents. A minute movement of the reed produces a large variation in the current passing between the contacts. Excellent results have been obtained in wireless work with this relay, and successful experiments over telephone cables have also been made. A new microphone transmitter, in which osmium iridium alloy granules are substituted for carbon, was also described. (Page 305.)

At the annual meeting of the Iron and Steel Institute, held in London last week, Mr. D. Selby Bigge read a Paper on the production of electric power from exhaust steam and blast-furnace gas. An interesting discussion followed, in which some actual figures for the cost of power generated from exhaust steam were given. A Paper by Dr. W. Borchers described the Girod electric furnace. In the discussion, the results obtained were compared with those for the Héroult furnace. A discussion on the relative merits of steam and electric drive for reversing rolling mills was aroused by a Paper on a new type of reversing mill engine, by Messrs. E. G. Sehmer and Dr. R. Drawe. (Page 307.)

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A COMMITTEE has been formed to further united action for the protection of electrical interests. (Page 309.)

ATTENTION is called in a letter in our correspondence column to the distribution of light obtainable by suitable design of street lighting fittings for metal-filament lamps. Another letter refers to the durability of Osram lamps. (Page 310.)

IN a report to his Committee, Mr. C. Hill, General Manager of the Bournemouth Corporation Tramways, recommended that the conduit system of traction, which is now used in the central narrow streets of the town, should be replaced by the overhead trolley system. He estimates a capital expenditure of £1,910, and an annual saving of £3,000 in working expenses. (Page 310.)

AT the annual meeting of the Welsbach Incandescent Gas Light Co., on Tuesday, it was stated that the advertising of the new electrical section of the company's business had cost over £6,000, and the legal expenses in connection with the action by the General Electric Co., concerning the company's trade mark, amounted to £1,000. (Page 310.)

A LATHE recently supplied for use in the Antarctic is described on page 311.

"NOTES from the Wiring Contractor's Point of View" will be found on page 311.

A PROPOSAL by the Electricity Committee of the Bethnal Green Borough Council to purchase electricity in bulk from the Shoreditch Council has been referred back.—Newcastle Corporation will apply next Session for powers to adopt the trackless trolley system.—Two new trunk telephone lines have recently been laid between London and the West of England, and five others are in course of construction.—In order to avoid arbitration in connection with the purchase of the Hartlepool Tramways by the Corporation, the Company have suggested a price which they would be willing to accept.—A large number of municipal electricity accounts for the year to March 31st, 1910, have been published. (Page 312.)

THE following loans for electrical extensions have been applied for or have been sanctioned:—Colchester (£8,000); Darlington (£1,500); Derby (£9,850); Grimsby (£6,459); Heckmondwike (£24,159); Weymouth (£1,970); York (£1,500). Rochdale Corporation require accumulator, reversible booster, and switchboard panels; Leicester Corporation a 750-kw. mixed pressure turbo-generating set, condensing plant, boilers, &c., and Wallasey Corporation A.C. transformers. (Page 313.)

CALLENDER'S Cable & Construction Co.'s accounts for 1909 show a net profit of £68,452. Johnson & Phillips made a net profit of £942. (Page 314.)

A NEW moving coil permanent instrument, which is rendered available by an arrangement of thermo-junctions for alternating as well as continuous current, is described. (Page 315.)

A REVIEW of a well-known electrical year-book appears on page 315.

AMONG the Specifications published by the Patent Office on Thursday last was one by E. B. Wedmore and the B.T.-H. Co., for switchgear for use with three-phase alternators running in parallel. This ensures that the neutral of one machine only will be earthed, and transfers the earthing connection automatically should the earthed machine be switched out.—Means for indicating when a cartridge fuse has blown is covered by the B.T.-H. Co. This consists of a piece of prepared paper in contact with an auxiliary fuse, which burns the paper when the fuse blows.—A. C. Stille describes a telephone relay comprising two co-axial coils wound in opposite directions, and placed in a strong magnetic field. Movements of the coils produced by sending the telephone currents through them vary the pressure on a carbon microphone placed between them.—A method of making the end connections of bar-wound armatures, covered by the Brush Electrical Engineering Co., consists in inserting the ends in a short tube, driving a wedge in, and locking the wedge.—An important patent granted in 1896 to H. O. Tudor for a process of forming positive storage battery plates expires during the current week. (Page 316.)

SPECIAL TRAIN FACILITIES TO THE I.M.E.A. CONVENTION

WE understand that the Incorporated Municipal Electrical Association has arranged for the issue of return tickets to Glasgow for the Convention, from June 14th to 17th, at a specially reduced rate, namely, single fare and a quarter. This will be greatly appreciated by those attending the Convention, for the ordinary return fare from London, for instance, is no less than £3 2s. 11d., and members attending the Convention, and others invited to it, will be able to obtain tickets at £2 1s. 3d. We believe this is the first occasion on which the Association has been able to negotiate with the Railway Company for such facilities, and we hope that it will in future be the rule rather than the exception.

Our contemporary *Electrical Industries and Investments* informs us that they have also made arrangements with the London & North Western Railway Company for a similar reduction in the fare by the 2 p.m. train from Euston, upon which they will have a special saloon carriage for their party.

Faraday House.—Major O'Meara, late R.E., C.M.G., will deliver a special lecture to the Third Year Students on May 20th, commencing at 10 a.m. The subject of the lecture will be "Depreciation."

Test-room Fatality.—Mr. G. J. Porter, who has for some years been works superintendent of the Brush Electrical Engineering Co.'s works at Loughborough, was killed by electric shock on Saturday last. Mr. Porter was engaged in the testing department, and accidentally received a shock while flashing an armature at 2,000 volts.

New C.B. Telephone Exchange.—On Saturday last, at 2 p.m., the National Telephone Co. transferred the subscribers connected to its Anfield exchange to a new C.B. equipment installed in a suitably altered building at Richmond Terrace, Anfield, Liverpool. The new equipment has been manufactured and installed by Messrs. Western Electric Co., Ltd., of North Woolwich, and is of the No. 10 C.B. type, consisting of eight subscribers' positions giving accommodation for 880 subscribers' lines and three incoming junction positions, and similar to that installed in the Great Yarmouth exchange (see ELECTRICAL ENGINEERING, Vol. V., p. 230).

Electrical Working of Fog-horns at a Distance.—A fog-signalling apparatus at an unattended lighthouse on an isolated rock called the Platte Fougère, off St. Peter's Port, Guernsey, is described in the *Engineer*. The fog-horn is worked from two compressed-air reservoirs, supplied from Reavel air-compressors, each direct-coupled to a Mavor & Coulson three-phase motor, and these compressors are supplied with current through a submarine cable from a small generating station on the shore, containing two 11½kw. gas-engine-driven sets. The cable was specially manufactured and laid by Messrs. Siemens Brothers & Co., Ltd., and is of specially heavy rock-armoured type, with three power conductors and a pair of small conductors for a telephone and control circuit. The whole cable is 3½ in. in diameter and weighs 45 tons per naut.

Interruption of Supply at Glasgow.—On Thursday night, at about 8.15, there was a temporary failure of the lighting supply in the centre of Glasgow. The light first dwindled down, and then went out completely. The duration of the stoppage was, however, only about three minutes in all, and, owing to the fact that darkness had not set in entirely, very few places except the theatres and music-halls were at all seriously affected. On inquiry we find that the two stations at Port Dundas and St. Andrew's Cross were running in parallel at the time—this is frequently done now in order to get the benefit of any diversity in the loads on the respective stations—and the mishap occurred through the failure of the field of one of the alternators, due, it is thought, to some outside cause. The disturbance in the circuits resulted in the maximum load cut-out relays on the E.H.T. trunk mains acting, and so preventing the St. Andrew's Cross Station from sharing in the load, with the effect that the Port Dundas station was unable to maintain supply until connection had been restored and other sets put on load.

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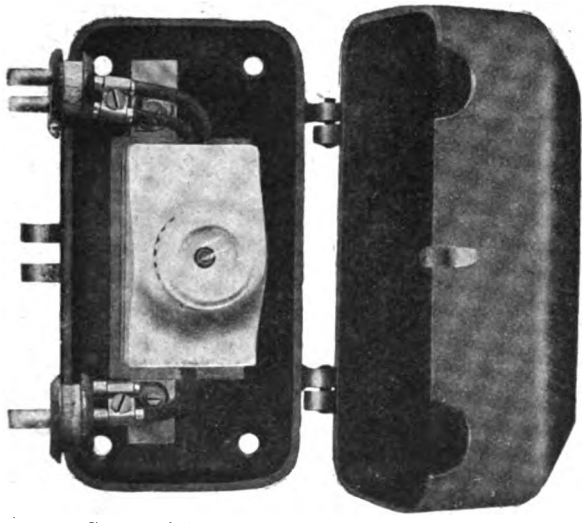
NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Incandescent Lamps.

In addition to their "one-watt" lamps with drawn tungsten filaments for high candle-powers, Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston), now announce that they are putting on the market a series of "one-watt" battery lamps from 2 to 16 volts, with a similar drawn wire filament. A very extensive range of sizes, shapes, and candle-powers are included in the new catalogue which has been issued, and the prices compare very favourably with those of other small metal filament lamps. The strengths of the filament should render these lamps particularly suitable for motor-car work.

Fittings, Switches, and Accessories.

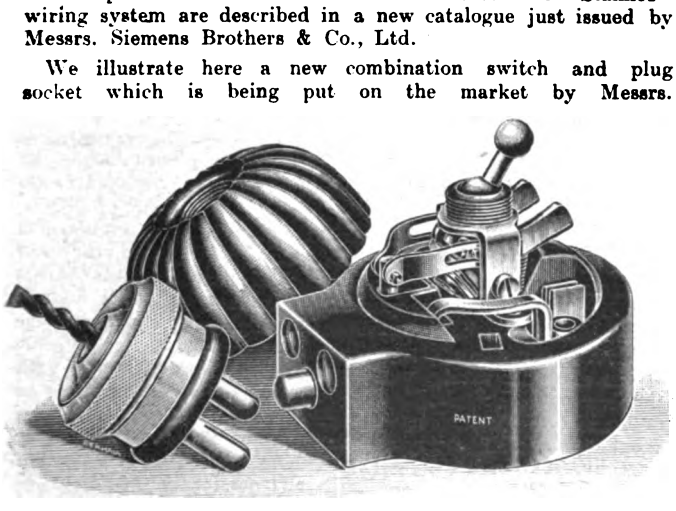
The accompanying illustration shows a new house fuse box which Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster), are introducing in connection with their now well-known "Stannos" system of wiring. This box consists of a small cast-iron case with hinged lid, containing a Siemens "Zed" cartridge fuse, with non-interchangeable cartridge. (For full particulars of "Zed" fuses see Electrical Engineering, Feb. 10th, page 89.) The "Stannos" wire enters the box through a wooden bush, and the sheathing is clamped into



Siemens' "Stannos" House Fuse Box.

a fitting, which is screwed to the base of the iron case, the inner conductor going to the fuse. The house wire, or wires, enter the box through a wooden bush at the other end, and are connected in a similar manner. The two clamps are bonded together by means of a copper strip. The lid of the box is provided with a glass window in order that the fuse may be inspected without unsealing the case. The latter is locked by means of a brass pin, which has a hole through which the seal wire is passed. This and other accessories for the "Stannos" wiring system are described in a new catalogue just issued by Messrs. Siemens Brothers & Co., Ltd.

We illustrate here a new combination switch and plug socket which is being put on the market by Messrs.

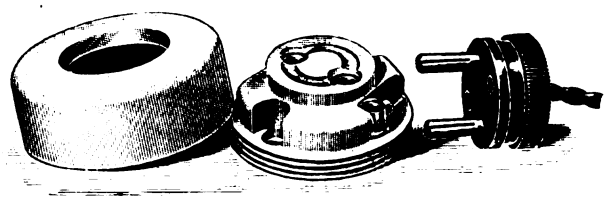


Lundberg "Auto Combination" Switch and Plug.

A. P. Lundberg & Sons, under the name of the "Auto combination." This is already obtainable in the 10-ampere size and a 5-ampere size is in preparation. The chief feature of the apparatus is the automatic release arrangement, which is covered by Messrs. Lundberg's patent No. 22,896/09. This acts by means of a horizontal spring plunger embedded in the base, which is in linked connection with the rocking cradle of the switch arm, and ensures a quick-acting automatic release of the switch contact arm before the plug can be withdrawn.

The advantages resulting from the use of this device are as follows :—The contact arm flies automatically into the "off" position before the plug can be withdrawn, and remains there. The rupture of the circuit on withdrawal of the plug is rapid and independent of the operator, the break occurring at its proper place, viz., at the switch contacts. While the plug is in position, the device does not prevent actuation of the switch in the usual way. Withdrawal of the plug is thus only necessary when the apparatus connected requires removal. The plug must first be pushed into full contact before the switch arm can be made to remain permanently in its "on" position. As the circuit cannot be broken where the plug pins leave the socket tubes, any destructive arcing at these points is effectually prevented. The switch is of Messrs. Lundberg's well-known "Pivot pattern," with knife blade contact arms, double contacts, and mica insulation.

We are able to illustrate here a new wall-socket and plug of British manufacture, which Messrs. Marsh, Son & Co. (15 Gerrard Street, Soho, W.), are putting on the market. A



New Wall Plug (Messrs. Marsh, Son & Co., Ltd.).

special feature of the design is the flatness both of the base and the plug, and the arrangement of the base and cover, both of which are very substantial, renders it very easy to wire. The pins are, of course, of standard dimensions. Messrs. Marsh & Co. are also bringing out a new design of 10-ampere tumbler switch with particularly large break and substantial parts, enabling it to withstand heavy overloads. Its construction is particularly suitable for looping in wiring.

A new catalogue from Messrs. D. H. Bonnella & Sons, Ltd. (58 & 60 Mortimer Street, W.), contains particulars of an extensive series of wall and floor sockets and plugs, including the ordinary types, as well as non-reversible, three-pin concentric, and other special plugs, flush-type sockets, combined switches and sockets, multiple sockets, &c. A special design, with plain round cover, is made for hospital work. The same list also deals with pressure switches of various patterns. It may be mentioned that this list is under the auspices of the Engineers' Standardised Publication Association.

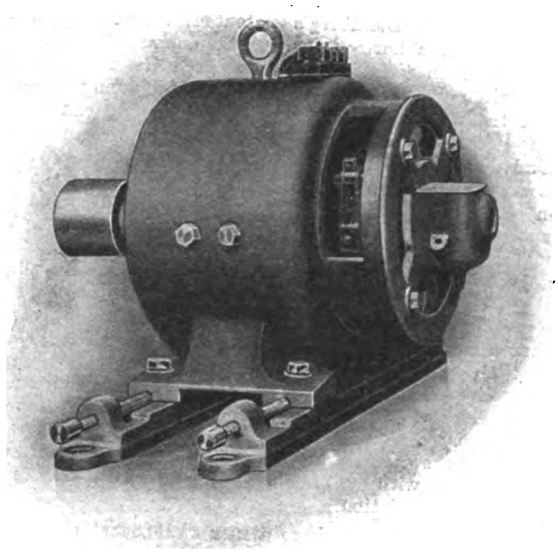
Miscellaneous.

Messrs. Birch Bros. (3 Brunswick Place, Leeds) have introduced a new bell transformer for ringing bells off A.-C. lighting circuits. The transformer itself is of the shell pattern, with the two coils of enamel insulated wire wound on the central leg and carefully insulated from each other to obviate any danger of the bell circuit reaching a high potential. All the iron joints are interleaved, and the constant loss is said to be less than one quarter of a watt. It is stated that if a short develops on the bell circuit, the transformer will not burn out, but will run safely until the fault is repaired, taking some 12 watts only. The shell is clamped between a cast-iron cover and base, rendering the whole water-tight. The terminal screws are embedded in a hard fibre block. The complete transformer measures 3 in. by 4½ in., and weighs just under 2¾ lbs. No special bell is required, the ordinary battery bells working quite well without any alterations. Where there are long runs or circuits including indicators, a transformer with tappings giving two different voltages is used. Messrs. Birch Bros. have also developed a line of small transformers for low-voltage metal filament lamps. These can be obtained with single or divided secondary circuits. They appear to have very low "no-load" losses.

Messrs. Matthews & Yates, Ltd. (Cyclone Works, Swinton), the makers of the well-known "Cyclone Fans," have recently placed on the market a new design of D.-C. motor, as illustrated

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in the accompanying figure. The motor can be supplied either open, protected, semi, or totally enclosed, and may be shunt, series, or compound wound. It is made at present in sizes

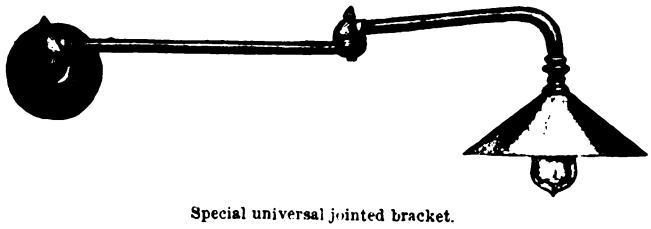


SMALL PATTERN D.C. MOTOR (MATTHEWS & YATES, LTD.)

from 3/16 B.H.P. to 5 B.H.P., and is suitable for driving all classes of machinery. This motor is also supplied in combination with the firm's "Cyclone" fans and exhausters, which, we understand, are regularly being supplied to H.M. Office of Works and General Post Office.

SOME SPECIAL FITTINGS FOR A HOSPITAL

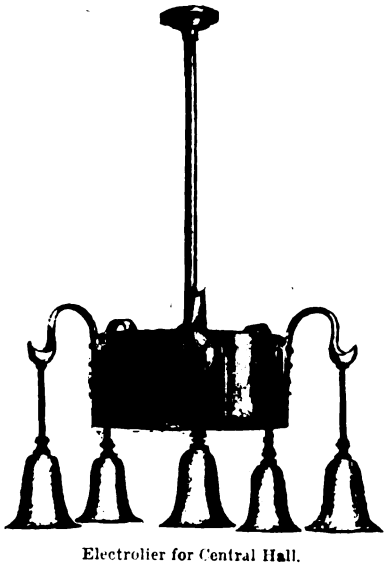
THERE are few classes of installation where special requirements call for more consideration than those in hospitals, and considerable interest attaches to the series of fittings which Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen-



Special universal jointed bracket.



Corridor bracket.



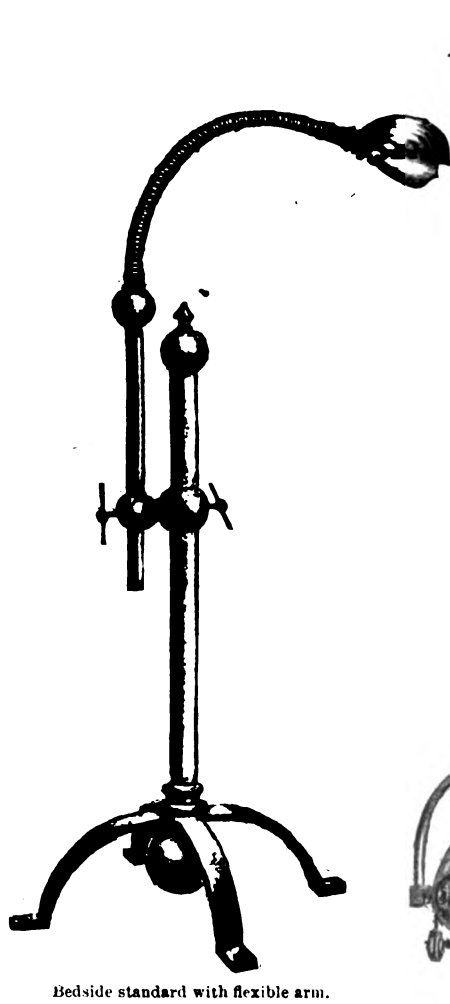
Electrolier for Central Hall.



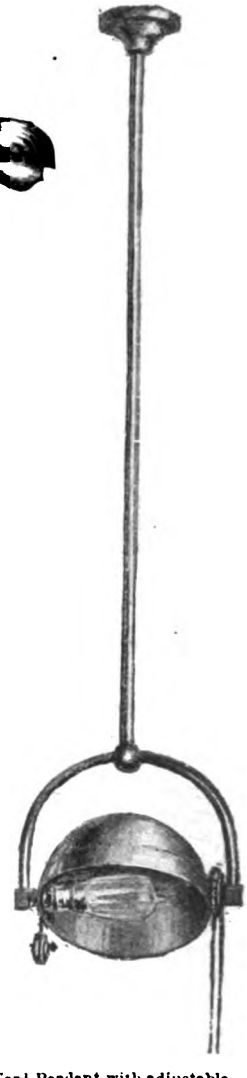
Oyster fitting for Storerooms.

SIEMENS' HOSPITAL FITTINGS.

street, Dalston), have just supplied to an eastern hospital, and added to their already long list of fittings for special purposes. In many of these, facility for freedom of action so that an effective light may be thrown in any desired direction, immediately at will, is essential, and must be accomplished with a degree of ease which is not readily obtainable in any one fitting. We illustrate here a few of the special designs which are installed in this hospital, and it will be noticed that considerable thought has been given to this requirement. In some cases, light mechanical devices have been employed to obtain this end. In the case of the ward pendant, which we illustrate here, the lamp is enclosed in a hemispherical reflector, which is mounted on a spindle or axis. To this spindle is fixed a toothed wheel, which may be turned, by means of an endless chain, from below. A balance weight is fixed on the spindle to counterbalance the weight of the reflector on the opposite side, so that it may be adjusted at any angle without fear of its swinging back owing to the weight of the reflector. The bracket which carries this reflector is loose, so that it can be swivelled round in a horizontal direction. We also illustrate a wall bracket, with an extension arm, which has at the back plate and at the junction of the extension a horizontal joint, so that the light can be adjusted anywhere within a wide radius from the wall as the require-



Bedside standard with flexible arm.



Ward Pendant with adjustable reflector.

SIEMENS' HOSPITAL FITTINGS.

ments of the patient may necessitate. The bedside standard is also capable of wide adjustments, special facilities having been taken for freedom of action, whilst it is portable, and capable of being moved from one position to another. Cheaper designs of brackets have been installed for corridors, and these are of fixed and massive design. For store rooms, &c., a durable design of oyster fitting was supplied, which is protected with a galvanised wire guard. For the central hall, electroliers of neat and artistic design were employed, having a spread of about 4 ft., and carrying 8 lights. These fittings give a very even distribution of light, and being fitted with opalescent shades, they entirely eliminate all possibility of glare or dazzling effect, which is often a set-back to electric lighting installations. For these fittings, many of which are continually being moved about, the tantalum lamps, with which the hospital is lighted throughout, are particularly suitable.

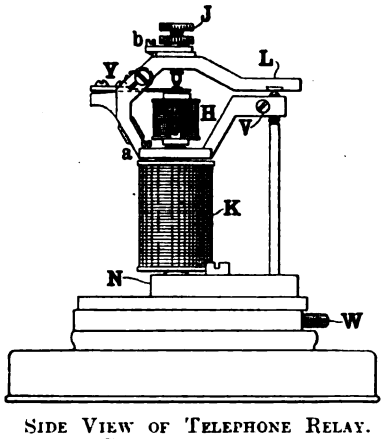
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A TELEPHONE RELAY

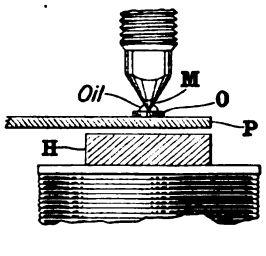
A TELEPHONE relay, which could be placed at the end of a long telephone line to strengthen the received current or be connected as a repeater in the middle of a long line, in the same way as telegraph relays and repeaters, has long been sought after. At the Institution of Electrical Engineers on Thursday, however, Mr. S. G. Brown (of Messrs. Clark, Forde & Taylor), described how, after six years' study, he had devised a telephone relay which had given extremely good results, both for ordinary telephony and wireless telephony, and afforded a practical solution of the first problem. In the Paper he also described an application of the same principle which governs the relay to improving the microphone transmitter for ordinary and trunk telephone circuits, and this suggests a new direction of useful research, in which extremely valuable results are practically assured.

DESCRIPTION OF THE RELAY.

If the metallic circuit of a dry cell be interrupted by a minute opening or space of the order of half a millionth (5×10^{-7}) cm., the metal at the point of interruption being platinum, the current will continue to flow round the circuit and across the opening, and any slight alteration in the length of the space, which Mr. Brown calls the conduction space, will vary its resistance and greatly affect the value of the current that flows round the circuit. This conduction space is employed by Mr. Brown for transforming microscopic mechanical movements into large current changes, which is the function of the telephone relay. The dimensions of the conduction space are so small that it is difficult to ensure and maintain it by direct mechanical means. The current that flows across the space was therefore made do its own adjustment, very much in the same way as the current that passes through the arc of an arc lamp is made to strike and maintain the length of the arc.



SIDE VIEW OF TELEPHONE RELAY. (COVER REMOVED.)



ENLARGED VIEW OF THE REED AND CONTACTS.

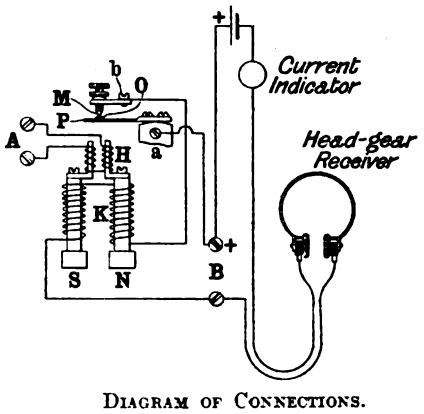


DIAGRAM OF CONNECTIONS.

In the accompanying illustrations of the relay, N is a permanent magnet, continued by soft iron poles right up to but not touching the "invar" steel reed P. Round the soft iron pole extensions are wound the two sets of coil windings H and K. The telephone currents to be magnified circulate round the winding H and thus by varying the magnetism set the reed P in vibration. M, O are the top and bottom metal contact-pieces, which are opened to an infinitesimal degree to form a microphone by a fine adjusting screw W and by the automatic action of the local current passing through the contact and round the winding K. So good is the automatic adjustment that the instrument may be turned upside down, without any effect on the working of the relay. The regulating winding K must not act when traversed by the rapidly varying telephonic currents; this is brought about by surrounding the iron under the coil by a closed circuited copper sheathing. Eddy currents set up in this sheathing by mutual induction destroy the self-induction of the coil. In the present instrument the contact is made between metal pieces of hard osmium iridium alloy. The top contact is pointed, the lower one is flat and is soldered to the reed, both are polished and work under a small drop of thin oil.

The connections are shown in the diagram. A single dry cell is sufficient to work the instrument, and the resistance of the telephone receiver employed is approximately 40 ohms. When the microphone contact is opened so as to cut down the local current to half its maximum value, the relay is usually at its best adjustment. The telephone currents to be magnified enter by the terminals marked A and circulate through the winding H.

Speech or signals that are too faint to be heard in the ordinary Bell receiver may be heard clearly through the relay.

This property of magnifying feeble telephone currents has made the relay particularly useful in wireless telegraphy, and the distance over which is it possible to receive signals has been doubled. Its utility in this direction has been tested among others by the Admiralty and the Post Office. In a wireless receiving station, messages, the very existence of which was not even suspected, owing to their extreme feebleness, when listened for under former conditions with the relay in circuit were easily read. The relay is not easily affected by extraneous noises and vibration. It can thus be carried on board ship and worked in all weathers.

On ordinary telephone lines, speech may be magnified many times in loudness without perceptible loss in the articulation, and it will work with large currents to a point at which the Bell receiver in its local circuit is responding with uncomfortable loudness. In experimenting over a 20-lb. standard cable and speaking only one way, it has been proved that, when the relay is applied, 30 miles may be added to any length through which it is possible now to speak direct. These tests prove that the telephone currents must be increased in strength to the extent of something like 20 times.

A LONG-DISTANCE STETHOSCOPE.

By means of the local regulating winding (K), the metal contact M O is transformed into the most exquisitely delicate microphone, more sensitive, there is very reason to believe, than could be formed by light pressure between carbons. Such a microphone has rendered possible the construction of an electric stethoscope, an instrument by the use of which the sound of the heart or other internal organs may be greatly magnified. In place of the ordinary end of the stethoscope, which is placed against the body, a shallow brass cell of similar shape, faced by a thin ebonite diaphragm, is used, which is connected by a tube to a second diaphragm. This latter is of metal; one of the two osmium iridium contact-pieces is mounted on it, and there is the same metal reed as before. Behind the reed is a horseshoe magnet, on one leg of which is a coil carrying the local current from the dry cell. The local circuit is made up by the cell, the osmium iridium contacts and the coil in series with the primary winding of a special transformer of 20 ohms resistance, to the secondary of which a telephone is connected. The electric stethoscope in its present form causes the sound of the heart to be three times as loud as in the ordinary stethoscope. But if a telephone relay, as previously described, be connected to the secondary of the transformer, the two instruments combined raise the intensity of the sound some twenty times and more.

The combined stethoscope and relay have been tested with great success at the London Hospital upon a number of diseased heart cases. Mr. Brown has also connected the secondary of the transformer to the telephone line at his own house, and has transmitted the sound of the heart over several miles of telephone line to doctors in various parts of London, and on one occasion from London to the Isle of Wight. Thus it is now possible for a specialist in London to examine, stethoscopically, a patient in the country.

The relay has also been used on the electrophone system, and by its aid, damping the reed with a piece of rubber, the speaking and music from the theatres are rendered with loudness and great clearness.

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Researches on an Improved Microphone.

During some experiments with the telephone relay, attempts were made to dispense with the regulating winding and form the microphone by the mere pressure of the electrodes one against the other as with carbon. With gold, platinum, palladium, and rhodium, it was not possible to do so; with iridium the action was only just shown, a ruthenium contact was a little better than carbon, but osmium iridium alloy made a microphone that can carry large currents stand high temperatures, and is exceedingly sensitive to small changes of pressure. This alloy can be readily purchased as natural grains or granules, sifted to any desired uniform size. Ruthenium and osmium are of little value for microphonic purposes if purchased in their commercial form as grains or powder; the grains must be first fused into a bead and then crushed into granules. This may account for the failure of previous experimenters, who tried nearly all these metals without success.

Mr. Brown has taken several "solid back" transmitters and altered them to make use of the new metal. In one case the ordinary carbon electrodes were entirely removed and replaced by sheet iridium faced ones $\frac{7}{16}$ in. in diameter; these electrodes were separated by a distance of $\frac{1}{8}$ in., and the space between was nearly filled by 3 grains weight of very fine granules of osmium iridium kept in place by a rubber tube. This new transmitter would take permanently a current of $\frac{3}{4}$ ampere from a 2-volt accumulator. It was connected to the telephone service through a large transformer, which had a low-resistance primary of only $\frac{1}{10}$ of an ohm, and produced far louder speaking than a carbon transmitter. After the instrument had been in use some months, however, there was a gradual weakening of the power of transmission, which was eventually found to be due to the iridium faces of the electrodes becoming superficially oxidised. To remedy this the iridium has been replaced by gold, which so far has proved satisfactory. Another improvement was to cone inwards the faces of the gold electrodes; this is to prevent the granules from unpacking, as they had previously a tendency to do when worked between plane faces.

An osmium iridium granular transmitter has been constructed embodying all these later improvements, the electrodes have a diameter of $\frac{1}{4}$ in., and it will work permanently with 1 ampere at 2 volts. Up to the present no regular long-distance tests have been made, but it has been tried over 60 miles of 20-lb. standard artificial cable, and will work over this length with clearness and reasonable loudness, showing that this was by no means the limit. The upper harmonics of the voice are more faithfully transmitted by the metal granules than by the carbon. A much smaller quantity of the metal powder or granules is required as compared with carbon, and its sensitiveness in resistance to small changes of pressure is much greater; the new material is therefore peculiarly adaptable for the purposes of a relay for use on telephone lines where moderate magnification only is required. Such a relay has been constructed using osmium iridium powder as the resistance varying medium; it is simple in design, requires no adjustment, and so far gives a moderate magnification with good articulation.

The Telephone Repeater.

A telephone relay, if placed simply in the middle of a long telephone line, can magnify the currents only in one direction —such a device is called a single repeater. The relay for practical use has therefore to be associated with balancing coils and placed in the line so that it may work in either or both directions—such a combination is termed a two-way repeater. In a two-way repeater the lines on each side of the coils have to be balanced one against the other, and anything that produces a variation, say leakage, will cause the relay to react upon itself and thus interrupt the conversation till the balance has been restored. Theoretically it would seem that the two-way repeater can be only one-quarter the efficiency of the single repeater. Although the one-way relay is now solved, it will be seen that there is still much to be done before the two-way repeater is practicable.

Discussion.

Mr. J. E. Taylor (Engineer-in-Chief's Department, G.P.O.) testified to the fact that the instrument was capable of picking up and magnifying 20 times wireless telegraph signals, which were entirely inaudible with the ordinary telephone receiver. When he first experimented with the instrument, the contact point had become flattened, and the results were not so good. He asked whether it was necessary to keep a fine point on the upper part of the contact in order to maintain the magnifying power and reliability. The new microphone transmitter gave a volume of sound at the end of 60 miles of artificial cable equal to that received at the end of 45 to 45 miles of line upon which an ordinary transmitter was used, but there was no experience of how it would act under practical conditions. However, the instrument was very suggestive of future progress.

Mr. B. Davies, who represented Sir Oliver Lodge, referred to some experimental work upon carbon relays, which had been carried out by Sir Oliver 10 years ago.

Dr. C. B. Voysey (London Hospital) said he had tested the electrical stethoscope in the out-patients' department of the hospital and over the telephone, and there were many possibilities in connection with it. It might enable the physiologist to demonstrate that what are now regarded as simple sounds are really compound, and it might be the means of splitting them up into their constituents. It might also enable a determination of the exact relationship in time between the occurrence of the heart contraction and the heart sounds. Clinically, also, it might be of assistance in detecting sounds in the body which at present are only suspected, *e.g.*, sounds caused by friction of gallstones in the gall bladder, calculi in the kidney, or by the passage of the blood stream along an aorta roughened by disease. He thought, however, that it would be difficult to damp down or exclude extraneous sounds, or to tune the instrument to different wave-lengths.

Mr. J. E. Kingsbury referred to the Shreeve repeater (Patent No. 11,605/05), which was unquestionably a practical telephonic relay. Such instruments had, however, all been subject to drawbacks in the shape of adjustments, and even Mr. Brown would have to tackle the question. One of the greatest difficulties was to make the repeater talk both ways. The metallic surface contact adopted by Mr. Brown was akin to the Berliner microphone, although the automatic adjustment was entirely different to anything Berliner ever thought of.

Mr. B. S. Cohen (National Telephone Co.) referred first to the principle underlying the action of the relay. Mr. Brown had explained the cause of the wide variations of current with small differences in the length of conduction space as being the variation in the flow of electrons across the gap, but Mr. Cohen thought that it was merely due to variation in resistance caused by variation in pressure and temperature at the surface of contact. The results of tests made in the National Telephone Co.'s laboratory with the relay were not quite so good as those given in the Paper, but probably this was due to their want of experience in adjusting the apparatus. With a relay placed in the centre of a line, an improvement of 19 miles of standard cable was obtained in volume. Articulation tests showed that with 44 miles of standard cable and a relay, and 25 miles without the relay, the percentage of words missed with the relay was 55 per cent. more than without the relay, so that the articulation with equal volumes was 55 per cent. worse. The cables were then readjusted to give comparative length and equal audibility, including both articulation and volume. The result was that the relay gave a net improvement of eight miles of standard cable. This sounded very little, but it might represent approximately 300 miles of trunk line. He supplemented Mr. Kingsbury's remarks concerning the Shreeve repeater by some figures given him by the Western Electric Co. This instrument was in use on a large number of long American telephone and telegraph lines, and was generally in series at the middle of lines, whose total length was not less than 12 standard miles. With less length, trouble was experienced by the receiver and transmitter reacting. With the repeater exactly at the centre, very good results were obtained. The improvement, with double repeaters working both ways, was about six standard miles. More than one repeater could be inserted in a line; for instance, on a 1,500 mile line, running out from Boston, three repeaters were joined in series, and the net improvement was 18 standard miles. He had obtained some encouraging results with Mr. Brown's metal transmitter, carried out under favourable conditions; there was an improvement over the ordinary carbon transmitter of 10 standard miles, whilst the articulation was good. He thought the Brown transmitter had a good future, providing it could be turned out in bulk for commercial work with the same efficiency. Unfortunately, he believed Mr. Brown had not been able to design an instrument to work on common battery systems, and this seriously limited the effectiveness. No doubt, however, he would get over this.

Mr. A. C. Booth (Engineer-in-Chief's Department, G.P.O.) stated that he had used the relay for wireless work, and that it magnified the received signals from four to twelve times. Working as a repeater in the middle of an artificial telephone line of 68 miles of standard cable, the speech was little inferior to that over 34 miles of standard cable without the relay. As a further test, the relay was placed half-way along 108 miles of standard cable, and one could clearly distinguish that speech was being made, whereas without the instrument the 108 miles of cable was absolutely silent. Experiments were being pursued on trunk line working. The instrument had weaknesses. Although the adjustment was simple, it took time to settle down, and sometimes more than an hour was spent in regulating before good results could be obtained. In wireless work, the ordinary detectors were absolutely silent except when signals were being received, whereas the relay gave a very slight noise, which seemed to have a disturbing effect on the operators, who wore headgear telephones for several consecutive hours daily. As regards trunk telephone circuits, such a very sensitive instrument would magnify any defects or disturbances which might be many on the long lines. The switching necessary for to and fro conversation was certainly a disadvantage. However, the invention marked a very long stride in the direction of a perfect telephone repeater.

Dr. W. H. Eccles, speaking on the question of wireless telegraphy, said that as such relays were not monotonic they magni-

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fied atmospheric and other disturbances, as well as the signals to be received. He had developed a selective form of Mr. Brown's relay, comprising an iron wire stretched so as to vibrate at the signalling frequency. This apparatus did not select as well as it should, due probably to the damping effect of the point in the oil. Working on the Clifden signals as heard in London, this instrument kept on singing for five or ten minutes after the signal was started. He thought Mr. Cohen's explanation of the action was the correct one, and this being so, it was possible to get a good idea of the size of the air-gap. Dr. P. E. Shaw measured, some years ago, that the minimum audible sound involved a diaphragm movement of 0·028 millionth of an inch, which was about 400 or 500 times smaller than the wave-length of blue light, and it was less than this that Mr. Brown succeeded in dealing with. This illustrated the difficulties of adjustment, and it was very surprising that Mr. Brown had been so successful.

Dr. E. H. Rayner (National Physical Laboratory) asked whether it was necessary to have the point of negative polarity. He also wished to know whether invar was used for the reed for magnetic or mechanical purposes, and whether it could be used for the whole apparatus to keep the dimension constant and avoid temperature changes.

Mr. Brown said it was advisable to have the point negative as it worked better. Invar was used for keeping the temperature constant and to keep the reed from warping. It was likely to buckle if it had a coefficient of expansion. It would be better if the whole instrument were made of invar.

Mr. D. H. Kennedy (Engineer-in-Chief's Department, G.P.O.) also referred to the experiments described by Mr. Booth, but said that he was able to follow what was being said over the 108 miles of standard cable with the relay in use. Before the tests he had deliberately put the instrument out of adjustment, and there had been no difficulty in getting it back again. The instrument had also been used on the Glasgow trunk line, and although there was a great increase in audibility, there was also a great increase in extraneous noises. He was very sanguine that the instrument would greatly increase the distance over which speech would be possible.

Mr. W. M. Mordey referred to the transactions of the Institution for 1883, when discussions took place upon the use of various substances for microphonic purposes.

Prof. Perry expressed his admiration of the instrument, and promised to send in a communication for the *Journal*, explaining mathematically how the film of oil between the contacts was maintained automatically at constant thickness. He understood the instrument had maintained perfect adjustment for twenty-four hours.

Mr. S. Evershed, who was in the chair, was inclined to think that a telephone relay, in the true meaning of the word, was impossible. Mr. Brown's instrument was a magnifier, and not a relay. A telephone relay would be an instrument that would not only restore the amplitude of the current impulses as Mr. Brown's did, but would also restore the waves to the same phase relation and the same shape as when they started.

Mr. Brown expressed a wish to reply to the discussion in writing, and a hearty vote of thanks to him concluded the proceedings.

THE IRON AND STEEL INSTITUTE

THE annual meeting of the Iron and Steel Institute, which now comprises over two thousand members, was held in London at the Institution of Civil Engineers on Wednesday and Thursday of last week. The chair was taken by the Duke of Devonshire, whose presidential address consisted mainly of a comparison of the present social and economical conditions with those obtaining in 1869, when the Institute was founded. The Paper on electric smelting, announced for reading by Mr. D. F. Campbell, has been postponed until the autumn meeting of the Institute, but the following Papers of electrical interest were read and discussed.

Production of Electric Power from Waste Heat.

In a Paper on this subject, Mr. D. Selby Bigge, of Newcastle-on-Tyne, deals with the generation of electric power in iron and steel works from waste gas and steam, with particular reference to the mixed-pressure turbine. Whereas the pure exhaust steam turbine runs with a constant supply of exhaust steam, such as that from blast furnace blowing engines, pumping engines, &c., the mixed pressure turbine utilises the exhaust from intermittently working engines, such as winding engines, rolling mill engines, compressors, steam hammers, &c. The turbine has two parts, a high-pressure end, adapted for running with live steam, and a low-pressure end, for working with exhaust steam. Live steam is automatically admitted to the high-pressure end if the supply of exhaust steam fails. The author gives diagrams showing how, by combining an exhaust steam turbine with reciprocating engines, the fullest range of expansion can be taken advantage of. Figures are given in the Paper for the steam consumption of a 1,000-kw. 3,000 r.p.m. mixed-pressure turbine set. The boiler pressure was 163 lbs. per sq. in., superheat 117° Fahr., exhaust steam pressure 15·7 lbs. per sq. in. abs. Using exhaust steam only, the consumption was 30 lbs. per kw-hour; with somewhat under half exhaust steam the consumption was 22 lbs. per kw.-hour; and with live steam only a figure of 17 lbs. per kw.-hour was reached. Referring to cooling plant, the author states that where ground space is not of great importance, spray nozzles are to be recommended. Mr. Bigge then describes briefly various types of mixed-pressure turbines.

Turning to gas-engine generating plant, the author refers to the large Mather & Platt engines, of which an illustrated description appeared in Electrical Engineering, Vol. V., June 10th, 1909, p. 523. The Nurnberg and the Cockerill-Westgarth types are also briefly referred to. One ton of coal distilled in a coke oven gives about 15 cwt. of coke, 5 per cent. ash, and 20 per cent. volatile matter. This latter yields gas of the value of 960,000 calories. The gas required for coking is about 65 per cent. of this, leaving a surplus of 336,000 calories, which will produce in gas engines some 135 b.h.p.-hours. If the 15 cwt. of coke are employed in a blast furnace, after allowing for the heat required for smelting, a surplus of 3,186,000 calories is left. Some 45 per cent. of this is required for the hot-blast stoves, and 15 per cent. for the blast-furnace auxiliaries, leaving 1,274,520 calories available for use in gas engines. This would give some 510 b.h.p.-hours. Thus the waste power from both coke oven and blast furnace would produce some 645 b.h.p.-hours per ton of coal consumed, assuming that 2,500 calories represented one b.h.p. A blast furnace producing 250 tons of iron per day delivers enough gas to generate 10,000 b.h.p. continuously, of which 2,500 b.h.p. is required for the furnace equipment, leaving 7,500 b.h.p. for generating electric power. Considering the question of cost of production, the author states that for a small 300 to 500-kw. steam plant with coal-fired boilers the total costs, including interest and depreciation, work out at from 0·6d. to 1·0d. per unit; the cost of power from a supply company depends upon the load factor and the amount purchased, but 0·5d. per unit may be taken as a low figure. For consumers of from 100 to 400 kw. it will generally be preferable to purchase power than to generate privately unless waste heat is available. In large works where power is required for driving machinery, rolling mills, and possibly for electric furnaces, the total amount may reach anything from 1,000 to 10,000 kw., and with waste heat private generating plant is desirable.

As an example to illustrate the utilisation of exhaust steam, the author takes the case of a steel works, where 1,600 b.h.p. is installed in electric motors supplied from a coal-fired steam plant. Exhaust steam is assumed to be available from other steam-driven machinery. Assuming that the average motor load for 20 hours out of the 24 is 400 kw., the units used per annum will be 2,400,000. Two 600-kw. mixed-pressure turbine units are installed, one to act as stand-by, and the cost of this plant may be taken as £9,000. Taking interest and depreciation at 12 per cent. per annum, or £1,080; attendants' wages, £200; oil and stores, &c., £52; and provision for live steam, £728; the total cost of production per annum will be £2,060, or 0·206d. per unit. The Fife Coal Co. have installed at their collieries five mixed-pressure turbines, each of 1,000 b.h.p., and one of 800 b.h.p., and current is generated at 3,000 volts, 50 cycles. At another colliery, where 750-kw. mixed-pressure turbine plant has been in operation for one year, the total cost of production, after allowing 12 per cent. interest and depreciation on the capital cost (£9,400, including stand-by unit), and including attendance, stores, and cost of live steam, amounts to 0·211d. per unit. The total amount generated during the year was 2,295,000 units. The net saving already exceeds £3,000 per annum, but will be more when the plant is fully loaded. The author refers briefly to the various applications of electric power, including the electric driving of rolling mills, and electric furnaces, and comments on the great progress which is being made on the Continent. Concluding, he asserts that this country is suffering from apathy and lack of enterprise, but that if the required improvements in plant and methods are

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effected, there is no country better able to meet the growing competition.

The discussion on Mr. Selby Bigge's Paper was opened by Mr. T. WESTGARTH (Richardsons, Westgarth & Co., Ltd.), who stated that the substitution of gas engines running with blast-furnace gas for steam plant in the Barrow Hematite Steel Works, to do the blowing for the furnaces and to produce electric power for the works, had resulted in a saving of 1,500 tons of coal per week, which he supposed was equivalent to some £50,000 per annum. Another course had been adopted at South Bank, where the exhaust steam from the original steam plant was utilised for low-pressure turbo-generators. They were not driving their rolling mills and heavy machinery by electricity, however. It was always a question as to whether it was the more economical to scrap steam engines and install electric drive, or to use the exhaust steam from the engines and effect economy in that way. At Messrs. Hickmans' works they had done away with the steam plant, installed gas engines, and they now drove their rolling mills electrically. At Messrs. Samuelson's works in Middlesbrough they had no use for their exhaust steam, so they sold it to the Waste Heat Co., who utilised it to feed the public electricity supply mains in that district. He understood that at Skinningrove power would be generated direct from gas, and that the works would be driven electrically, whereas at Frodingham gas engines would be used for blowing and for generating electricity, and the large machinery and rolling-mills would be steam-driven, exhaust steam turbo-generators being employed in conjunction with the steam engines. There were thus varied methods, and no general rule could be laid down. Each case had to be considered on its own merits.

Mr. C. H. MERZ stated that exhaust-steam and mixed-pressure turbines were advocated in a number of cases where the conditions, if properly looked into, did not justify their use. There was a fashion for these turbines. It was due, he thought, to the love of the engineer for his old plant. Instead of putting in exhaust steam turbines to improve the efficiency of old plant, it might often be more economical to install entirely new steam plant, or gas engines, or take power from a supply company. The speaker then emphasised the importance of a good vacuum with exhaust plant, and stated that very costly condensing plant was necessary to get good results. Referring to the figures given by the author, he did not think that two 600 kw. turbo-generators could be installed for £9,000. If it had been done, they were either installed in existing buildings or the condensers had been cut fine. The allowance of 12 per cent. for interest and depreciation was also too low, as it would only allow the plant to be written off in twenty years. He thought the total costs would amount to 0·5d. per unit, not 0·206d. Further, in the costs, no allowance had been made for the cost of the exhaust steam. This had a value, as by putting in new plant altogether, all the heat would be utilised in the one engine. There were, however, cases where the use of exhaust steam plant was justifiable. Such was Messrs. Samuelson's works, where the heavy cost of the necessary condensers was justified, as the plant was continuously loaded throughout the year. In general, however, exhaust steam plant did not pay, and it would be better to wait until entirely new plant could be installed.

Mr. W. C. MOUNTAIN (Messrs. Scott & Mountain, Ltd.) referred to actual results obtained with exhaust steam generating plant in collieries. In one case power was produced from the waste heat of coke ovens, and cost 0·146d. per unit. At the Kirkby Colliery, with coal at 2s. 6d. per ton, depreciation at 10 per cent., and interest at 5 per cent., the total costs came to 0·326d. per unit. In a South Wales colliery, with coal at 3s. 6d. per ton, the average cost for 12 years was 0·29d. per unit. These results confirmed Mr. Bigge's figures for total costs. It was questionable whether the application of electric drive to rolling mills would always be commercially successful. Finally, the speaker referred to a colliery plant in which the exhaust steam from two winding engines had been utilised in a low-pressure turbo-generator to supply power to three 200-h.p. haulage gears and a 200-h.p. electric winding gear.

Mr. W. J. LARKE suggested that in certain cases it might be most economical to burn the waste gases from blast furnaces and coke ovens under boilers to raise steam for high-pressure turbines.

Mr. I. WILLIAMS said that at the works at Eston they used the gas from the blast furnaces to raise steam for the engines in the steel works. The exhaust steam was collected and used for electric generating plant and turbo-blowers. They had no difficulty in obtaining a vacuum of 28 or 28½ in., but certainly they would lose enormously if they did not keep this vacuum.

Mr. SELBY BIGGE, in reply to Mr. Merz, said that 28½ in. was quite an ordinary vacuum, and that he had known cases where 29 in. had been reached. He agreed that it was very important to install a large enough condensing plant. With regard to his figures for costs, he would be sorry to advocate a scheme which would not show a return on the capital in three or four years. He had found the total costs to be always below 0·25d. with exhaust steam plant. The £9,000 quoted referred to an actual case, and was the exact figure for the total outlay.

Steam v. Electric Driving for Rolling Mills.

A Paper read by Mr. E. G. Sehmer and Dr. R. Drawe (Messrs. Ehrhardt & Sehmer, Saarbrücken) deals with the economies to be effected by the use of modern reversing steam engines for the driving of rolling mills, and includes a description of a new design of valve gear to obtain low steam consumption and rapid reversal. Results obtained with some engines fitted with this gear are compared with similar results for an ordinary rolling-mill engine, showing an economy of 50 per cent. The authors conclude that such an engine is much more economical than an electrically driven reversing mill. Further, they assert that whereas the high steam consumption of rolling-mill engines has led to the adoption of exhaust steam turbines in conjunction with the mill engines, the steam consumption of a mill engine is increased considerably by the interpolation of the exhaust turbine between it and the condenser, and that there is no economy effected.

Mr. A. LAMBERTON did not think that it was possible to effect the saving of 50 per cent. in steam consumption claimed. However, he agreed that driving by modern steam engines was more economical than by electric drive. With regard to the use of exhaust steam plant, the power obtained from the turbine might more than make up for the increased consumption of the mill engine, and it had been proved that the combination often effected great economy.

Mr. C. A. ABLETT (Siemens Bros. Dynamo Works) stated that the arrangement of valve gear described by the authors was a compromise between conflicting requirements, and that both to obtain economy and to avoid stalling involved a larger engine with a correspondingly higher capital cost. This was interesting when comparing electric drive, because it was well known that though electric drive required less power, the capital cost was higher than that of steam drive. To effect economy, it was necessary that the saving in power should more than pay the extra capital charges. The results given by the authors were very vague, and did not allow of strict comparison with electric drive. With an electrically driven reversing mill the energy consumption in rolling a 7-ton ingot measuring 34½ in. by 25 in. to ten times elongation would be 14-kilowatt-hours per ton, with an output of 65 tons per hour. Power from blast-furnace gas cost from 0·1d. and 0·2d. per unit, and would therefore amount to 2d. per ton rolled, as compared with Mr. Sehmer's figure of 4·375d. per ton for the cost of steam with a steam-driven mill. The electric mill therefore saved 2·375d. per ton, and, with an output of 4,000 tons per week, this was nearly £2,000 per annum. This would pay the capital charges on a greater difference of cost than actually existed between the steam and electrically driven mill. The latter would cost from £12,000 to £13,000. In the last twelve months ten or eleven contracts had, he said, been placed in Germany for large electrically driven reversing rolling mills. About twenty-four large electrically driven reversing rolling mill plants were either on order or at work on the Continent, while only four were on order or at work in England.

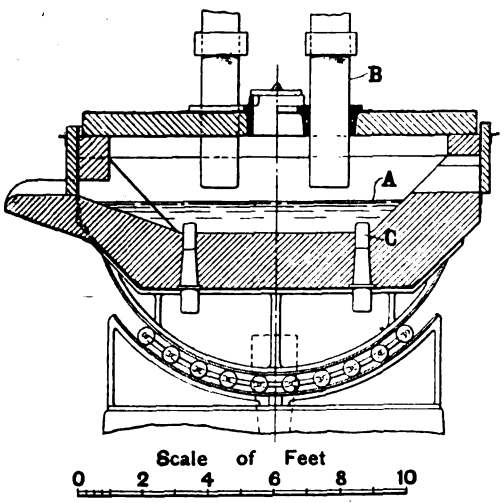
In reply, Mr. E. G. SEHMER stated that by employing the new design of steam rolling mill engine, a saving of over 60 per cent. could be effected in the steam consumption over that of the old type of engine.

The Girod Furnace.

A Paper by Dr. W. Borchers, of Aix-la-Chapelle, on the Girod electric furnace was taken as read. The author states that the Girod furnace is the simplest of modern electric steel furnaces. As shown in the illustration opposite of a 12½-ton furnace, it is a combination of a resistance and an arc furnace. The metal to be smelted *A* serves as one of the electrodes, and is covered by the refining slag as an electrolytic conductor, while carbon blocks *B*, introduced through the cover of the furnace, form the opposite electrodes. The arcs play between the carbon blocks and the slag, and the current flows from the slag to the metal, and through the metal to the electrodes *C*, of which there are several round the periphery of the furnace. These electrodes are of pure iron to avoid any deterioration of the charge, and are water-cooled. The molten metal is kept in constant motion, and this effects contact between the impurities of the iron and the refining slag. In the author's opinion, the advantages of the induction or transformer furnaces and of electrode furnaces are combined in the Girod furnace, while the imperfections of both forms have been overcome. When cold scrap is to be smelted, the upper electrode is lowered until it rests upon the scrap, and the current passes by means of numerous arcs through the scrap to the hearth-bottom. The heap breaks down simultaneously, and there is no necessity for stirring. For a 2-ton furnace the charge consists of 2,000 to 2,500 kilogrammes of iron scrap, and the first batch of flux usually consists of about 80 kilogrammes of lime and 220 to 250 kilogrammes of iron oxide in the form of ore, which, with the iron oxide on the scrap, serves

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as an oxidising agent. The smelting of the iron charge and of the first batch of flux requires 4½ to 5 hours. On the slag becoming exhausted, samples are taken to ascertain the degree of refining. A second, and if necessary a third, batch of lime and iron oxide is then introduced. After cleaning the surface, refining agents such as ferro-mangano-silicon, ferro-aluminium-silicon, and other alloys are added. For producing carbon steels an addition of Swedish charcoal iron can be made. The final step in the production of special steels is the addition of iron alloys with metals like nickel, tungsten, and chromium. The total duration of one smelting operation from the starting of the current to the casting of the finished product into ingots or moulds covers about eight hours, assuming that the raw material is not pure. The smaller of the two types of furnaces consume about 300 kilowatts A.-C. at about 60 to 65 volts. The larger furnaces require 1,000 to 1,200 kilowatts at 70 to 75 volts. Taking into account a loss of 10 to 11 per cent. of the charge by oxidation and evaporation, the power required to make one ton of steel in a small furnace is 900 to 1,000 kilowatt hours, and, in a large furnace, 800 to 900 kilowatt hours. The consumption of carbon electrodes amounts to 12 or 15 kilogrammes per ton of steel. The calcined dolomite furnace lining will withstand at least 80 charges. The bottom of the furnace will, however, stand 120 to 160 charges without repair.



Section of 12½-ton Girod Furnace.

With liquid charges the linings last longer; one furnace working in this manner was run for 200 charges without any repairs. The linings of the furnace covers require more frequent renewal. In the small furnaces they need repairs after 25 to 30 charges, and in the larger furnaces after 20 to 25 charges.

At the works of the Soc. Anon. Electrométallurgique Procédés Paul Girod at Ugine only scrap iron is used as raw material for steel-making as well as for the manufacture of iron-alloys; a high degree of refining is obtained. The cost of a 2½-ton furnace, including regulators, measuring instruments, tilting device mechanism, and cables, is about £600. A 12½-ton furnace with a similar outfit will cost about £1,200. The electrodes cost about four francs per ton. A complete plant with one 2½-ton furnace for regular running and one furnace for reserve, and with all appliances and melting-house, but without dynamo or transformer, will cost approximately £8,000 to £12,000; and a plant working with a large 12½-ton furnace, £12,000 to £16,000. At present the Ugine plant consists of nineteen furnaces aggregating 400 to 600 electrical h.p., and twelve new furnaces, of 1,200 electrical h.p. each, are being installed, some in a new works which will be devoted to steel manufacture. The old works will make only alloys. The company also owns an electrode factory, turning out 7 tons of carbons daily. The power-house for the old works contains ten Pelton-wheel turbo-sets, furnishing 8,000 to 9,000 electrical h.p.

A second power station provides a further 12,000 electrical h.p. Three-phase current is transmitted some 3 or 4 km. at 45,000 volts to Ugine, where it is transformed to 60 to 75 volts for the furnaces. Besides this, the works are obtaining 6,000 electrical h.p. from a power station at Bionnay, and 8,000 to 10,000 electrical h.p. from a power station at Veuthon. The plant in the new steel works consists of three 2-ton and two 12-ton furnaces. The steel is cast into large ladles worked by electric cranes, and run into ingots, which are sent to the rolling-mills. Steel castings (dynamo frames) up to 20 tons have been made.

Mr. J. H. Heap opened the discussion on this Paper, pointing out that the conditions in the Middlesbrough district were very favourable to electric steel furnaces. Ferro-alloys produced in the electric furnace were imported into this country, but electric power could be obtained here cheaper than that produced from water-power on the Continent. He was surprised that Dr. Borchers approved the Girod furnace, and further that he confined his Paper to the one type. The only special feature was the row of lower electrodes, and he thought this was a doubtful improvement. No arrangements were made to produce a good circulation, and this had been found to be necessary. He was surprised that Sheffield should be the first to adopt electric furnaces, as the conditions there were by no means favourable. They had not, he thought, selected the most suitable type.

Prof. J. O. Arnold (Sheffield University) said that in Sheffield they wanted a melting furnace and not a refining furnace, and had therefore selected the Kjellin type. All that concerned them was the relative capacities of the electric and the crucible furnaces. They used the finest Swedish iron, and its quality remained unchanged during melting.

Mr. F. W. Harbord was surprised that the author should state quite generally that the Girod furnace was the simplest. He thought that, as in large 200-ton furnaces they had no trouble with circulation, in the small sizes it could not be a matter of importance. The ordinary reactions produced a sufficient circulation. He suspected that there would be much trouble with the bottom electrodes.

Mr. D. F. Campbell compared the Girod furnace with the American Héroult furnaces. The figures in the Paper did not justify the statement that the Girod was the simplest. A 15-ton Héroult had three holes in the roof and a bottom as in the best open-hearth practice, but the 12½-ton Girod had four holes in the cover and 16 electrodes in the bottom. The latter were likely to be a source of trouble, as the steel might get under the layers of dolomite. In refining furnaces, the essential object was the slag reaction; there should be no trouble with the circulation. With the Héroult furnaces at South Chicago the bottom lining lasted 4,000 to 5,000 heats. The roof lasted 100 to 150 heats, and cost about 2d. per ton of steel produced. The heating period was six instead of eight hours. The consumption of a 15-ton furnace was 111 kw. hours for five heats, refining only, and 172 kw. hours for five heats with a more impure charge. With current at 0·3d. per unit refining should cost only 3s. 6d. to 4s. per ton when producing axle steel.

COMMITTEE FOR PROTECTION OF ELECTRICAL INTERESTS

At a meeting held last Friday at the Savoy Hotel—the Hon. Arthur Stanley, M.P., presiding—a committee was constituted with the object of endeavouring to secure united action, with a view to the protection and advancement of the commercial and legislative interests of the British electrical industries. The committee, which is limited to eighty members, consists of the following:—Messrs. Addenbrooke, Albright, A. B. Anderson, L. B. Atkinson, Baylor, Lt.-Col. Beddoes, H. R. Beeton, E. Bergtheil, Browett, J. C. Bull, Charrington, Conaty, Connett, Cownie, A. Dickinson, Dobson, Drake, Dykes, Eck, Elphinstone, Erskine, Esson, de Ferranti, Freeman, Garcke, Geipel, Glenn, Gripper, Hammond, Handcock, Hawtayne, Highfield, Hirst, F. Hope-Jones, E. M. Lacey, Lorrain, Lycett, Madgen, Morcom, Morse, W. C. Mountain, Murphy, Lee Murray, Nalder, Hon. C. A. Parsons, W. H. Patchell, Phipps, A. H. Preece, W. L. Preece, Rawlings, J. S. Raworth, Renwick, Rich, J. R. Salter, Seabrook, S. Sellon, A. M. Sillar, J. F. C. Snell, C. P. Sparks, Hon. A. Stanley, Statter, Campbell Swinton, W. A. Vignoles, F. J. Walker, H. L. Webb, Wetzler, Woodhouse, A. P. Wood, Foulds (Electrical Standardising, Testing and Training Institution), Gay (Associated Municipal Engineers of Greater London), Goodyer (Metropolitan Association of Electric Tramway Managers), L. G. Tate (Electrical Contractors' Association), de Turckheim (Incorporated Association of Electric Power Companies and Tramways and Light Railways Association), J. Glynn Williams (Institution of Mining Electrical Engineers), and R. Borlase Matthews (hon. sec.). The Electrical League and the Electrical Industrial Association of Great Britain will not now be proceeded with, and all subscriptions which have been received are being returned in full.

The George Montefiore Levi Prize.—A prize, to be known as the *Fondation George Montefiore Levi*, is offered triennially for international competition for the best original work on the scientific advance or the progress of the technical applications of electricity. The essays may be in French or English, and the regulations exclude what may be described as compilations or descriptions. The first prize will be awarded in 1911, and will amount to 20,000 francs. The awards will be made by a jury of twelve electrical engineers, six Belgian and six of other nationality, chosen from the holders of diplomas of the *Institut Electrotechnique Montefiore* of Liège, and including the director of that institution. Further particulars can be obtained from the Secretary, 31 Rue St.-Gilles, Liège.

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CORRESPONDENCE

OSRAM LAMPS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—As illustrating the increasing robustness of some forms of metallic filament lamps, your readers may be interested in the enclosed photograph. It shows two outside weather fittings of the General Electric Co.'s make, each equipped with one 100-c.p. 240-volt Osram lamp, and supported by ¾ in. gas-barrel brackets, erected by Mr. J. A. Allan, electrical contractor, Bellshill, for Mr. J. Hamilton, draper, Bellshill. As can be surmised from the photo, the spring attachment holding the sun-blind in position broke, and allowed the heavy blind, with the attached front-board, to fall with such force as to bend the brackets about six or seven inches in a downward direction and to shatter the front board. Notwithstanding the severe shock, the Osram lamps were undamaged, and were in use that same evening in the position shown. They are still in use, this making their sixth week, as they had been erected for about a month before this photo was taken at the beginning of last week.

When examined by Mr. J. Allan and myself on the day following the mishap, we were surprised to find that not only did the lamps light, but that the filaments were absolutely intact—we quite expected to find one or more loops broken off short and welded together—and that they were only slightly curved owing to having been in use in an inclined position.

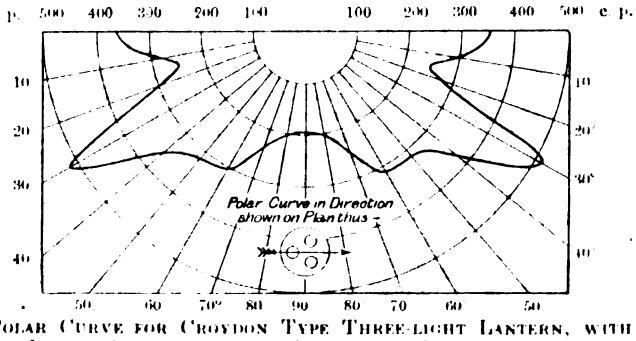
Yours truly,

Glasgow, May 2nd, 1910. P. FREDK. ALLAN.

STREET LIGHTING.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I note with interest that Mr. Cunliffe Owen, in your issue of May 5th, calls your attention to the excellent results obtained when lighting a street by means of 400-c.p. Osram lamps, and that you have had an opportunity of inspecting a lamp erected at the Bayswater Road end of Westbourne Terrace. While on this subject, it may interest you to know that nearly 300 grouped Osram lamps, each group consisting of three 100 c.p. lamps in one lantern, have been erected in the streets of Croydon. These lanterns are designed to take full advantage of the upper hemispherical rays by means of a large and correctly



POLAR CURVE FOR CROYDON TYPE THREE-LIGHT LANTERN, WITH LARGE SPHERICAL CLEAR GLOBE AND INSIDE AND OUTSIDE ENAMELLED REFLECTORS, THREE CLEAR 110-WATT SPHERICAL OSRAM LAMPS.

shaped reflector, which directs them to a useful angle, with the result that 300 watts give over 500 candle-power at the most important angles for street lighting purposes. This is clearly demonstrated by the profile curve submitted herewith. An inspection of these lamps will show the very excellent and even illumination which results.

11 Victoria Street, Westminster, May 9th, 1910. Yours faithfully, HAYDN HARRISON.

BOURNEMOUTH TRAMWAYS
Conduit System to be Abandoned

MR. C. HILL, the General Manager of the Bournemouth Corporation Tramways, has presented a report to his Corporation in favour of substituting the overhead trolley system for the conduit system, which is now in use in the narrow portions of the streets. The report, which has been adopted by the Corporation, has been prepared from financial considerations only. There is nothing amiss with the conduit system beyond the heavy cost of working, and unfortunately the tramway traffic of Bournemouth, up to the present, at any rate, has certainly not been sufficient to warrant the expense. The conduit system in the centre of Bournemouth was adopted purely for aesthetic reasons. In fact, there was bitter opposition to tramways in Bournemouth at all, and the conduit system was accepted as a sort of compromise. Having in mind that the opinions of the inhabitants have changed since those days, Mr. Hill points out that it will be cheaper to work on the overhead system, and that by so doing the tramways, within the next year or two, will show a small profit instead of a loss.

Mr. Hill, in his report, states that he is in a position to say that a saving of £3.000 per annum would be effected if the conduit were abandoned and the overhead construction substituted. In his opinion, the adoption of the side slot for Bournemouth was unfortunate owing to the tortuous nature of the route. Many of the present difficulties would not have arisen had the centre slot been adopted, and the cost of maintenance would certainly have been reduced. The cost of renewing the rails is causing a great deal of anxiety, not only for the present but for the future, as, even if all the rails are shortly renewed, a similar expenditure would have to be incurred again in the course of a few years' time. Further, the bogie trucks carrying the plough gear are beginning to show signs of fatigue, and will all shortly have to be braced up at a considerable cost. Another consideration of extreme importance is that without the plough gear on the cars the question of fitting mechanical attachments to the car brakes, concerning which there has been correspondence with the Board of Trade, becomes a simple one so far as the small cars are concerned, and even on the large ones it becomes possible. Mr. Hill, after mentioning the delay at the points of changing over from the trolley to conduit and *vice versa*, and the loss of traffic entailed thereby, estimates that the erection of overhead construction on the present conduit routes would cost £1.910, and that the saving in working would soon place the undertaking in a sound financial position. With regard to the conduit itself, this could be gradually filled up, and in the meantime would be cleaned out as usual, so that no difficulty would arise from a sanitary point of view. In conclusion, Mr. Hill expresses the opinion that the advantages to be derived by the changing over of the system, both to the travelling public and the department, outweigh any objections which might be raised from an aesthetic point of view.

THE WELSBACH COMPANY AND THE ELECTRICAL INDUSTRY

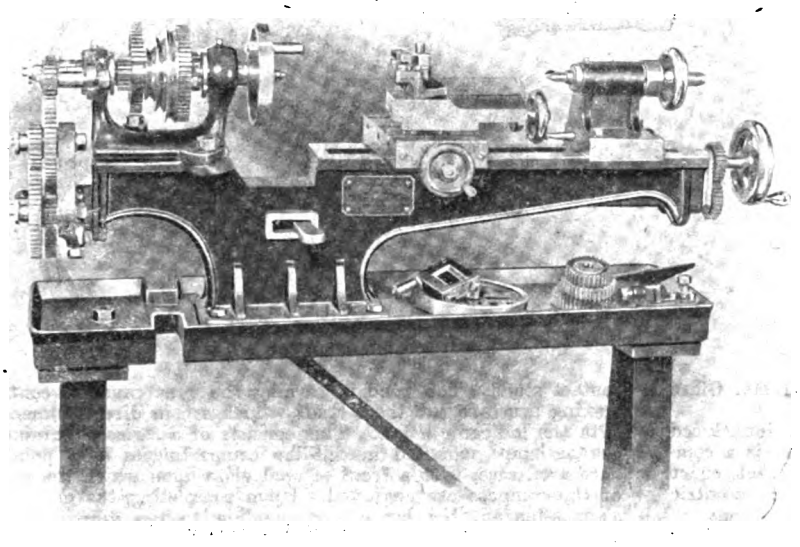
AT a noisy meeting of the shareholders of the Welsbach Incandescent Gas Light Co., Ltd., on Tuesday, the proposals of the directors for the drastic reduction of capital, referred to in our last issue, were postponed for twelve months. This course was adopted by the Board in view of the strong opposition by a number of large preference shareholders, although proxies for an overwhelming majority in favour of the scheme were held by the directors. The scheme provided for the conversion of 600.000 £1 preference shares into common stock having a value of 15s. each, and the reduction of 743,975 £1 ordinary shares to the value of 1s. 4d. each. The accounts for the year to March 31st show a net profit of £5.966, after meeting preference dividends.

The Rt. Hon. Lord Weardale, chairman of the company, presided, and considerable reference was made to the company's venture into the electrical business. The cost of the advertising campaign in this connection, placed by a member of the Shareholders' Committee which has been conferring with the board, at considerably in excess of £6.000, has shown practically no return, owing to the inability to obtain deliveries of the lamps, but a new contract has been entered into by which delivery is guaranteed. The Board have great faith in the possibility of profit for the electrical section, although several disappointed shareholders pointed out that the electrical industry is already in a bad way from over competition. It was interesting to hear the chairman confess that the poor result from the sale of gas mantles was due, in a considerable degree, to the competition of electricity, which, he said, had now invaded even the smallest house. Referring to the action taken by the General Electric Co. in the Clerkenwell Police Court in respect of the use of the trade mark "Aur" (which, by the way, cost the Welsbach Co. £1.000), Lord Weardale said the company were not going to be kept out of the great electrical market by futile litigation. During a discussion on the report and accounts, which were eventually adopted, it was stated that the cost of the electrical section last year had been met out of revenue, and not capital. A number of the shareholders complained that they were never able to obtain the company's goods, and one gentleman, who had been making inquiries amongst the trade, said that retailers would not stock because the terms offered were not so good as those to be obtained from other makers. The management was also blamed for extensive but injudicious advertising, but the meeting ended more or less in harmony on account of the board accepting the proposal to postpone the writing-down scheme until next year.

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A LATHE FOR THE ANTARCTIC EXPEDITION

WE have received from Messrs. Drummond Brothers, Ltd. (Churchill Works, near Guildford, Surrey), the accompanying illustration of a lathe which they have just supplied to Captain Scott's South Polar Expedition. The machine is one of their standard 3½-in. screw-cutting lathes, as usually supplied for motor-car repairing, fitted, at the request of the Expedition, with the same accessories as one recently supplied to H.M.S. *Swift*. Besides its use in connection with the motor sledge equipments, &c., this lathe, which we believe is the first to take part in a polar expedition, should be of welcome assistance in relieving the tedium of the long waits at the base. These lathes have several points of usefulness, among which are the following:—The slide-rest can be detached by undoing one nut, leaving a truly surfaced ⊥ slotted, self-acting sliding boring carriage, converting the lathe into a convenient boring machine. The headstock can be set over for small taper work to an exact angle, and is graduated for this purpose. The tail-stock can also be set over for long taper turning. When accurately set it remains true (until altered for taper), as it is accurately guided by and locked to the outside of the bed, instead of loosely fitting a slot. The lead-screw is central and close up to the saddle, and therefore has no twisting tendency and works easily. Quick return by hand can be made when cutting odd pitch-screws without chalking gear-wheels or the use of wood stops. It is speeded highly for small work and wood turning, and has low speed also for large work.



LATHE SUPPLIED BY MESSRS. DRUMMOND BROS. TO CAPTAIN SCOTT'S EXPEDITION.

Arc Works Engineering Society.—The annual meeting and conversazione of this society was held at Chelmsford last Friday, when it was announced that a first-class pupil's premium had been awarded to Mr. C. G. S. Willet for a Paper on electric heating and cooking. Messrs. F. Jackson and W. Peyton were bracketed for the First-class Apprentices' Premium for Papers on "Metal Cutting Tools" and "Metal Founding" respectively. These premiums were presented by Col. R. E. B. Crompton, who also gave a discourse on flight and aeroplanes. Lord Rayleigh, who was present, also made a few remarks.

Sir George Gibb.—The appointment of Sir George Gibb to the chairmanship of the new Road Board, which is being constituted under the Development and Road Improvement Funds Act, 1909, is announced. In consequence, Sir George will sever his connection with the Underground Electric Railways Co. of London, the Metropolitan District Railway, and the Baker Street & Waterloo, Great Northern & Piccadilly, and Charing Cross, Euston, & Hampstead Railway Companies. Sir George Gibb will also retire from the Board of the North-Eastern Railway Co. The directors of the Underground Electric Railways Co. of London have passed a resolution recording their regret at Sir George Gibb's retirement, and expressing their appreciation of the invaluable services rendered by him to the company.

OSRAM·LAMPS

From the Wiring Contractor's Point of View

SATISFACTORY arrangements have been made between the Electrical Contractors' Association and the Cable-Makers' Association for members of the former body to receive a rebate on the orders for C.M.A. cable placed during the past year, in spite of the fact that the sales did not reach the agreed amount of £100,000.

At Hull the electrical contractors are keeping a very close watch on the Corporation. It has been alleged that the Corporation are selling motors outright after hiring them to consumers. The local contractors have also apparently a grievance against the City Architect, who has been formally asked by the Hull Branch of the Electrical Contractors' Association not to include electrical items in contracts for decorations, furnishing, &c., and in specifying arc lamps and other electrical apparatus to specify the nature and size of the lamp without saying from whom they should be procured. The City Architect, remarks the Editor of the *Electrical Contractor*, evidently wishes to save poor overworked electrical contractors all unnecessary brain fag.

At the April meeting of the Hull Branch of the Association, the Honorary Secretary read a letter from the General Electric Co. *re* the sale of Osram lamps by Gamage's at lower than list prices. He was asked to thank the G.E. Co. for the steps they had taken. In connection with the action of Gamage's, we may say that we recently heard of a case in which a firm of lamp suppliers, who had been unable to obtain payment from a bankrupt creditor for certain lamps, actually found them being offered for sale by a large shop of this character in competition with the suppliers own lamps at a lower price.

Marylebone Borough Council appear to recognise the trade status of a contractor. A case recently occurred in which a consumer called in the Borough Council to remedy some defects in the installation, for which it appears that the contractor who originally carried out the work was liable. The consumer passed on the Borough Council's account to the contractor for payment, who then took the matter up with the Council's electricity department and obtained the ordinary trade rebate off the account.

There is an unfortunate dispute between the Dublin Electrical Contractors' Association and the Electrical Contractors' Association. It appears that the Dublin Branch of the Electrical Contractors' Association was dissolved in 1906, but a large number of the members formed a new association as a separate body. At a dinner of this new Association in Dublin last January, the chairman said that it was when they found that most of the money was going to England that they decided to start a branch of their own. Apparently the Electrical Contractors' Association has taken this up, and has reminded their Dublin friends that up to April, 1906, the branch was indebted to the Association to the extent of about £20, and they are pressing for payment.

Mr. E. T. Steinthal, a prominent north country member of the Electrical Contractors' Association, has recently gone out to Winnipeg, where, we learn, he has established a satisfactory business.

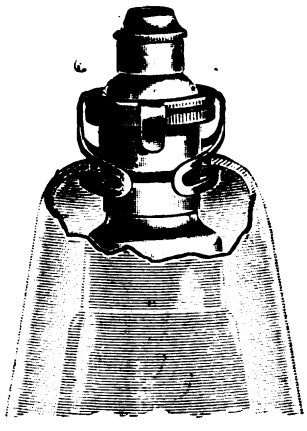
An average of 500 units per week have been consumed in a ten-roomed house near London during the past six months. In this house all the lighting, heating, and cooking is done by electricity. There have been radiators in use in every room practically throughout the winter, and the bath-water heating is done by a "Therol" heater. The house is occupied by a family of three adults and a child, and one servant. This consumption is regarded as satisfactory, when it is considered that no coal had been used and that much servant labour has been saved by the smaller amount of cleaning, not only in the house generally, but to the kitchen utensils, &c. Another advantage in the cooking is that there is a very great gain in efficiency over a coal fire, or even a gas stove, by the fact that the precise time for cooking any particular dish is always constant, and does not depend on the state of the fire or the pressure of the gas.

In connection with the overhauling, re-wiring, &c., of the electrical installation at the Marylebone Public Baths, the Electricity Committee have now offered to do the work at prime cost plus a small percentage for supervision. If this is not accepted, they regret they will be unable to comply with the request for Mr. Seabrook, the General Manager, to prepare a specification upon which tenders could be invited. The General Manager stated that the job is a complicated one, and that he would prefer to do the work himself rather than take the responsibility of supervising a contractor. Under these circumstances the Baths Committee have requested their chairman to give notice of a motion in the Council to the effect that the Electric Supply Committee be permitted to carry out the work at prime cost plus a small percentage for supervision.

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THE QUARTERLY GENERAL ELECTRIC PROGRESS SHEET

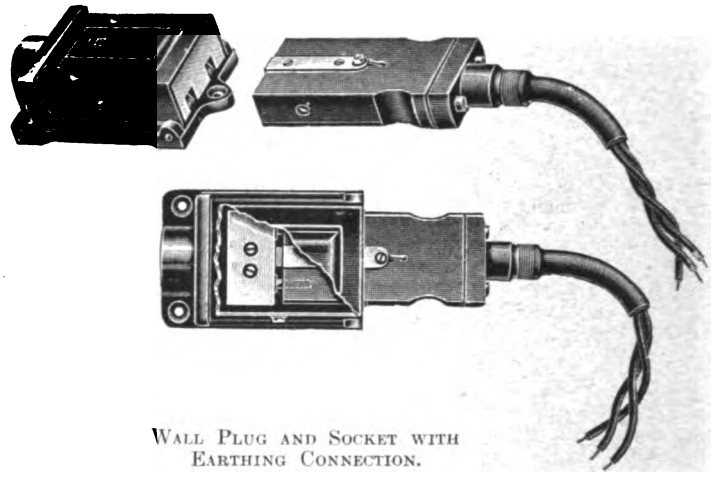
THE May issue of the "*General*" *Electrical Progress*, dealing with the past quarter, contains a description of some feeder pillars which the General Electric Co. (67 Queen Victoria Street, London, E.C.) have recently supplied to India (see ELECTRICAL ENGINEERING, February 10th, page 97), and describes recent patterns of stage and cinematograph arc lamps, &c., vacuum cleaners, reflectors, heating appliances, Aron meters, shade carriers, and a special series of lampholders, wall plugs, &c., with earthing terminals to comply with the Home Office Regulations.



NEW SHADE HOLDER FOR DEEP SHADES.

A convenient piece of apparatus which has been introduced for use with alternating-current cinematograph lamps is a combined transformer and choking coil, arranged so that exact adjustments can be made on the choking coil by an eccentric lever arrangement without altering any electrical connections.

We illustrate here a new shade carrier specially adapted for use with the deep shades which metal filament lamps necessitate. No shade ring pliers being required—the carrier clipping over the top cap and dome of the lampholder—it provides a ready and very simple means of fixing the shade, which can be hung quite rigid and more quickly than when the ordinary screwed shade ring is used. One of the forms of plug with earthing connection referred to above is also illustrated. This is so arranged that the earth connection is made first and broken last, an essential feature of the new requirements. Among other items dealt with is a wind-direction indicator suitable for clubs, hotels, &c. The vane mounted on the roof is provided with a staff at the base of which is a hollow box containing a series of contact studs. The wind in turning the vane causes a contact-making brush to rub these studs, which are in direct connection with the indicator below. This consists of a series of miniature Osram lamps mounted in cell-like compartments in a polished hardwood case, with a front of opal glass upon which the points of the compass are engraved. Upon completing the circuit by a push-button, the lamp corresponding to the direction from which the wind is blowing is illuminated.



WALL PLUG AND SOCKET WITH EARTHING CONNECTION.

The list contains descriptions and prices of other new accessories, and, as there will doubtless be a great demand for it in the retail trade, any of our readers desiring copies should make early application to the company.

LOCAL NOTES

ASTON: *Electricity Profits.*—The net profits on the electrical undertaking for the year to March 31st amounted to £4,694, against £2,941 in the previous year. It is proposed to place £2,000 to a reserve fund, and to hand over £2,600 in aid of the rates.

BATH: *Trunk Telephone Communication.*—In answer to a communication from the local Chamber of Commerce, as to inefficiency in the trunk telephone service to South Wales, the Postmaster-General is unable to find any evidence of this. He points out that two new trunk lines have been recently provided between Bristol and Cardiff, and one between Bristol and Newport, and four additional Bristol—Cardiff circuits are in course of construction. The extensions will, it is expected, materially improve the service to South Wales.

BEXLEY: *Inaccurate Tramway Meters.*—The Electrical Engineer reports his belief that the B.T.-H. meters used for measuring the tramway energy are reading inaccurately. The three meters are to be tested *in situ* by the London County Council.

BLACKBURN: *Tramway and Electricity Profits.*—*The* accounts of the Tramways Department show a profit of £453 for 1909–10, against a loss of £4,803 in the previous year. There was a net profit, after meeting capital charges of £1,388 upon the electricity undertaking. This has been placed to reserve.

BLACKPOOL: *Electricity and Tramway Profits.*—The net profit on the electricity undertaking last year was £6,500, and on the tramways undertaking £9,430.

DUBLIN: *Electricity Deficit.*—A ratepayer having objected to the inclusion in the rates of a sum of £4,000, part of the loss on the electricity undertaking, the Town Clerk has taken counsel's opinion, and is advised that the Corporation is entitled to include this sum in the rates.

HARROGATE: *Street Electric Lighting.*—The Council have unanimously passed the Electrical Engineer's scheme for an additional 500 lamps to be converted from gas to electricity. Competitive schemes have been submitted by both the gas and electricity undertakings, and the saving by substituting electricity was found to be a very substantial one. The cost per post to be charged to the Lighting Committee for a 50-c.p. lamp, including renewals and all accessories, is 17*s.* per annum, the lamp being extinguished at midnight.

LONDON: *Bethnal Green.*—A recommendation by the Electricity Committee that a supply of electrical energy in bulk should be taken from the Shoreditch Council was discussed at the last meeting of the Council. On an estimated annual consumption of 300,000 units, the total costs were put at £2,952, and, after meeting the amount payable to the Shoreditch Council, a profit of £48 was looked to in the first year. Repairs to mains were estimated to cost £50 a year; financial management, collections, books, stationery, &c., £150; rates, taxes, and insurance, £120; and capital charges, £1,119. Some discussion took place upon the proposition during which exception was taken to the estimate of £50 per annum for repairs to mains worth £25,000, and that the charge for financial management was much too small. The Council decided in favour of the principle of the proposal, but referred to report back for further consideration of details by the Electricity Committee.

MIDDLESBROUGH: *Electricity Profits.*—The net profit upon the electricity undertaking for the past year amounted to £1,301, against £1,277 in the previous year. The number of consumers increased by 144.

MORLEY: *Electricity Accounts.*—The accounts of the Electricity Department for 1909–10, after meeting all capital charges, show a deficit of £792, against £1,799 in the previous year.

NEWCASTLE-ON-TYNE: *Trolley Omnibus.*—It is probable that the Corporation will promote a Bill next session in which powers will be sought for tramway extension, with authority to use trolley omnibuses.

RIO DE JANEIRO: *Electric Supply Concession.*—A *Central News* cable from New York states that the Brazilian High Court of Justice has issued an injunction against the Companhia Brazileira de Energia Electrica, restraining that company from exercising a concession to supply electric light and power for a period of ninety years, in competition with the Rio de Janeiro Tramway, Light, & Power Co. The Court holds that the latter company has the exclusive concession for the purposes mentioned.

ROTHERHAM: *Electricity Profits.*—The Electric Light Committee have come to the rescue of the Finance Committee, who have found themselves with a big deficit, by voting £2,000 out of the profits of the electrical undertaking.

WARRINGTON: *Electricity and Tramway Profits.*—The net profit on the electricity undertaking for the past year amounted to £1,697, against £943 for the previous year, and on the

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tramways undertaking £2,750, against £2,307 for the previous year.

WEDNESBURY: *Electricity Accounts.*—The electricity undertaking showed a profit last year for the first time, there being a balance of £142, after meeting capital charges.

WEST HARTLEPOOL: *Electricity Accounts.*—After meeting capital charges, the electricity accounts for 1909-10 show a net profit of £1,128, which is to be added to reserve.

Proposed Tramway Purchase.—The Hartlepools Electric Tramway Co. have, in order to avoid arbitration, offered to accept £22,000 for the sections of their undertaking, concerning which the Council have given notice of purchase.

WIGAN: *Electric Supply Accounts.*—There was a profit on Wigan electricity works of £3,952 for the past year, to which was added the sum of £1,472 brought forward from the previous year, giving a total of £5,424. Of this there has been transferred to capital account as ordered by the Local Government Board a short time ago, the sum of £4,472, add to which is the loss on Pemberton, £1,746, making £6,218. There was therefore a deficit of £794 on the year's working.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

CANADA.—The Winnipeg Board of Control require tenders by May 16th for transformers and switchgear. This information is only of value to firms having agents in Canada, whom they can instruct by cable.

COLCHESTER.—An inquiry has been held into an application by the Council for a loan of £8,000 for mains and house services.

DARLINGTON.—A loan of £1,500 for extensions to the condensing plant at the electricity works is to be applied for.

DERBY.—A loan of £9,850 for a motor-generator, mains, services, meters, &c., is to be applied for.

DUBLIN.—A loan of £76,320 has been taken up with the Liverpool Victoria Legal Friendly Society by the Electricity Committee.

GRIMSBY.—A loan of £6,459 for electrical purposes has been sanctioned.

HECKMONDWIKE.—A loan of £24,159 is to be applied for. Of this, however, £19,959 represents excess expenditure over existing borrowing powers. The additional capital is required for condensing plant, cable, and services.

IRELAND.—The Monaghan Council have adopted an electric lighting scheme, prepared by Messrs. Curran Bros., of Belfast.

LEICESTER.—A 750-kw. mixed pressure turbo-generating set, condensing plant, switchboard, boilers, &c., are required by the Tramway Committee. Particulars from the Tramway Engineer, and tenders by May 25th.

LONDON: *Southwark.*—An exhaust steam turbine, condensing plant, cooling tower, and switchgear is to be installed at an estimated cost of £6,909.

NETHERLANDS.—Plans and specifications are being drawn up for electricity generating stations in the towns of Deventer and Zwolle, in the province of Overijssel.

NEWPORT (MON.).—Two 400-kw. motor-generators (three-phase to direct current), one 600-kw. motor-generator (three-phase to single-phase), and a three-wire booster are required by the Corporation. (See an advertisement an another page.)

ROCHDALE.—The Corporation require battery accumulators, reversible booster, and switchboard panels. Particulars from the Borough Electrical Engineer, and tenders by May 25th.

WALLASEY.—The Council require tenders by May 30th for two years' supply of alternating-current transformers.

WEST BROMWICH.—A new turbo-generator is to be installed. New mains are also to be laid.

WEYMOUTH.—An inquiry was held last week concerning a loan of £1,970 for mains and mechanical stokers. There was little opposition.

YORK.—A loan of £1,500 is to be applied for to extend the condensing plant at the electricity works.

Miscellaneous

BIRKDALE.—Additional street electric lighting is to be put in hand.

CLACTON.—The Council invite tenders for electrical service fittings, and joint box compound. Particulars from the Clerk, and tenders by May 23rd.

HANDSWORTH.—A loan of £19,150 has been granted in connection with the purchase of the cable tramways, and their reconstruction for electric traction.

LONDON: *St. Pancras.*—The Council require 21 flame arc lamps with 20 suitable cradles. (See an advertisement on another page.)

URUGUAY.—The Ministry of the Interior has granted to Don Antonio Rossi a concession for the establishment of a telephone service at Villa del Carmelo (Colonia).

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

S.E.—Cinematograph theatre, Ventry Place, Walworth Road. Architects, Gilbert & Constanduros, 43 Finsbury Square, E.C.

Public slaughterhouses, Deptford, S.E. (£20,000). F. Summer, Engineer, City of London Corporation, Guildhall, E.C.

W.C.—Nurses' home at Holborn Workhouse (£2,500). A. S. Snell, 32 Southampton Buildings, Chancery Lane, W.C.

PROVINCES.

BECKENHAM.—The Council invite tenders for the electric wiring of houses in their district. Particulars from the Borough Electrical Engineer, and tenders by May 23rd.

BIRMINGHAM.—Factory, Edward Street. Builders, Sapcote & Sons, Camden Street.

Factory, Regent Place. Builders, G. Webb & Son, Soho Hill.

CANTERBURY.—Extensions, School of Art (£2,453). Builder, C. Mount, Canterbury.

COLWYN BAY.—Pavilion (£1,200). Builders, Woodhouse & Co., Nottingham.

CROYDON.—Tenders are invited for the wiring of the two isolation pavilions and additions to the administrative block of the Borough Hospital. Particulars from the Town Clerk, and tenders by May 26th.

DERBY.—Nurses' Home. Builders, Ford & Sons, Summer Hill, Derby.

DONCASTER.—Technical institute. Schofield & Berry, architects, 61 Albion Street, Leeds.

DUMFRIES.—Crichton Royal Institution (£12,000). Architects, Mitchell & Wilson, 13 Young Street, Edinburgh.

GATESHEAD.—Police station (£3,000). Architects, Fenwick & Watson, Pearl Buildings, Newcastle.

MIDDLESBROUGH.—Reconstruction of markets (£25,000). S. E. Burgess, Borough Surveyor, Town Hall, Middlesbrough.

PONTYPOOL.—Bank, Crane Street, for the London, City & Midland Bank.

SHEFFIELD.—Baths, Corporation Street (£7,250). City Architect, Town Council.

TENDERS RECEIVED AND ACCEPTED

DUBLIN.—Messrs. R. Waygood & Co., Ltd., who have already installed their automatic push-button lifts in Buckingham Palace and Marlborough House, have just received the order to fit a similar lift in the Viceregal Lodge, Phœnix Park, Dublin, for the use of his Excellency the Lord Lieutenant.

EDINBURGH.—The tender of the Lahmeyer Electrical Co., Ltd., has been accepted for the supply of cable for one year at £5,866. Complaint was made at the last Council meeting that a British tender had not been accepted, but it was pointed out that the lowest British tender was £600 more than the accepted one.

GLOUCESTER.—The tender of Messrs. Geipel & Co. for the supply of carbons at £112 (the lowest) has been accepted.

LONDON: *Bermondsey.*—The Council have accepted the following tenders:—Meters, British Thomson-Houston Co., Ltd., and Ferranti, Ltd.; demand indicators, Reason Manufacturing Co., Ltd.; cut-outs, General Electric Co., Ltd.

St. Pancras.—The Council have received the following tenders for arc lamp carbons:—Sloan Electrical Co. (accepted), £687 15s.; William Geipel & Co., £744; H. G. Mayer & Co., £756; Crompton & Co., Ltd., £763 15s.; Ship Carbons, Ltd., £774 10s.; G. Baulik, £813 15s.; General Electric Co., Ltd., £922 18s.; Siemens Bros., Ltd., £1,279 8s. 11d.; Sirius-Werke, £1,386; Johnson & Phillips, Ltd., £777.

SALFORD.—The Council have accepted the following tenders:—Circuit breakers, Cowans, Ltd.; switches and cut-outs, Electrical Co., Ltd.; bitumen cables and bare copper stranded wire, W. T. Glover & Co., Ltd.; copper fuse wire and white tape, Johnson & Phillips, Ltd.; high- and low-speed motors, ½ to 7½ h.p., Verity's, Ltd., and General Electric Co., Ltd.; 10 to 15 h.p., Electric Construction Co., Ltd.; 20 to 50 h.p., Lancashire Dynamo & Motor Co., Ltd.

MANCHESTER.—The Electricity Committee have accepted the tender of a Milan firm for low-tension house-service cable. The chairman of the Electricity Committee said this tender had been accepted in view of the combination of English cable-makers to keep up prices. In the present case there would be a saving of £158.

WALTHAMSTOW.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E., has been accepted by the Council for the supply of "tantalum" lamps.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. per ton. (Last week, £57 15s. to £58 5s.)

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—A meeting of creditors of the late Mr. F. H. Medhurst, Electrical Engineer, 13 Victoria Street, London, was held last week. The claims amounted to £117,309, including: Lord Armstrong, £53,642; P. Saunders, £37,420; Earl of Verulam, £1,700; Viscount Grimston, £8,534; and Capt. H. J. de la Condamine, £2,150. The assets are said to consist of shares in various companies. Messrs. F. S. Salaman and F. W. Pixley were appointed trustees.

A meeting of the Himalaya Electric Railway, Ltd., will be held at 28 Chapel Street, Liverpool, on June 10th, at 11.30 a.m. to hear the liquidator's account of the winding up.

BUFFOLINE GEARS.—Messrs. Davies & Ransome, Caxton House, Westminster, London, have been appointed sole agents in London and the south of England for the Buffoline Noiseless Gear Co., of Levenshulme, Manchester.

DISSOLUTIONS OF PARTNERSHIP.—Messrs. Morgan Williams & Couzens, consulting electrical engineers, 39 Victoria Street, London, are dissolving partnership. Mr. H. W. Couzens will continue.

F. B. Hellon and H. P. Twyerner, electricians, 57 Moorfields, Liverpool, have dissolved partnership. The former continues.

MESSRS. VERITY'S GLASGOW BRANCH.—Our Glasgow correspondent writes that a great deal of surprise was expressed when it became known throughout electrical circles in Glasgow that the above firm had suddenly decided to close their warehouse and showrooms in this city and to maintain only a comparatively small branch office. The present staff numbers somewhere about twenty to twenty-two persons, we believe, and a good deal of sympathy is felt for those members of the staff who are not to remain on at Glasgow or to be transferred. The new office is to only have a staff of some four people, under the direction of Mr. Andrews, the present manager.

ELECTRICAL FOOTBALL LEAGUE.—The annual general meeting will be held on May 18th at the offices of the St. James' & Pall Mall Electric Supply Co., 19 Carnaby Street, Golden Square, W. All football clubs attached to firms in the electrical trade within fifteen miles' radius of Charing Cross are invited to send two representatives, as the Council are anxious to increase the number of clubs. Full particulars of the League can be had from the Hon. Secretary, Mr. H. W. Roberts, 71 Queen Victoria Street, E.C.

COMPANIES' MEETINGS AND REPORTS

JOHNSON & PHILLIPS.—The accounts for 1909 show a gross profit of £16,040, after charging £3,691 for maintenance of buildings, plant, &c. Directors' fees, debenture stock interest, debenture sinking fund reserve, and second debenture interest absorb £15,098, and the balance of £942 is carried forward. The gross profit exceeds that of the previous year by £5,322.

URBAN ELECTRIC SUPPLY CO.—At the meeting on May 4th, Mr. P. D. Tuckett pointed out that a moderate writing down of capital would be necessary if an early resumption of dividend was to be made. He foreshadowed a new agreement with Edmundson's Electricity Corporation.

BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO.—Mr. J. A. Bryce, the chairman of the company, presided at the annual meeting on Monday, and said there were distinct signs of improvement in the electrical industry. During a time of keen competition, the company were specially handicapped by having works much too large for the amount of business available, and their only policy was to carefully foster economy in all departments. He thought it was a satisfactory feature in the accounts that there was a difference of over £17,000 to the good compared with 1908. Mr. J. A. Lange, Works Manager, has been elected to a seat on the Board.

CARLISLE TRAMWAYS CO.—A circular has been issued to the shareholders, pointing out the very depressed condition of the company's business, and recommending that an offer for the purchase of the undertaking at £7,000, subject to the debenture holding of £41,000, be accepted. If the proposal is carried out, the ordinary £1 shares will be purchased at 2s. 2d. each.

DIVIDENDS ANNOUNCED. Eastern Telegraph Co., final dividend making 7 per cent. for the year on the ordinary shares.—Eastern Extension, Australasia & China Telegraph Co., final dividend on the ordinary shares making 7 per cent. for the year. West African Telegraph Co., final dividend on the ordinary shares making 4 per cent. for the year.—Callenders Cable & Construction Co., 10 per cent., with a bonus of 5s. per share.

The Royal Society.—Prof. B. Hopkinson and Mr. F. Soddy have been elected Fellows of the Royal Society.

APPOINTMENTS AND PERSONAL NOTES

The short list of candidates for the post of Borough Electrical Engineer at Torquay, in succession to the late Mr. P. Storey, was as follows:—Messrs. A. W. Clegg (Accrington); J. M. Keenan (Torquay); J. W. Turner (Huddersfield); B. S. Hornby (Bolton); C. N. Hefford (Leeds); and S. W. Salt (Bradford). The choice of the Electricity Committee fell upon Mr. Salt, Chief Assistant at Bradford, and this has been confirmed by the Council.

At the last meeting of the Acton Electricity Committee, it was decided to request Mr. J. M. Blair, the Borough Electrical Engineer, to resign. When the proposal came before the Council, however, it was negatived by 12 votes to 9.

It is with great regret that we hear of the resignation through ill-health of Mr. V. A. H. McCowen, chief electrical engineer to the Salford Corporation. The Salford Electricity Committee have placed on record their appreciation of Mr. McCowen's valuable services to the Corporation and the ratepayers, and wish him a speedy recovery. A successor is to be advertised for at a salary of £700 per annum, rising to £800.

The St. Pancras Electricity Committee has promoted Mr. G. T. Rawson, second clerk, to the position of first clerk, at a salary of £150, increasing annually by £10 to £200.

Mr. H. C. Quinn, of the Bristol Tramways & Carriage Co., has been appointed Assistant Superintendent of the Bombay Tramways Co.

The late Mr. Frank Dawes, a director of the Underground Electric Railways Co. of London, who died on April 5th, left £51,469.

A draughtsman is wanted with experience in electrical starters, controllers, and other switchgear. (See an advertisement on another page.)

Telegraph Traffic.—The route between Bagdad and Bassorah was restored on the 3rd inst., while communication between Mozambique and Majunga, and between Madagascar and the Island of Réunion, was down on the same day. The cables between Souakim and Djedda and Bonny Duala broke on the 6th inst., and May 9th saw the failure of communication between Saigon and Bangkok, traffic being sent *via* Pakse Obone with delay. The Saigon-Bangkok route was again restored on the 9th inst. The Madagascar—Réunion Cable was restored on the 10th inst.

Advertising Electricity in London.—The Electric Supply Publicity Committee of London and District, whose show-card and poster advertising the advantages of electric lighting have already been referred to in these columns, has now issued similar advertisements illustrating electric ironing. The poster (40 in. by 25 in.) is lithographed in five colours, and the show-card (15 in. by 20 in.) is of identical design and colouring. An illustrated four-page folder touching on the various domestic uses of electric power, and a tastefully coloured post-card illustrating electric ironing have also been designed.

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A NEW ALTERNATING CURRENT INSTRUMENT

A NEW aperiodic millivolt and amperemeter which can be used either for continuous or alternating currents, is being put on the market in this country by Messrs. Isenthal & Co. (85 Mortimer-street, W.). The instrument itself is of the ordinary moving coil permanent magnet type, with shunts for current measurement and resistances for voltage measurement, and is made suitable for alternating as well as continuous current by the following ingenious arrangement.

The moving coil is placed across two opposite corners of a Wheatstone bridge, of which the four branches are built up of thermo-elements, in the manner shown in the figure. The two other corners of the bridge are connected to the two terminals of the instrument, so that the current to be measured, directly traverses the thermo-elements, and thus heats them. The

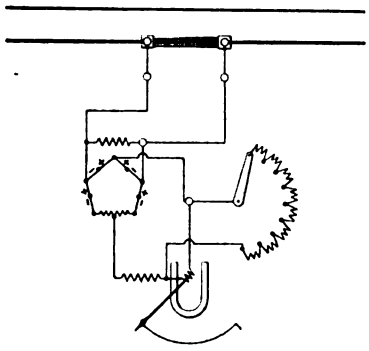


Diagram of Connections.

thermo-elements are placed in series in the two lateral branches from the connecting points to the moving coil, and they are paralleled in these points so that the moving coil is traversed by the thermo current of two paralleled groups of thermo-elements in series. By means of suitably arranged compensating resistances, the branches of the bridge are so adjusted that it is impossible for any part of the thermo current to enter the outer leads or for any branch current to be measured to enter the thermo-elements. An adjustment for the temperature of the atmosphere is provided.

This arrangement renders all the advantages of the moving coil permanent magnet instrument available for alternating as well as continuous currents. It is not affected by periodicity or wave form, and is, of course, independent of the effects of stray fields.

BOOK REVIEWED

Manual of Electrical Undertakings and Directory of Officials, 1910. Compiled by E. Garcke. Fourteenth Edition. 1,774 pp. 8½ in. by 5½ in. (London: *Electrical Press.*) 21s.

The fourteenth annual edition of Garcke's Manual, recently published, contains statistical and general information relating to about 3,000 electrical undertakings. When it is pointed out that the first edition, published in October, 1896, contained particulars of only 200 undertakings, the enormous growth of the electrical industry—and consequently the value of the Manual—will be appreciated. But the Manual does something more than bring together available and scattered information in a concentrated form; it supplies information which is not obtainable in any other publication, and must not be regarded as in any way clashing with the electrical directories. A valuable feature is a list of members of the principal Electric Lighting and Tramway Committees, with their addresses; whilst a new departure has been made in a directory of electrical contractors, in which the special business of each firm is indicated where possible. As a record, compiled from official sources, of all electrical companies formed under the Joint Stock Acts, of all electrical undertakings belonging to local authorities in Great Britain and Ireland, and of electrical undertakings in the Colonies and all British Possessions, Garcke's Manual is unique, and is unapproached by any other publication relating to the electrical industry. It consists of 1,774 pages, and not the least valuable portion is the special series of over 60 maps relating to tramways and electric power undertakings. A map is also reproduced showing the routes of underground telegraph lines in the United Kingdom.

Asbestos-Covered Wire for Tramcar Controllers and Motor Starters.—At the offices of the Concordia Electric Wire Co., Ltd. (Crown Parade, Cricklewood Lane, N.W.), we were recently shown some asbestos-covered wire, which appears to be extremely suitable for tram-controller connections and motor starters. The asbestos covering presents a smooth and compact surface, which is fairly hard, and it does not disintegrate or become loose even when exposed to very high temperatures.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

GEARS.—We have received a folder, having written on the cover, "Have you heard of us?" On opening this we are met by the word "No," and then "Why?" and on unfolding the sheet inside, the answer appears, "Because we are noiseless." This refers to the gears of the Buffoline Noiseless Gear Co., Ltd. (Levenshulme, Manchester).

TELEPHONES.—A new catalogue from the Sterling Telephone & Electric Co., Ltd., 200 Upper Thames Street, E.C., describes the Sterling common battery automatic intercommunication system, in which one common battery supplies the ringing and speaking current for the entire system. The instruments are made with radial or multiple lever selector switches. A special cell, known as the Invicta sac cell, with specially low resistance and large capacity, is listed for use with these telephones, and a multiple cable, with two extra heavy conductors, for the battery lines, is also included in the list, with various accessories.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

STEAM TURBINES.—The construction of the Oerlikon mixed pressure steam turbine is dealt with in a new leaflet issued by the British Department of the Maschinenfabrik Oerlikon (34–35 Oswaldestre House, Norfolk Street, Strand, W.C.). The special feature of this turbine lies in the fact that the exhaust or low-pressure steam works in two separate low-pressure turbine sections, one of which is directly connected in series with a high-pressure turbine the moment the machine is to run with live steam alone.

FLEXIBLE CABLES WITH EARTHED CORE.—A leaflet from Messrs. W. T. Henleys Telegraph Works Co., Ltd., describes several types of twin flexible cables, provided with earthing cores to meet the requirements of the Home Office Regulations for factories and workshops.

CARS FOR LIFTS.—Particulars of a number of handsome designs for lift cars, both in wood and iron, are given in a new catalogue from Messrs. A. & P. Steven (Thanet House, 231–232 Strand, W.C.). Some views are also included of the company's works at Glasgow, where these are made.

TECHNICAL BOOKS.—The latest catalogue of new books and new editions added to Messrs. H. K. Lewis & Co.'s Medical and Scientific Circulating Library, 136 Gower Street, W.C., contains a number of works on electrical engineering and science.

COMMUTATING-POLE MACHINES.—Messrs. T. W. Broadbent, Ltd. (Victoria Electrical Works, Huddersfield), are issuing an illustrated leaflet calling attention to the fact that they have modified the design of their standard 440 volt-460 volt D.C. machines, and are now fitting them, both motors and generators, with commutating poles. This ensures large overload capacity and sparkless running with fixed brush position. The machines have some interesting features. In the larger sizes, longitudinal ventilating ducts are carried right through the commutator.

GOVERNORS.—A catalogue from Messrs. Jens Orten-Böving & Co. (9½ Union Court, Old Broad Street, E.C.), gives full particulars of the Jahns combined centrifugal and inertia governor. This apparatus is made for every class of engine, and the weights, springs, &c., are entirely enclosed. A very high degree of sensitiveness is claimed with the slightest trace of instability.

THE SIEMENS WOOLWICH AND DALSTON WORKS.—We have received from Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster), a copiously illustrated book describing these two works. The Woolwich Works was established in 1864, and until 1905 was the headquarters of the dynamo, motor, and heavy electrical engineering branches of the business, as well as the submarine and other cables, telegraph, and apparatus department, &c. The dynamo work was however, transferred to Stafford in 1905, but not only were the shops thus vacated immediately filled by the cable department, but considerable extensions were required as well, including new battery and insulator shops, &c. A glance through the illustrations gives a good idea of the variety of the work and the large scale on which it is carried out, and the views of the various telephone and lead cable shops, as well as of the instrument adjusting, testing, and calibrating rooms, are of particular interest. The railway signalling department also has its manufacturing headquarters here. The works at Tyssen Street, Dalston, was established for the manufacture in this country of tantalum lamps, and the book follows through the various stages of the preparation of bulbs, mounting of the filaments, and exhausting, finishing, and testing of the lamps. Messrs. Siemens' customers and, indeed, many others will find much of interest in this book.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published May 5th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

5,891/09. **Wiring Fittings.** J. J. RAWLINGS, H. W. HANCOCK, and A. H. DYKES. A clip for fixing cables or wiring conduit consists of a saddle of resilient metal with a long lug arched over on itself. Opposite holes are made in the upper and lower portions for the nail. The lug is thus put in compression. There is less risk of damaging the conductor when hammering in the nail, as the head is on a level with the saddle. A bridging piece for several conductors is also described. Three claims, eleven figures.

8,979/09. **Earthing Switch for Three-phase Generators in Parallel.** BRITISH THOMSON-HOUSTON CO., LTD., E. B. WEDMORE, and J. WITCHER. When three-phase alternators are running in parallel, it is usual to earth the neutral of only one, in order to avoid circulating currents due to the third and ninth harmonics. According to this invention, double-throw switches, mechanically operated by the main switches, are interposed between the neutrals and the earth connection, and so interconnected that only one machine is earthed at a time. If this particular machine is switched out, one of the other machines is earthed automatically without breaking the earth connection. In an alternative arrangement the earthing switches are operated electrically by solenoids controlled by auxiliary contacts on the main switches. Nine claims, four figures.

9,318/09. **Lamp Globe and Reflector.** S. HORVATH. A spheroidal, shaped glass globe, silvered at the back and adapted for use with a tubular incandescent lamp. (See ELECTRICAL ENGINEERING, Vol. V., p. 631.) Two claims, four figures.

16,476/09. **Centrifugal Fan.** ALLDAYS & ONIONS PNEUMATIC ENGINEERING CO., LTD., and E. L. JOSELIN. A two-part centrifugal fan casing is fixed to the driving motor bedplate by means of a ring-shaped bracket, the central hole of which coincides with the inlet aperture of the fan casing. The bracket is either integral with the motor bedplate or has a foot for bolting to it. Three claims, three figures.

17,368/09. **Telephone Transmitter.** F. GOTTSCHALK. The effect of the sound waves on the diaphragm is intensified by focussing them at the centre. This is accomplished by attaching a cup-shaped device to the centre of the diaphragm, the concave surface facing the aperture in the mouthpiece. The cup also protects the diaphragm from dust and moisture. A microphone contact consisting of a small asbestos chamber, with partitions filled with carbon granules, is also described. Four claims, five figures.

17,389/09. **Ships' Course Recorder.** W. H. HENNAH and A. K. W. RISSEL. The movements of a compass card are caused to vary the current in a circuit which includes an electromagnetically controlled clockwork mechanism. The latter records the variations of the compass. Five claims, two figures.

19,209/09. **Indicating Fuses.** BRITISH THOMSON-HOUSTON CO., LTD. (*General Electric Co., U.S.A.*). The fuse is enclosed in a fibre cartridge, and an auxiliary fine wire fuse in parallel with the main fuse is threaded through apertures in the wall of the tube, so that a short portion lies on the outside of the tube. Over this is placed a piece of rice paper impregnated with potassium chlorate, and coated with collodion to keep it dry. A label with an aperture to enable the condition of the rice paper to be seen is pasted over the whole. When the main fuse blows, the fine wire blows and burns the rice paper. A recess is made in the outer wall of the tube under the wire to provide air and prevent the conducting away of the heat. Four claims, four figures.

27,641/09. **End Connections of Windings.** BRUSH ELECTRICAL ENGINEERING CO., LTD., and G. J. PORTER. Two saw-cuts are made in the ends of each of the two bars to be connected, and after inserting these ends into the rectangular connecting tube, a metal wedge is driven in between the two bars. The two outer ends of each of the split bars are then bent over so as to lock the tube and wedge respectively. The connection may be sweated up if desired. One claim, three figures.

65/10. **Telephone Relay.** C. STILLE. Two coils wound in opposite directions and connected in series are placed side by side in a strong magnetic field, the axis of the coils being at right-angles to the direction of the field. A stationary iron core is inserted in the coils to increase the flux. The two coils are pivoted or suspended and are kept in position by a spring or torsional wire. Attached to each coil is a carbon block, and between the two blocks are carbon balls forming a microphonic contact. Weak telephone or other currents in the coils cause them to move in opposite directions and vary the pressure on the microphone contact. This variation in pressure reproduces the original current waves in the secondary circuit containing this microphone contact. Three claims, one figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: OSTERBURG [Suspension gear] 22,941/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: AMES [Conduit manhole covers] 14,898/09.

Dynamos, Motors, and Transformers: ALLGEMEINE ELEKTRICITÄTS GES. [Machines] 6,512/09; THOMSEN and CHRISTENSEN [Driving Small dynamos for cycle lamps] 27,810/09.

Electric Ignition: BLOXAM (*R. Bosch*), 19,306/09; GILLIES and MCPHEE [Electric blasting fuses] 23,302/09; DEIMEL [Electric gas-igniter] 24,500/09.

Electrometallurgy and Electrochemistry: WILLIAMS, BRADLEY and BRADLEY [Electrolytic cells] 9,796/09; BENKÖ [Carbon electrodes for cells] 12,677/09.

Incandescent Lamps: REGNART [Reflector lamps] 15,115/09.

Storage Batteries: O'KILL, 8,875/09.

Switchgear, Fuses, and Fittings: SILL [Controllers] 9,349/09; VON ZWEIGBERGK [Protection of H.T. d.c. motors running in series] 11,304/09; VANDERVELL and MIDGLEY [Switchgear for small lighting installations] 18,665/09; PETZET [Combined lamp shade and reflector] 21,044/09.

Telephony and Telegraphy: SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Semi-automatic telephone exchanges] 9,055/09; SAYERS [Protection of telephone circuits from disturbance by traction systems] 15,158/09; HUFSCHMIDT and WAGNER [Telephone mouth-pieces] 23,269/09; COMPAGNIE GÉNÉRALE RADIOTÉLÉGRAPHIQUE CARPENTIER, GAIFFE, ROCHEFORT [Wireless telegraphy and telephony] 25,542/09; SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Telephone exchanges] 3,400/10.

Traction: LLOYD-DAVIES and NOVELLI [Speed indicators] 8,815/09; ABRAHAM and BRITISH PNEUMATIC RAILWAY SIGNAL CO. [Relays for signalling apparatus] 13,831/09; KITTO [Operating points] 15,386/09; GIBSON [Air brakes] 25,911/09.

Miscellaneous: BEVILLE [Illuminated signs] 21,725/08; VICKERY [Signalling apparatus] 1,948/09; HOLLINGHURST [Illuminated signs] 9,250/09; FELTEN & GUILLEAUME-LAHMEYERWERKE A.-G. [Transporting mechanism] 25,590/09; GRUNDY [Insulated shaft-couplings] 4,093/10.

The following Specification is open to Inspection at the Patent Office before Acceptance, but is not yet published for sale.

Dynamos, &c.: ALLGEMEINE ELEKTRICITÄTS-GES. [Control of A.C. induction motors] 8,621/10.

Amendments Allowed.

19,520/03. **Control of A.C. Commutator Motors.** C. F. SCOTT. The British Westinghouse Electric & Manufacturing Co., Ltd., have been given leave to amend this specification.

28,546/07. **Track Brake.** E. FREUND. Leave has been granted to amend this specification subject to certain modifications.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

10,718 of May 18th, 1896. **Storage Battery Plates.** H. O. TUDOR. A modification of the Planté process for forming positive plates. Lead plates are charged in weak acid as positive electrodes and discharged at intervals until a thick porous layer of oxide is formed containing sulphate. They are then charged as negative electrodes until the oxide is reduced to spongy lead. Finally, they are repeatedly charged and discharged as positive electrodes in strong acid until the layer is completely converted into peroxide.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: SIEMENS BROS. & CO., A. E. FOSTER and H. J. NOTT [Cable conduits] 1,148/00.

Dynamos, &c.: E. E. NOLAN [Mounting core plates on spiders] 16,489/97.

Electric Ignition: R. H. JONES [Contact-breaker and switch] 883/05.

Electrometallurgy, &c.: E. ANDREOLI [Ozone generator] 1,356/03; H. PAWECK [Refining of zinc] 1,688/02.

Switchgear, &c.: J. G. LANG [Motor controller] 1,374/04; H. P. DAVIS and F. CONRAD [A.C. reverse energy cut-outs] 352/05.

Traction: C. H. JERRARD [Rail cleaner] 1,323/02; A. J. BOULT (*J. E. Forsyth*) [Air brake couplings] 1,610/02.

Miscellaneous: O. RENNERT [Temperature control apparatus] 1,704/04.

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ELECTRICAL ENGINEERING

No. 177 [Vol. VI., No. 20] THURSDAY, MAY 19, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

We regret to announce the death on Tuesday of Major Philip Cardew, R.E. (Page 318.)

The new type of Edison alkaline storage battery differs from the previous patterns in the construction of the pockets of the positive plate and the composition of the active materials. Nickel hydrate mixed with nickel flakes is used for the positive, and iron oxide and mercury for the negative pockets. We are enabled to publish some curves from tests, and also the results of the trials made in New York with a small tramcar equipped with the new cells. (Page 319.)

In a Paper read recently before the Physical Society, Mr. B. S. Cohen gave results of some experiments on telephone currents in loaded and unloaded lines. (Page 320.)

We describe a large electric power system which is being completed in the Argentine, involving the lighting and tramways of the town of Bahia Blanca, and power supply to the harbour. The article includes a plan and section of the station, and detailed description of the new Browett-Lindley expansion gear and the Leblanc condensing plant. (Page 321.)

The Papers to be read at the Annual Congress of the Tramways and Light Railways Association, which has been postponed as a mark of respect to the late King, have been published. Mr. R. S. Tresilian gives a historical account of the Dublin tramway system, a proposed standard brake shoe is described by Mr. J. A. Panton, Mr. J. R. Salter writes on the business side of a tramway undertaking, Mr. H. England compares railless traction with the ordinary system for new routes, and a short Paper on the Tramways Act of 1870 is contributed by Mr. F. Coutts. (Page 324.)

A paper read before the Institution of Electrical Engineers, by Mr. A. V. Clayton, on the water-power installations of Sweden, includes full particulars of two large power stations of unusual design. A large three-phase generator with magnet-wheel boss, arms, and poles in one single steel casting, and a novel construction of oil tank for transformers with water-cooling, are described. In the discussion, the low capital cost of the stations was referred to, and comment was made on the high regulation figure of 1·5 per cent. at unity power-factor obtained with one of the generators described. The subject of protection from lightning and earthing resistances was also brought up. (Page 325.)

A letter from Mr. T. L. Miller condemns the practice of canvassing in connection with the election of the Council of the Institution of Electrical Engineers. —A letter from a firm of battery makers comments on a battery and booster installation in America.—The consulting engineer to the Glasgow Main Drainage System writes regarding some inaccuracies in the descriptions of the Shieldhall Outfall Works which have appeared in some of our contemporaries. (Page 327.)

The annual report of the Comptroller-General of Patents shows an increase of 7 per cent. in the number of applications for patents in the year 1909. The

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accounts show a surplus of over £94,800, excluding an amount of £30,000, which has gone towards the purchase of a site for new offices. The number of applications for patents relating to electric railway signalling has increased considerably. (Page 328.)

UNDER Electrochemistry and Electrometallurgy, is given an account of the South Chicago Electric Furnace plant of the United States Steel Corporation, where a 15-ton Héroult furnace is used in combination with a Bessemer converter. (Page 328.)

A NEW testing set is described on page 329.

THE overhauling of the electric wiring of the Marylebone Public Baths, concerning which there has been considerable discussion, is to be carried out by the Borough Council's Electricity Department, and will not be tendered for by wiring contractors. This decision was arrived at after a somewhat heated debate. (Page 329.)

AMONG the specifications published by the Patent Office on Thursday last was one by J. Sayers for a method of neutralising the induction effects of A.-C. traction systems on telegraph and telephone circuits. Insulated wires are run parallel to the trolley wires, and are joined so as to form a closed circuit, and this circuit is supplied with an A.-C. current proportional to and 180 degrees out of phase with the traction current.—C. C. Regnart covers a form of reflector lamp unit. The body is of porcelain, with pins at one end and sockets at the other, enabling several units to be connected end to end to form a long rigid trough. The conductors are embedded in the body.—A process for constructing accumulator cells of the rolled grid pattern is described by G. Okill; the grids are successively charged and discharged as negative plates before rolling.—Apparatus for telephone exchanges for registering the time of conversation between two connected subscribers is described by Siemens Bros. & Co. (Page 330.)

THE new station which has been erected in Horseferry Road for the Westminster Electric Supply Corporation, by arrangement with the London County Council, replaces the company's original Millbank Street station, as the latter site has been acquired by the Council for extension of the Thames Embankment. The station is equipped with continuous-current turbo-generators at present aggregating 3,000 kw., not including steam balancers. There is also converting plant for dealing with the three-phase supply from the Grove Road station of the Central Electric Supply Co. Condensing water is taken from the river through pipes over 300 ft. long. Special arrangements, including the use of a battery, are employed to ensure continuity of supply to the Houses of Parliament. (Page 331.)

A NEW lamp locking device is described on page 332.

THE Acton Electricity Committee recommend the Council to decide whether their undertaking should be transferred to the Metropolitan Electric Supply Co.—A smoke abatement exhibition is to be held in Glasgow.—It is proposed to convert 282 street gas lamps in Grimsby to electric lamps.—The Fulham Borough Council propose to adopt a scheme of free wiring, using the "Stannos" system.—A proposal by the Hampstead Electricity Committee to convert all the remaining street gas lamps to electric lamps has been referred back.—The Board of Trade threaten to refuse to renew the licence for the Dolter surface contact system at Torquay.—An independent expert is to report upon the Limerick undertaking. (Page 333.)

LOANS have been granted, or applied for, as follows:—Belfast Board of Guardians (£6,000); Bridlington (£3,000); Wakefield (£7,150). The Cornwall Electric Power Co. propose to erect a power station. Mains and extensions are to be carried out at Sheffield, Rotherham, and Rhyl. Generating machinery is required at Coventry, Copenhagen, and Batley. (Page 333.)

IT was stated at the annual meeting of the Electric Supply Corporation that the introduction of metal filament lamps has upset all the calculations upon which the company was formed. The Canadian General Electric Co. propose to issue 9,400 $100 shares. Mr. Thomas Dence, one of the directors of Messrs. Johnson & Phillips, stated at the annual meeting last week that he looked forward to considerable improvement in the electrical industry in the near future. (Page 335.)

ARRANGEMENTS FOR THE WEEK

SATURDAY, MAY 21ST.

Institution of Mining Electrical Engineers.

4.30 p.m. Cumberland Branch. At the Scientific Institute, Whitehaven. Continuation of discussion on Mr. Glynn Williams' Paper, "Storage Batteries for Colliery Work."

MONDAY, MAY 23RD.

National Electrical Manufacturers' Association.

8 p.m. Discussion on Free Trade *v.* Protection, at Caxton Hall, Westminster.

WEDNESDAY, MAY 25TH.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. Annual meeting at the University. "Standardisation of Fuses," by H. W. Kefford.

THURSDAY, MAY 26TH.

Institution of Electrical Engineers.

8 p.m. Annual meeting at the Royal Society of Arts. [Ballot papers for the election of Council were posted yesterday.]

OBITUARY

PHILIP CARDEW.

IT is with great regret that we have to announce the death of Major Cardew, R.E., one of the partners in the well-known firm of consulting electrical engineers, Preece & Cardew. Major Cardew paid a visit to Sydney about twelve months ago to inspect the Corporation's electrical power station, and to advise upon further extensions. On his return to England in July of last year he was suffering from ptomaine poisoning, and has been unwell ever since. In November he was operated upon for a tumour behind the nose, which is thought to have been possibly an indirect result of the poisoning, and later on one or two similar operations upon the neck were found to be necessary, but unfortunately his illness gradually got worse, and he passed away on Tuesday last.

Major Cardew, who was born in 1851, obtained a commission in the Royal Engineers in 1871. He served in Bermuda, and was subsequently instructor in electricity at Chatham. In 1888 he was appointed electrical adviser to the Board of Trade, a position which he held during a period of great development of the electrical industry, following on the passing of the Electric Lighting Act of 1888, with its less onerous terms for the promotion of electric supply undertakings. The first Board of Trade regulations—both those for electricity supply and electric traction—made their appearance during his tenure of office, and he was the originator of the rule limiting the drop on the rail return circuit of tramway systems to 7 volts.

Major Cardew was the inventor of the famous hot-wire voltmeter, which was for many years during the earlier history of electric lighting regarded as practically the standard instrument for use on central station switchboards.

The necessity of the introduction of a device for the automatic earthing of transformer windings in the event of a breakdown between primary and secondary was early recognised by Major Cardew, and resulted in the invention of his well-known "Cardew Earthing Device," which is still employed to a considerable extent, although now its place is largely taken by earth shields.

Major Cardew interested himself considerably in recent years with electric traction on railways, and as a director of the London, Brighton and South Coast Railway Co. he had considerable influence in the adoption of single-phase traction on the company's line, a policy which has been attended with conspicuous success.

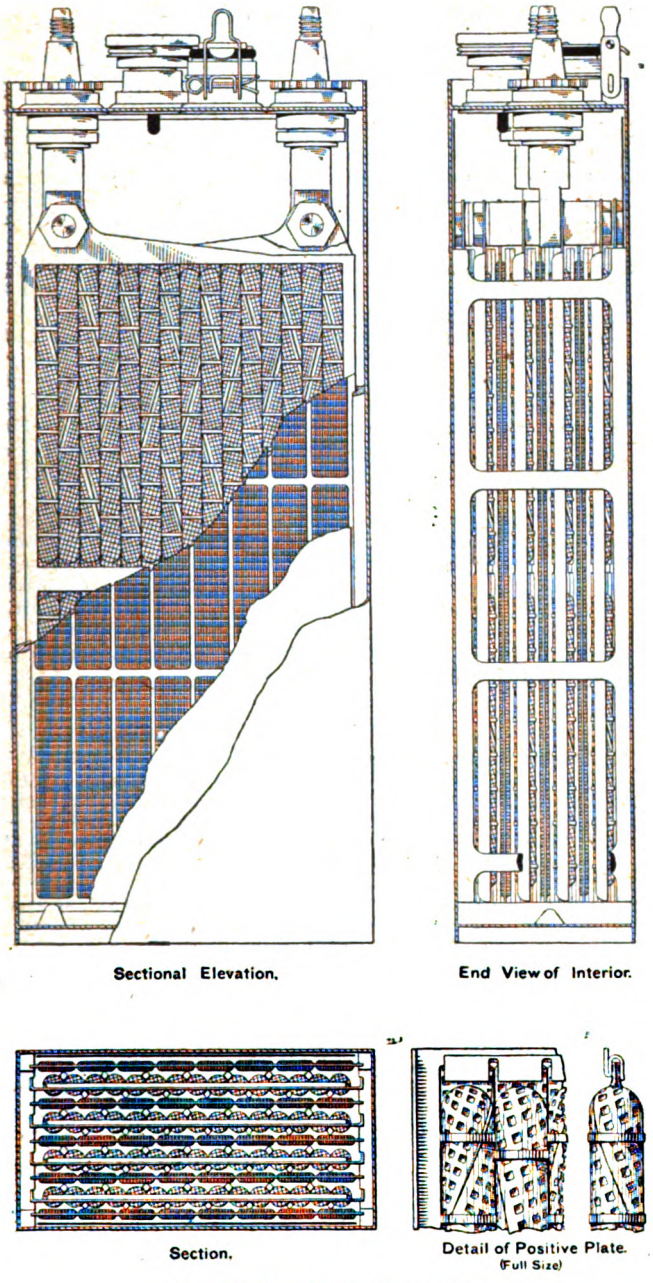
With the death of Major Cardew, we lose not only one of the most earnest and conscientious workers in the electrical profession, but one whose work carries us back to the pioneering days of an industry when there was great need for men with the abilities and perseverance of Major Cardew.

His loss will be deeply regretted by a large circle of friends and acquaintances, for he was held in esteem by all who came in contact with him.

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TESTS ON THE NEW EDISON BATTERY

SOME particulars of the tests which were made in New Jersey with a small tramcar equipped with a battery of the new "A" type Edison accumulator were given in ELECTRICAL ENGINEERING, Feb. 24th, 1910, page 139. This car has been tested in New York, and we are informed has given such satisfaction that sixteen cars of the same pattern have been ordered by the authorities on whose lines the test was made. It will be remembered that the first commercial cell of the Edison alkaline pattern was put on the American market as long ago as 1903. Considerable advance



THE EDISON CELL, TYPE A.-4.
(Scale: Approx. One-third Full Size.)

has been made since then. A more recent cell, made by the German Edison Accumulator Co., was described in ELECTRICAL ENGINEERING, May 7th, 1908, Vol. III., p. 695. The latest pattern cell, Type "A," embodies a number of improvements, which are said to have raised the capacity by 25 per cent., and was introduced by Mr. Edison in the latter part of 1909.

The "A" type cell is constructed in two standard sizes, of 150 and 225 rated ampere-hour capacity, and designated by Type "A.-4" and Type "A.-6" respectively. The former has four positive and five negatives plates, the latter six positive and seven negative plates. As shown in the illustration, each positive plate consists of a grid of nickel-plated steel holding thirty tubes, 7 mm. in diameter, of thin spirally-wound, nickel-plated, perforated sheet steel. The active material consists of horizontal layers of nickel hydrate 0·01 in. thick separated by thin flakes of pure nickel to increase the conductivity of the mass. There are some 350 layers of each material in a tube 4⅛ in. long. The flakes are prepared by an electro-chemical process, described in ELECTRICAL ENGINEERING, January 7th, 1909, Vol. V., p. 8. The negative plate has twenty-four flat rectangular pockets. These are made of thin, perforated nickel-plated steel, and are filled with a mixture of iron oxide and mercury. The plates of each group are hung from a rod, on which they are spaced by nickel-plated steel washers, and held firmly in contact by nuts screwed on both ends. The plates are insulated from the containing can by pieces of hard, vulcanised rubber. The nickel-plated steel containing can is corrugated to give strength, and the seams are welded by the autogenous process. The cover is also welded on. The terminals pass through stuffing boxes in the cover,

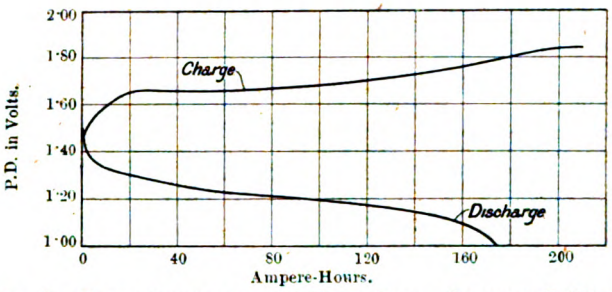


FIG. 2.—TEST CURVES OF A.-4 TYPE CELL. CHARGED 7 HOURS AT 30 AMPS. AND DISCHARGED AT SAME RATE.

which has two other fittings, namely, a separator for filtering the escaping gas of spray, and a water-tight cap for filling. Connection from cell to cell is made by nickel-plated copper connectors with steel lugs on each end for making a taper-joint connection with the terminals. The electrolyte consists of a 21 per cent. solution of potassium hydrate, to which has been added a small amount of lithium hydrate. This solution has a normal specific gravity of 1·210, which does not change during charge or discharge. The average discharge voltage per cell is 1·2 volts. Some interesting information with regard to the effects of charging at high rates were given on page 139 of our issue of February 24th, referred to above. A life of 1,200 complete charges and discharges is claimed for the plates.

We are indebted to Mr. H. F. Parshall for the following curves and test results, and for lending us the cell from which the above illustration was drawn. The curves were plotted from test results obtained at the Edison Laboratory towards the end of last year, and refer to cells of the A.-4 type, which have a rated capacity of 150 ampere-hours.

Fig. 2 gives the charge and discharge curves at the normal rate of 30 amperes. The ampere-hour input was 210 at an

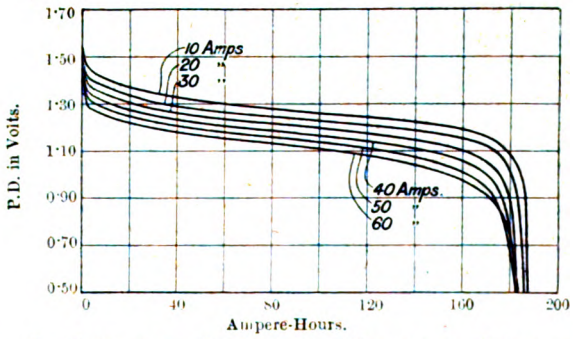


FIG. 3.—DISCHARGE CURVES FOR DIFFERENT RATES AFTER CONSTANT CHARGE OF 30 AMPS. FOR 7 HOURS IN EACH CASE. TYPE A.-4 CELL.

average P.D. of 1·7 volts, and the ampere-hour output was 174·5 at an average P.D. of 1·2 volts. This gives an ampere-hour efficiency of 83·1 per cent., and a watt-hour efficiency of 58·7 per cent. The weight of an A.-4 type cell is 13·5 lbs., so the output per lb. of cell is 15·57 watt-hours. Including the

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weight of the crate and connections, the battery weight per horse-power hour works out at 50·5 lbs. Fig. 3 gives a series of discharge curves at different rates obtained from an A.-4 type cell which had been given a 7-hour charge at 30 amperes in each case. The normal discharge rate for this cell is 30 amperes, but it will be seen that the ampere-hour output was practically the same for all discharge rates from 30 to 60 amperes. Another test consisted in charging the same cell at different rates, and discharging at 30 amperes until the terminal pressure had fallen to 1 volt. When charged at 40 amperes for 5¼ hours, the ampere-hour efficiency was 79 per cent., and the watt-hour efficiency 55·8 per cent.; when charged at 20 amperes for 10½ hours the ampere-hour efficiency was 83·8 per cent., and the watt-hour efficiency 61·2 per cent. A three-hour charge of 210 ampere-hours (2 hours at 90 amperes and 1 hour at 30 amperes) gave an output of 156 ampere-hours up to a terminal pressure of 1 volt. This is an ampere-hour efficiency of 75·3 per cent. Charging continually at such a high rate reduces the life of the cell, however, owing to the excessive heating. The Type A.-6 cell weighs 19·2 lbs., and has an output of some 16 to 17 watt-hours per lb. The normal charging and discharging current of this cell is 45 amperes, and at this rate, a watt-hour efficiency of over 60 per cent. is attained.

We described in the article already referred to in our issue of February 24th, the tramcar with which the recent tests have been carried out. It will be remembered that it is a two-axle 5-ton car, seating 26 passengers, and driven through silent chain gear by two 110-volt, 5 h.p. motors. The battery consists of 200 Type "A.-4." cells, weighing 3,000 lbs. The

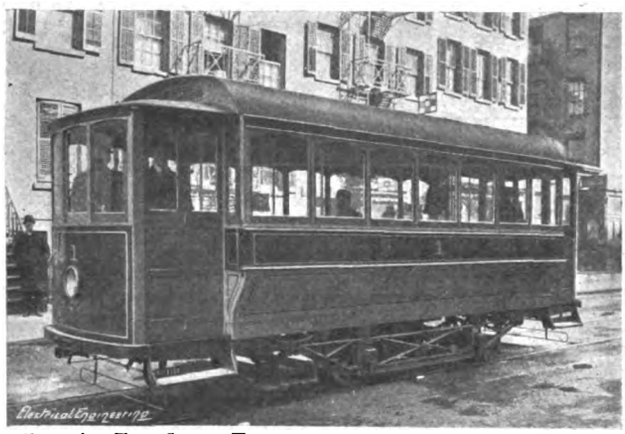


FIG. 4.—THE 5-TON TRAMCAR EQUIPPED WITH THE EDISON BATTERY, AND TESTED IN NEW YORK.

controllers give series parallel connection, both of the cells and motors. A maximum speed of 15 m.p.hr., and a schedule speed (with 14 stops per mile) of 8 m.p.hr. were obtained in New Jersey. The power consumption in accelerating is said to be about 3·5 kw., and in running about 1·5 kw.

On March 3rd last, the car was started in the ordinary service on the 28th and 29th Streets, New York, and the results of a month's trial are very satisfactory. We understand that the car was in service for 14½ hours daily, covering in all a distance of nearly 67 miles. At the end of each day's run, it was inspected, and the battery charged for five hours. The track conditions were not favourable, there being a large number of curves, and further nearly 600 stops were made on the total daily run of 67 miles. The registered consumption of the motors was 530 watt-hours per car-mile, and 853 watt-hours per car-mile at the station bus-bars. On two days, the car was run 85 miles with its full complement of passengers without on either day completely discharging the battery. By April 1st, the records of the car showed that the battery had been charged and discharged 476 times, and on that date the capacity was found to be 11 per cent. higher than when the battery was first put into service. Assuming a run of 80 miles per charge, this corresponds to a total distance of 38,000 miles.

The Edison accumulator factory at Orange, New Jersey, is a four-storey building with some 200,000 square feet of floor space. A large amount of special machinery is employed, including electrolytic apparatus for producing the nickel flakes for the positive plates and for plating the cans and various other steel parts of the cells, tube and pocket filling machines, hydraulic presses for crimping the negative plates, and a number of special lathes and stamping machines. The output of the works is already over 200 complete cells daily, and, it is expected, will soon reach 500.

Glasgow Local Section of the Institution of Electrical Engineers.—At the annual meeting of the Section on May 10th, the chairman announced that arrangements had been made to combine with the Iron and Steel Institute for the summer excursion down the Clyde, as was done last year. A steamer had been chartered, and all arrangements made for the 9th of June.

TELEPHONE CURRENTS

AT the meeting of the Physical Society on April 8th, a Paper entitled "Demonstration of Telephone Currents in Loaded and Unloaded Lines," was read by Mr. B. S. Cohen. The demonstration showed the relationship between the sent and received currents in telephone lines under the various conditions which occur in practice. As mentioned by Prof. Perry in his Paper read before the Society a few weeks ago, it is of little or no practical value to make calculations on the current attenuation in lines of infinite length and with the terminal conditions neglected. The effects of the line length and of the terminal apparatus must be taken into account. By the aid of Prof. Kennelly's formulæ it is possible to calculate the relationship between the sent and received currents under any conditions met with in practice, and for some of the conditions used in the demonstration the calculated results had been obtained. Four essentials were necessary for the experiments shown:—(1) A current comparable to the actual telephonic speech current. This was obtained from a vibrating wire interrupter giving a wave with a fundamental of about 100 cycles per second with a damped oscillation of about 800 cycles per second superimposed. (2) A telephone line with or without its load in the shape of inductance coils. (3) Terminal apparatus. The lines were terminated by receivers and induction coils as used in practice for what is known as local battery working. (4) Current measures. For this purpose barretters arranged as alternating current ammeters were used. The first experiment showed the relationship between the received and sent current for various lengths of standard cable unloaded. The second experiment illustrated the variation in the current sent when the receiving end was open or closed circuited and the length of cable was varied. The third experiment showed the current distribution along the loaded cable by inserting a barretter at different points along the cable. The author gave explanations of the various phenomena illustrated in the experiments. He pointed out that it is now possible to make both calculations and quantitative telephonic tests which give mutual confirmation.

In reply to questions asked during the discussion, the author stated that the current was determined in practice by the volume of sound transmitted, and not by articulation conditions. In his experiments he was working with an attenuation of 1·5 per cent., and the sending current was 3 or 4 milliamperes. The apparatus would work quite well up to frequencies of 1,500. Increasing the current in the circuits up to 0·1 ampere would have no effect on the inductances.

Agreements under the London Electric Supply Act, 1908.—We recently referred to some agreements between the London Electric Supply Corporation and the St. James & Pall Mall Electric Light Co., and the London Electric Supply Corporation, under the London Electric Supply Act, 1908. It will be remembered that the London County Council took exception to some of the provisions in these agreements, and urged the Board of Trade to withhold their consent to them. The Board of Trade has now stated that it does not see its way to give effect to the Council's suggestions, and that it proposes to approve the agreements. In the circumstances, the Highways Committee of the London County Council does not think that any further action can with advantage be taken in the matter.

Overhead v. Underground Telegraph Wires.—The Railway and Canal Commissioners last week decided a dispute between the Postmaster-General and the Tottenham Urban District Council as to the laying of telegraph lines in St. Ann's Road, Tottenham. The Tottenham County Court judge had decided in favour of the contention of the Council that the line should be underground, but the Postmaster-General, on the plea of economy, desired to erect poles and carry the wires overhead. It was urged by the Council that the extra cost would only be £105, and that in order to avoid overhead wires in the district the Council themselves had transferred theirs underground at a cost of over £5,000. In view of these circumstances, the Court held that the underground system should be adopted.

Battery Tramcars in New York.—A tramcar propelled by storage cells of the ordinary lead type has been put into experimental service on certain lines of the Third Avenue Railroad Co., New York. The car in question is a reconstructed horse-car for 26 passengers, and weighs complete with passengers about 6 tons. Two 5 h.p. motors are fitted, driving through chains, and the car is designed to run at from 7 to 8 miles per hour. The battery consists of 44 cells of the Gould type, each with 29 plates, and is rated at 420 ampere hours. The cells are placed under the seats, and special arrangements are made for their ventilation.

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A LARGE ELECTRIC POWER SYSTEM IN THE ARGENTINE

BAHIA BLANCA, a town about 400 miles from Buenos Aires, is the principal port in the Argentine Republic for the shipment of grain, and is rapidly developing in size and importance. It is served by two railways: the Buenos Aires and Gt. Southern, and the Buenos Aires and Pacific. The port itself is practically owned by the latter railway company, to whom all the moles belong, and they have there a complete equipment of jib cranes and capstans, grain silos and elevators, all electrically driven by three-phase motors. Until recently the concession for the supply of electricity in the town of Bahia Blanca itself—a town of about 80,000 inhabitants and some three miles distant from the port—was owned by the South American Light & Power Co., and the supply was given from a station in the town named the Usina Donado; the railway company had a separate power-house for driving the machinery above mentioned. A few years ago, however, when the railway company erected some repair shops by the terminal station, they decided to co-operate with the Light & Power Co. by taking over the whole of the generation themselves and supplying the latter company in bulk.

They therefore took over the Usina Donado, which contains three 250-kw. and two 500-kw. steam turbo-generators (put in about three years ago), and two 1,000 k.v.a. Bellis—Dick, Kerr triple-expansion steam alternators erected more recently. Owing to a large increase of the electrical energy required for the harbour, and also for the town and tramways, Mr. J. F. C. Snell, M.Inst.C.E., the Consulting Electrical Engineer to the Buenos Aires & Pacific Railway Co., was called in to advise, and he recommended the erection of a new station on the Paraguaya site, and a reconstruction of the distribution system.

The work in accordance with Mr. Snell's designs and specifications is now proceeding with great rapidity, the erection being carried out under the superintendence of Mr. P. W. Beatty, the resident engineer at Bahia Blanca, and a short description of the main features of the scheme will doubtless be of interest to our readers. For supplying us with the necessary information for this article, we are indebted to Mr. Snell, and to the British Westinghouse Electric & Manufacturing Co., Ltd., who were awarded the complete contract. Messrs. Browett, Lindley & Co., Ltd., have also given us some information with regard to the engines which they supplied as sub-contractors to the Westinghouse Co.

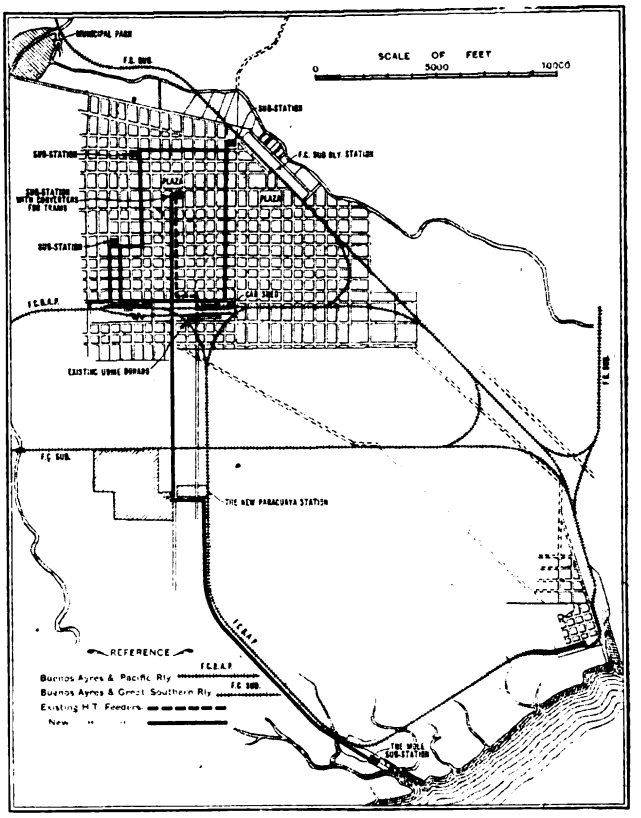


FIG. 1.—MAP, SHOWING RELATIVE POSITIONS OF THE TOWN, HARBOUR, AND ELECTRICITY WORKS AND THE ROUTE OF THE H.T. MAINS.

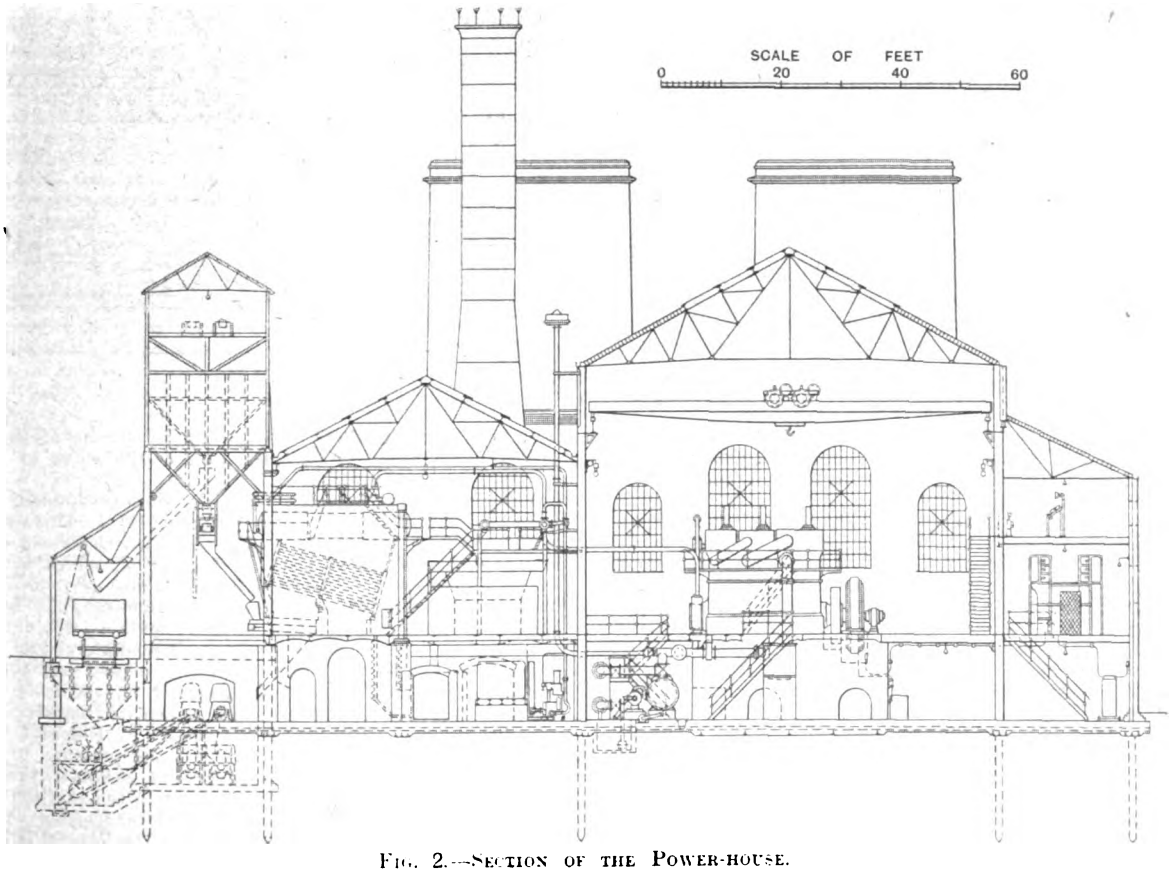


FIG. 2.—SECTION OF THE POWER-HOUSE.

The relative positions of the harbour, town, stations, and sub-stations are seen in the map (Fig. 1).

The new station will contain three 1,000-kw. (1,250 k.v.a.) Browett-Lindley–Westinghouse triple-expansion steam alternators, two 75-kw. sets by the same makers for exciting and station lighting, and two (1,000 k.v.a.) Belliss-Dick, Kerr sets with their own exciters transferred from the Usina Donado. Figs. 2 and 3 are a section and plan of the new Paraguaya station;

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these represent, however, only a quarter of the ultimate size of the station, as it is proposed to extend it eventually to twice the length, with a second boiler-house on the other side of the engine-room. The liberal space allowed will be noticed. In summer, the temperature frequently reaches 90° F. in the shade in the daytime for periods of two or three weeks continuously, and in consequence it was necessary to depart slightly in this respect from the conventional lay-out of the engine-room which would be adopted in power-houses in this country.

There are four B. & W. boilers, each having a total evaporation per hour of 23,000 lbs. under normal steaming conditions. The working pressure will be 180 lbs. per sq. in. Each boiler will be fitted with a superheater capable of imparting 50° C. superheat. The stokers are of the Underfeed type, arranged to burn Welsh coal. Forced draught will be produced by means of two electrically-driven blowers, and an 800-tube Green economiser is being fixed in the main flue. In addition to these four boilers, three B. & W. boilers are being transferred from the old station. The main flue is led outside to a 100-ft. steel chimney.

A complete coal and ash handling plant of the gravity bucket pattern will be installed, and the coal will be discharged direct from the railway waggons into a crusher and screen, from

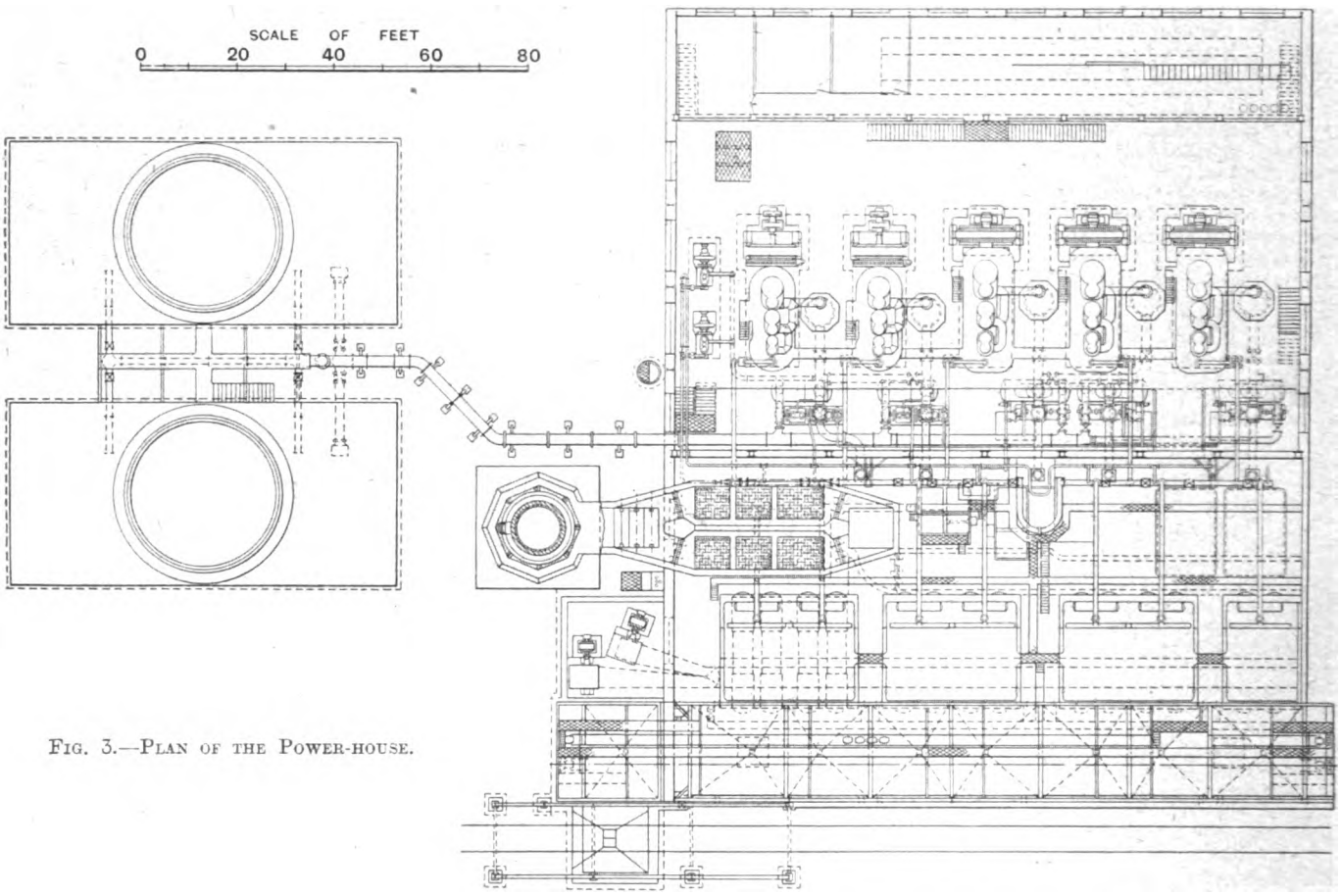


FIG. 3.—PLAN OF THE POWER-HOUSE.

which the buckets will be automatically filled. The aggregate capacity of the coal bunkers will be 1,000 tons, and the ash bunker 50 tons. The conveyor will be capable of dealing with 50 tons from each.

The three new Browett-Lindley engines are three-crank triple-expansion double-acting vertical engines, each designed to develop its full output continuously at a speed of 188 r.p.m., with 170 lbs. steam pressure, 50° C. of superheat, and condensing into a 25½ in. vacuum. The above rated output can also be obtained continuously when exhausting into the atmosphere. They are also specified to stand a 25 per cent. overload for two hours when condensing. We were privileged to see the second engine on the test-bed at Messrs. Browett and Lindley's works before shipment, and were pleased to note the solid design and construction and the evidences of fine workmanship. The cylinder diameters are H.P., 21¼ ins.; L.P., 34 ins.; L.P., 54 ins.; the stroke is 24 ins., and the flywheel weight just over 13 tons. The shaft is 13 ins. diameter, and 14 ins. at the thrust-bearing end. United States metallic packing is employed.

The chief feature of interest in the engines is Messrs. Browett, Lindley & Co.'s improved expansion gear, the main object of which is to utilise oil pressure for actuating a relay motor to move the gear. By this means great power can be obtained for actuating the gear without putting any extra work upon the governor. The general arrangement of the gear as applied to the engines is shown in Fig. 4. The piston A is connected up to the expansion gear lever C by connecting link B, the lever C being keyed to the upright shaft D, which actuates the valve. The piston A is operated by the valve E, oil under pressure entering at F. For instance, if the valve moves to the right, oil under pressure is admitted at X, and the oil is exhausted through the port Y. Mechanism placed between the valve E and the governor brings the valve E into its central position, after the piston A has moved through an amount proportionate to the movement of the governor spindle G. To provide an ample supply of oil to operate the gear instantaneously, independently of the supply delivered by the oil pumps, an accumulator W is fitted. It consists of a spring-loaded piston J, the load of the spring being such that the piston is allowed to move a considerable amount, at least equal to twice the capacity of the relay cylinder, with a pressure of 5 lbs. per sq. in. Although the pressure in the pipe may be intermittent, the piston J of the accumulator will be gradually raised, as the oil passing the check valve H cannot again return to the oil main.

The throttle valve is actuated from the governor by the lever K and the spindle G in the usual way. The lever K is also extended, as shown at L, and by means of the link M a bell crank lever N and the link O the valve of the relay cylinder is actuated.

The valve E is operated from the link O through a rocking lever P (see end view also Diagram (b)). This lever P is mounted on another similar lever Q, which is pivoted at R, and engages with a pin S fixed in a lever C, which actuates the upright shaft D. Referring to Diagrams (a), (b), and (c), assume, for instance, the engine was running fully loaded and the whole load was thrown off, the lever C would be in the position shown by Diagram (a); immediately the load was thrown off the throttle valve would be closed and through the mechanism P L M N already referred to, the lever P, which lies above the lever Q in position, shown in Diagram (a), would be pushed over to the position shown in Diagram (b). This would open the valve E and admit oil pressure to one side of the piston and open the other to exhaust, thus causing lever C to be immediately moved over to the position shown in Diagram (c). In moving over, this lever carries with it the pin S to which lever Q is connected, and as lever P is centred at T on lever Q, the valve is caused to move over again to its central position, the lever C thus remaining in that position until altered by another movement of the governor.

The two extreme positions of the levers only are shown in Diagrams (a) and (b), but when the governor only moves

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through a portion of its travel, the lever *C* moves only a proportional amount, as the valve is returned to its central position automatically as just described.

As a safeguard, a spring is fitted at *U* on the link *M*, and is sufficiently strong to make the connecting link, this link being practically a positive connection; but should, through any unforeseen cause, the valve of the relay cylinder stick, it will not in any way interfere with the control of the engine by the throttle valve. For instance, should this occur, and the whole load of the engine be thrown off, the lever *K* would close the throttle valve, and the arm *L* would move downwards, simply compressing the spring at *U*.

The guaranteed steam consumption per kw.-hr. at unity power factor, and with the steam pressure, superheat, and vacuum already mentioned, are as follows:—25 per cent. overload, 17·68 lbs.; full load, 17·58 lbs.; three-quarters load, 18·14 lbs.; half-load, 19·15lbs.; and quarter-load, 22·99 lbs.—not including steam for auxiliaries.

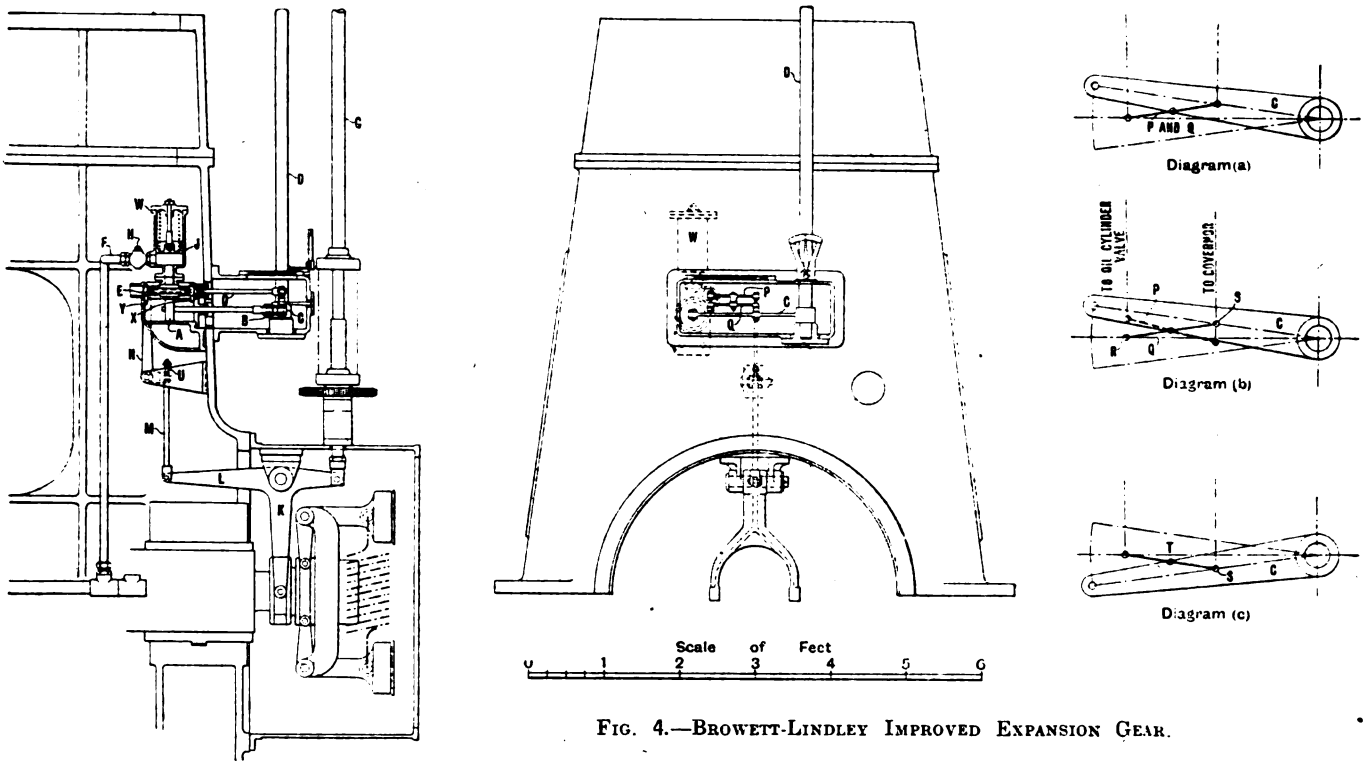


Fig. 4.—Browett-Lindley Improved Expansion Gear.

Reciprocating engines were employed rather than steam turbines for these sets, at the particular instructions of Mr. Snell's clients.

Each engine is coupled direct to a Westinghouse three-phase revolving field type generator, the rated output of each machine being 1,000 kw. continuously at 80 per cent. power factor, and 6,600 volts between phases. The frequency is 50 cycles per second. Each generator is also designed to carry an overload for two hours of 1,250 kw. at the same power factor. The high temperature which prevails at Bahia Blanca in the summer has already been mentioned, and in addition the atmosphere is at times extremely humid (85 per cent.) and dusty. It was, therefore, necessary to give most careful consideration to the selection of suitable forms of insulation for the generators and electrical plant. This subject was very carefully investigated by the consultant and the contractors, and a large number of tests were made before the work was put in hand in order to ascertain the best possible combination of insulating materials and method of insulation to be adopted. Before shipment the stator coils of the generators were tested for five minutes at 13,000 volts between the windings and the frame, and the rotor windings for the same length of time at 1,000 volts.

The main generators are separately excited by two 75-kw. Westinghouse dynamos driven by Browett-Lindley engines.

The piping is being supplied by Messrs. Aiton & Co., of Derby, the steam pipes and hot and cold feed mains being of weldless, solid-drawn, open-hearth steel. These pipes are tested before shipment under an hydraulic pressure of 400 lbs. per sq. in.

Each of the main engines has its own condenser, designed for giving a 25½-in. vacuum with 25,000 lbs. of steam per hour, cooling water being supplied from cooling towers at a temperature of 36° C. The condensers are of the surface type, with centrifugal circulating pump, Leblanc rotary dry air pump, and turbine water extracting pump; a general view of one of these plants is shown in Fig. 5. The pumps are all driven by one motor, which is direct coupled to the Leblanc air and the circulating pumps, while the water extracting pump is driveu by Morse chain from the end of the air pump spindle.

The condensers are of the usual surface type in which the steam passes over the nests of tubes; the cooling water enters at the bottom and leaves at the top, after having passed twice through the length of the tubes. However, as the Leblanc air pump is operated as a dry air pump, special arrangements are necessary to cool the air and incondensible gases coming from the condenser, and also to ensure that no steam is taken away with the air. These special arrangements consist of baffle plates placed inside the condenser, so as to cause all the steam and air to pass right down to the bottom, where the condensed steam is drawn off. The air and incondensible gases are then drawn to the air pump over a nest of tubes, through which the coldest circulating water is passed.

The construction of the Leblanc air pump is shown in Fig. 6. It may be regarded as a reversed Pelton wheel in conjunction with an ejector. Sealing water is introduced through the inlet at the left into the central chamber, from which it passes through the port *C*, is caught up by the blades *D* of the Pelton wheel, which is rotated at a suitable speed, and is finally ejected into the discharge cone *E* in the form of thin sheets having a high velocity. These sheets of water cover the sides of the discharge cone and thus form absolutely tight water pistons, which entrap the air coming from the condenser through the suction branch *E*, and carry it out against the atmospheric pressure.

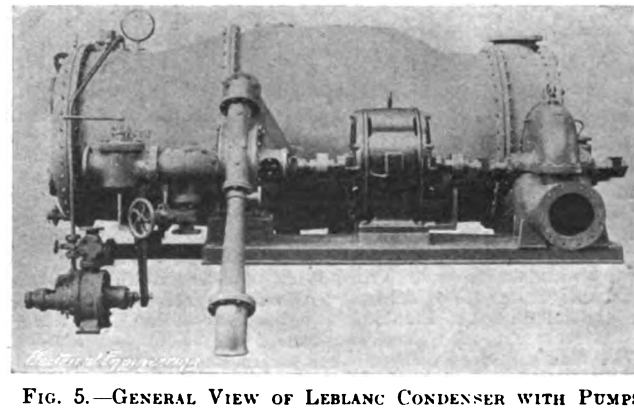


Fig. 5.—General View of Leblanc Condenser with Pumps.

As there are no reciprocating parts, valves, waste clearance spaces or pistons to wear and cause leakage, the efficiency of the Leblanc air pump is extremely high. The satisfactory and efficient transference of the heat in the steam to the water depends to a very great extent on the removal of the air which enters the condenser with the steam, so that the use of the

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Leblanc air pump reduces the cooling surface and the quantity of cooling water required, the respective figures for the Bahia Blanca plant being 2,500 sq. ft. and 1,900 gallons of cooling water per minute.

The turbine pump, which withdraws the condensed steam from the condenser, delivers the water straight to the hot-well tank, which is placed in the boiler-house with about a 15-ft. head. The motor driving the pumps is of the standard Westinghouse squirrel-cage type for three-phase current at 50 periods and 720 r.p.m.

Oil is removed from the condensed steam by mechanical oil-separators and a Paterson plant.

Before shipment, one of the condensing plants was tested in the maker's works under conditions as near as possible to those actually obtaining on site, and the results obtained were, we are informed, appreciably better than the guarantees.

Two cooling towers are being supplied of the Balcke natural-draught pattern, constructed of brickwork and ferro-concrete, and containing a water distributing system consisting of special impregnated wooden laths and troughs. The duty of each tower

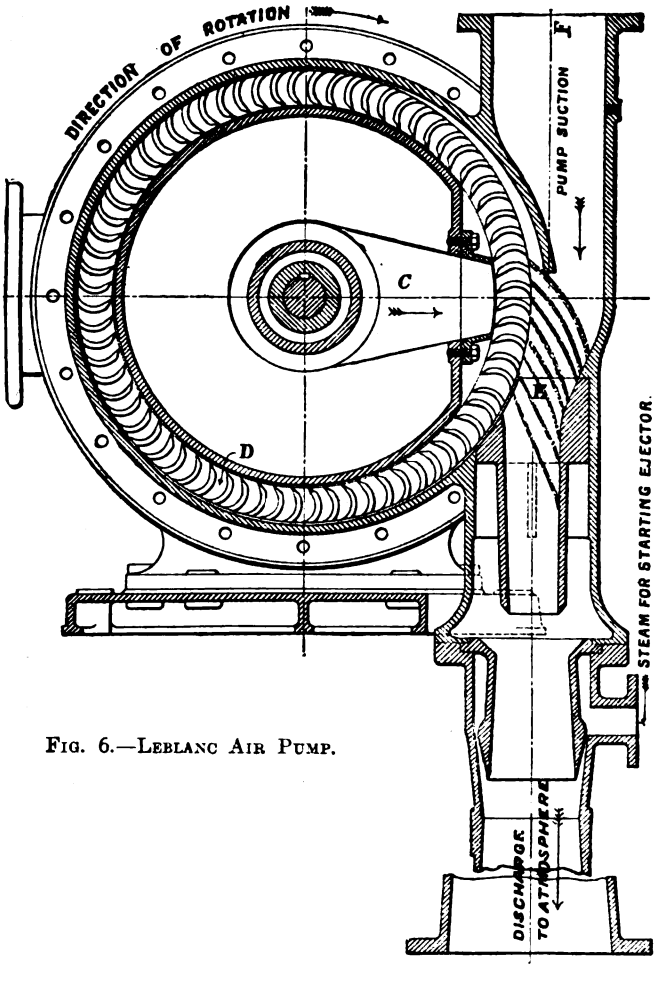


FIG. 6.—LEBLANC AIR PUMP.

is a capability of cooling 175,000 gallons of water per hour from 54° C. to 36° C., with a temperature of the surrounding air at 32° C., and 85 per cent. average humidity. Each chimney will be 48 ft. in height and 30 ft. in diameter, the total height of the structure being about 83 ft. from the ground level. The structure is designed to withstand a lateral winding pressure of 50 lbs. of sq. ft. of surface. At certain periods of the year the district of Bahia Blanca is swept by severe hurricanes, and dust storms are also very frequent.

The make-up circulating water is taken from an artesian well, and the make-up feed water from the town mains.

That portion of the power-house which is devoted to switch-gear is divided into three floors, of which the basement floor will be used as a cable tunnel; the middle floor will be the high-tension switch-room, containing the oil-immersed circuit-breakers, each enclosed in a separate cubicle; and the top floor the desk control-boards. Each of the neutral points of the generators will be connected to earth through isolating link switches and heavy resistances, one of which will only be connected to earth at any time.

Arrangements are being made at first for the equipment of five sub-stations in the positions shown in the map given in Fig. 1. The one in the centre of the town near the Plaza will have rotary converters for the tramways, but the others are equipped only with static transformers. The secondary A.-C. pressure for the motors in the town is 380 volts between phases, and a fourth wire is used for the lighting, which is therefore at 220 volts. This fourth wire is earthed at one point of the distributing system. In the rotary sub-station, each rotary is fitted with a starting motor, so that it can be started direct from the secondary of the main transformers. The Mole sub-station will be equipped with four 500-k.v.a. transformers, the primary windings being mesh-connected; the secondary star-connected, the secondary pressure in this case is 500 volts. There will be about 2,000 h.p. of motors connected to this sub-station, chiefly for grain elevators, jib-cranes, and capstans.

From the generating station to the Mole an overhead H.T. line is being erected. Steel lattice poles spaced about 75 metres apart are used, and the wires are of 0000 S.W.G. copper, forming two triangles, as the feeder is in duplicate. The tramway feeders and the remaining lighting and power cables are underground. Messrs. W. T. Henley's Telegraph Works Co., Ltd., are supplying the cable, and are also laying it. With the exception of the tramway feeders, which are V.B., all the mains are paper-insulated lead-covered, laid solid on bitumenised wood bridges in stoneware troughing. The high-tension trunk feeders are three-core, being coloured red, white, and blue, and the L.T. cables are four-core. One hundred and eighty-eight arc lamps have been erected, forming ten circuits, which will be operated on the series system from constant current, 2,250-volt, automatically regulated transformers. Single-core cables are employed for these circuits, looped into the base of each lamp-column. The tramway feeders are also single-core. Messrs. Henley's contract includes some 130 km. of cable: 83 km. of H.T. and L.T. lead-covered for feeders and distributors, 38 km. of V.B. cables (including the telephone cables as well as the tramway feeders), and 18 km. of vulcanised rubber service cables, which have been prepared especially to withstand the extremely high temperature. The conductors of some of the larger cables are made on Henley's patent "laminæ" system.

The existing tramcars in Bahia Blanca were driven by petrol and steam, and have just been converted to electric traction, while at the same time considerable extensions are being carried out. On account of the rigorous climate and the liability to dust storms which prevails in this district, a special design of tramcar was necessary, and it was finally decided to use a semi-convertible single-deck car with double windows. The car bodies and trucks have been furnished by the United Electric Car Co., of Preston, they have standard Westinghouse double tramway equipments comprising two 35-h.p. motors, and the cars are fitted with the Westinghouse magnetic track brakes.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION

ALTHOUGH the Annual Congress of the Tramways and Light Railways Association, which was to have been held at Dublin last week, has been postponed until further notice as a mark of respect to the late King, the five Papers which are down for reading have been published in the Association's Official Circular for May.

The first Paper describes the system of the Dublin United Tramways Co., and is by Mr. R. S. Tresilian, secretary to the company. The history of the undertaking, from the laying of an experimental length of horse tramway in 1867 to the conversion of the last section of the system to electrical working in 1900, is given, and the plant at the Ringsend power station and at the various sub-stations is described. The financial position of the company is also outlined. Mr. J. A. Panton, rolling-stock superintendent of the Liverpool Overhead Railway, contributes a Paper entitled "Brake-Shoe Standardisation." The author points out that the cost of brake-blocks amounts to some 10 per cent. of the total car maintenance, and suggests that greater precautions should be taken to ensure even wearing in order that a smaller proportion of material may be returned to the scrap heap. After comparing the relative advantages of the various different materials, the author describes a proposed standard shoe and brake-head, the use of which he estimates would effect a saving of 50 per cent. in material. "Tramway Economics" is the title of a Paper by Mr. J. R. Salter, General Manager, South Lancashire Tramways Co., who discusses the relationship between the receipts, car mileage, and working expenses of a tramway undertaking, and the general commercial principles which should govern the operation of a tramway system. The Paper includes some interesting curves. Mr. H. England, General Manager, Wakefield & District Light Railways Co., has written a Paper on the subject of railless traction. The various systems are briefly described and criticised, and a detailed comparison of the working costs of a railless and an ordinary tramway service is made. For a four-mile route, the capital cost is placed at less than one-third in the former case, while the working costs are also estimated to be slightly lower. The last Paper is by Mr. F. Coutts, General Manager, Paisley District Tramways Co., and introduces the question of the advisability of a revision of the Tramways Act of 1870.

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WATER-POWER INSTALLATIONS IN SWEDEN

ON Thursday, April 21st, a long Paper describing some of the typical water-power installations of Sweden was read before the Institution of Electrical Engineers in London by Mr. A. V. Clayton. The amount of water-power available in Sweden is equivalent to 3,800,000 h.p., of which only 550,000 h.p. is at present harnessed. In 1900 only 253,000 h.p. was utilised, or less than half of what is now employed. In the neighbouring country, Norway, there is available 4,800,000 h.p., of which in 1906 only 250,000 h.p. was utilised. The author gives brief descriptions of some of the earlier installations, including those at Hellsjön, Alby, and Ringdalen. In the last-named there are five 1,100-h.p. single-phase generators supplying power at 10,000 volts to carbide furnaces at Alby. Each generator supplies one furnace and has its own transmission line with step-down transformers, so that they form five complete separate and independent units.

One of the newest stations is at Gullspang, in the south, between the lakes of Skagen and Vanern. The power is transmitted to a number of towns,

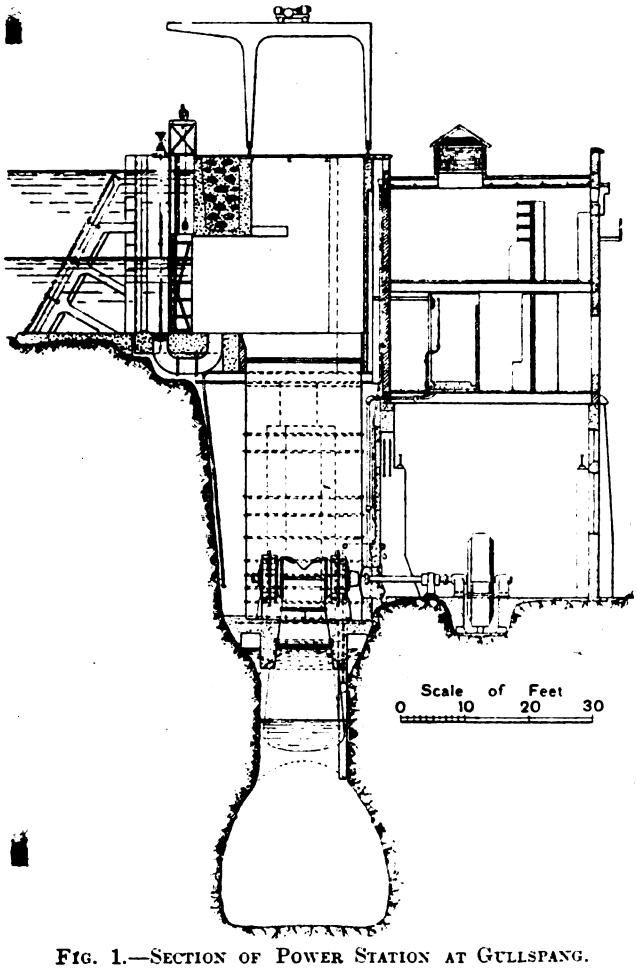


FIG. 1.—SECTION OF POWER STATION AT GULLSPANG.

ironworks, and other industrial undertakings, at 40,000 volts, the greatest distance at present being 50 miles. The level of the water in Skagen is about 79 ft. above the level of the water in Lake Vänern. Lake Skagen has an area of 50 square miles, and forms an ideal natural storage for the water. The mean water flow at Gullspang for high- and low-water periods is about 2,550 cu. ft. per second. Where the power station is situated the river runs through steep walls of rock, and in order to build a dam the water had to be diverted through a temporary tunnel, about 60 yards long and 30 ft. diameter, blasted through the rock. The water is led from the head race to the turbine house in an open canal. The power station and the forebays are built close together. Fig. 1 shows a section of a forebay with ice-racks, sluices, turbine flume, turbines with draft tube, tail race, tunnel, and power house. The turbines are of the twin type, and are placed in open vertical flumes. When completed there will be six turbine flumes, each constructed for a pair of 4,500–5,000-h.p. turbines for driving the main generators, beside the auxiliary turbines for the exciters. Only four pairs are installed at present. Each flume is provided with its own forebay, ice-rack, and head-gate. The gates are raised or lowered by a travelling crane, which can be moved over each sluice. The power house building is in three storeys. Above the generators are the transformers and switchgear, while the top is devoted to the lightning protection devices and outgoing lines. The first floor is level with the ground outside, and on this floor run rails connected with a siding on the main railway lines. A 20-ton electric crane can take goods off the railway trucks and deliver them on to this floor, or drop them through an opening into the machinery hall below, which is provided with another 20-ton electric travelling crane. A complete system of ventilation has been arranged to keep the machinery hall cool, and channels running under the floor conduct cool air to the generators. The runners of the turbines are made with boiler-plate buckets cast into a cast-iron hub and ring. This ensures a smooth bucket, and minimises skin friction. At the same time the bucket is stronger than a cast-iron bucket. This style of making runners is much employed for turbines working on falls up to about 65 ft., and up to sizes about as large as these—*i.e.*, 2,000 to 2,500 h.p. per wheel. For larger sizes and bigger falls cast-steel runners should be used. The guides or chutes leading the water into the wheel are movable on pivots, and the amount of water admitted is regulated to suit the power required. The efficiency is 85 per cent. at 3,500 h.p., falling

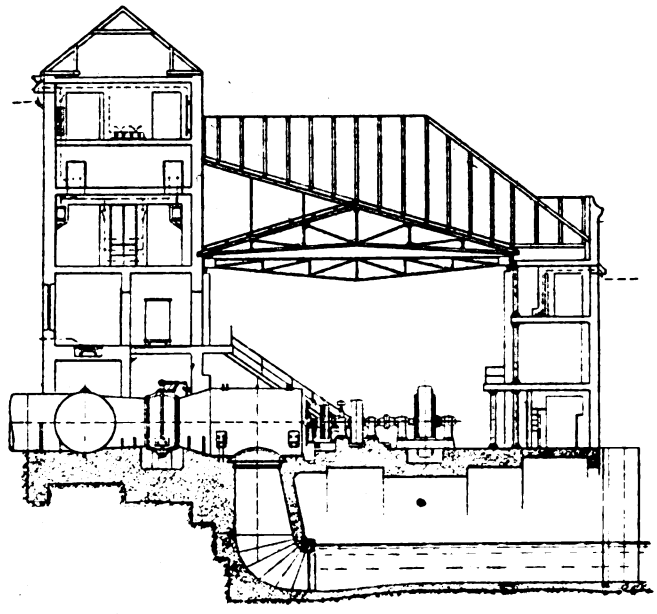


FIG. 2.—SECTION OF GRANINGE POWER STATION.

to 81 per cent. at 4,500 h.p. Regulation of speed is effected by automatic hydraulic regulators operating directly on the shafts connected to the links of the movable chutes. The governor balls are driven from the turbine shaft. Records taken on the Gullspang turbines show that with the instantaneous application of full load to the turbine running light, or the throwing off of full load, there is a variation of only 5½ per cent. in speed; while for load variations of half or full load the speed varies only 2 per cent., and, what is still more important, there is absolutely no hunting.

At the present time there is installed in this station machinery aggregating 16,500 h.p., exclusive of excitation, and this has been erected at a total cost of £173,000, or about £10 10s. per horse-power. When completed for its full capacity of 25,000 h.p., the power station will cost £192,000, or about £7 15s. per horse-power.

In the north of Sweden, continued the author, a new power station has been completed at Graninge. This is built for a capacity of 10,000 h.p., of which 5,000 h.p. is now at work. The units are each of 2,500-h.p. capacity, running at 300 r.p.m., and generate at 5,000 volts, at which voltage part of the power is used in the immediate neighbourhood, while the remainder is transformed up to 40,000 volts for long-distance transmission up to 40 miles. Fig. 2 shows an elevation of the power house. In this case there are not separate feeder tubes for each turbine, but three tubes lead into a common header from which the four turbines are fed. All the 5,000-volt bus-bars, appa-

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ratus, and outgoing lines have been kept on one side of the building, and all the 40,000-volt apparatus on the other. The central portion is devoted to the turbines and generators. The transformers are situated over the feeder pipes of the turbines, while the three floors above the transformers contain the 40,000-volt bus-bars, switching apparatus, and outgoing lines. The turbines operate under a 60-ft. head, and consist of twin wheels mounted on horizontal shafts. Heavy flywheels are placed between the turbines and the generators. These flywheels have their own bearings, and are connected through leather band flexible couplings to the turbines, and through flange couplings to the generators. On test the speed variation was found to be 2½ per cent. for sudden variations of load equal to 20 per cent. of full load. The three-phase generators are of 2,150-kw. capacity each, 50 cycle, 20 pole, 300 r.p.m., and generate at 5,000 volts. Their tested efficiency is 95·4 per cent. on full load of unity power factor, and 94·2 per cent. on full load of power factor 0·8. The inherent regulation is 1·5 per cent. for unity power factor, and 6·3 for power factor 0·8. In general the regulation of generators employed in Sweden is not nearly so good, 7 per cent. and 16 per cent. being the more usual figures. The rotating magnet-wheel with poles, arms, and boss, is in one single steel casting, and the pole-shoes are of forged steel screwed to the poles with countersunk bolts. The flanges former by the pole-shoes hold the field-spools in place. The stator winding consists of bars, two in each slot, and the slots are partially closed. With the exception of a few electro-chemical works, 50 cycles has generally been accepted as the standard periodicity in Scandinavia. The new State power scheme at Trollhättan is, however, designed for 25 cycles, partly with a view to the use of the power for railways.

An interesting generator of 10,500-kw. capacity, 10,000 volts, 50 cycles, and 250 r.p.m., built by the General Electric and Manufacturing Co. of Sweden, has been supplied to the Notoddens Saltpetre Works in Norway. The steel poles and ring are cast together, and are supported on a cast-iron arm system. The magnet ring and poles are divided transversely, and an air duct is left between the halves. The width of the iron axially in this machine is no less than 49 in. The bearings are of the ring lubrication type, and are provided with water cooling in case it is required—this has, however, never been necessary.

Turning to lighting and excess pressure protection devices, the author mentions that in the case of Graninge zinc roller tension limiters and horn lightning arresters are used, while impedance coils are placed between these devices and the 40,000-volt bus-bars. On each phase there are two horn arresters in series, one of which is connected in parallel with a water resistance. The latter consists of a very large glazed earthenware bent pipe filled with water. It has been found that a gap of 32 mm. for the first horn and one of 40 mm. for the second horn, which is in parallel with the resistance, give the best results. Another method is to make connections from the lines to earth through fixed resistances. The resistances are adjusted so as to allow a very small current constantly to flow to earth, and these connections to earth lead off the small static charges which would otherwise accumulate on the line. Experiments have been made with carbon resistances for this purpose, but a circulating water resistance has proved best. The cooling coils of the transformers at Graninge present some novelty, in that instead of one or a few circulating pipes of large diameter, or a water jacket, they consist of a number of small diameter copper tubes placed in parallel, like a little water-tube boiler. The tubes are expanded or sweated into headers which form one side of distribution boxes for the inlet and discharge of the circulating water. The tubes are attached to the transformer box lid, so that when the lid is removed the coils are removed with it. The latest pattern of box is built up of wrought-iron plate, and constructed with deep radial corrugations to assist the cooling. The radiation surface is concentrated towards the top of the box where the oil is hottest. A small cistern on the top of the box is provided to allow for the extra space required by the oil when hot and to keep a constant head of oil pressure against the lid. This is necessary to prevent moisture condensing on the under side of the lid in cold weather, which happens if an air space be left between the top of the oil and the lid of the box. Such drops of moisture will fall through the oil on to the transformer, and may cause serious damage. The oil in this cistern is connected to the oil in the box by a small tube, the upper end of which is some inches above the bottom of the cistern, so that any moisture that may condense on the under side of the lid of the cistern will not be drawn into the transformer box, but will lie at the bottom of the cistern, and can periodically be drawn off. The bottom of these boxes is circular and is of ¼-in. boiler plate, and the top part is corrugated and of 14-gauge sheets. The whole box is galvanised after it is riveted and complete. The makers of these boxes were Messrs. John Fraser & Sons, of Millwall.

In order to get a reasonable speed on low falls, continued the author, some remarkable designs have been evolved. At Nyqvarn, the 500-h.p. turbine units consist of two pairs of wheels—that is, four runners—with vertical shafts. The fall in this case is 13½ ft., and the speed of the turbines is 150 r.p.m. At Korsnäs no less than four pairs of turbines—that is, eight wheels—are used on one shaft. The fall in this case is only 6 ft., and the speed is only 107, while the power is 420 h.p. Installations with such very low falls are very costly. The same turbine wheels used in this case would, on a fall of, say, 40 ft., develop, not 420 h.p., but about 7,000 h.p. On high falls single wheels having high peripheral velocity are used. A 3,300 h.p. turbine of this class is in operation on a 290-ft. fall at the works of the British Aluminium Co., at Stangfjorden, Norway. The speed is 300 r.p.m., and the D.-C. generators had to be divided into two units of 1,100 kw. each. On still higher falls Pelton or impulse-type wheels must be used. There are two such installations being carried out in Norway. One of these is at Tya, where a head of about 3,300 ft. is utilised to develop about 70,000 h.p.; the other is at Rjukanfos, where the head is about 1,000 ft. The units at the latter station will be of 14,500 h.p. each. The installation at Tya is estimated to cost about £525,000, or £7 10s. per electrical horse-power developed.

DISCUSSION.

Mr. J. F. C. SNELL asked the author to amplify his figure of capital cost, viz., £7 15s. per horse-power installed. Could he also give the price charged per h.p. year or per kw. year that obtained in Scandinavia. With a power station at such a low cost as that mentioned, it would seem a very difficult matter for a steam station to compete unless the cost of transmission was unnecessarily high. Finally, he asked whether the figure for available h.p. in Sweden was estimated upon the drought rating or upon the average rainfall for the year.

Mr. STJERNBERG drew attention to the figures in the Paper relating to regulation of generators. It seemed to him that an inherent regulation of 1·5 per cent. at unity power factor and 6·3 per cent. with a power factor of 0·8 was very low. Of course, theoretically, machines could be designed for even lower regulation if made large enough, but he did not think it desirable to have machines of this description in connection with long transmission lines where short-circuits were frequent. If the regulation were not so good, it would reduce the short-circuit effects very considerably, and with automatic regulators the pressure could be kept as constant as might be required. He disagreed with the author that there were no short-circuit troubles in water installations in Sweden. He had been told that in several places choking coils without iron were provided specially for the purpose of decreasing short-circuit effects. He did not think the design of transformer case described by the author, with the deep cooling ribs, tended to produce good circulation in the transformer, although it might cool the oil very well. Further, in view of the thinness of the plates, he doubted whether it would be possible to get the riveting perfectly tight.

Mr. H. BRAZIL, after learning from Mr. Clayton that the neutral point of the Graninge system was not earthed, stated that the arrangement of the arrester horns was not satisfactory, as it would require double the pressure to cause the horns to spark than it would if one pole were earthed. With regard to the resistances used, failures with the carbon rod type were due either to the resistance per unit length not being uniform, or to cracks in them. When a discharge occurred the potential was concentrated at the point of high resistance, and the rod got hot and broke. A modified form of carbon resistance due to the speaker consisted of a fireclay slab 12 in. square by 1½ in. thick, with a zigzag groove ¾ in. deep, and ⅝ in. in width, moulded in it. A special carbon powder was placed in the groove, and carbon electrodes were provided at each end. With 10,000 volts across this, the current rose to a maximum of 2·4 amperes, and then decreased to 1·8 amperes at the end of one minute, the maximum load being 24·2 kw. These were very severe conditions, and improbable in practice. After such a severe discharge, the powder should be mixed and redistributed. Objections to water resistances were that they introduced moisture into the E.H.T. chamber, they varied in resistance to a very great extent, the range of temperature and the capability of absorbing power was very limited, and in cold weather they would freeze. A carbon resistance on a number of slabs as described above, with grooves ¼ in. wide, might be used in place of the water streams of the permanent leak arrester mentioned by the author. For a current of 1/50th of an ampere, the resistance would have to be some two million ohms. There would be about 20 slabs per phase stacked one on top of the other and connected in series.

Mr. W. H. PATCHELL said the author did not mention whether the water leak protective devices were put in, as was done in Northern Italy, when they saw a storm coming on, or whether they were in all the year round. On the question of transformer cooling, the design described did not lead him to

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believe that the best oil circulation would be obtained. He did not see how the cold oil could thoroughly circulate down to the bottom. The author had mentioned that the magnet wheel, boss, and poles of one of the generators were cast in one piece, but the photograph did not show that the boss was split. This seemed to him very risky, and considerable trouble must be experienced in getting the castings out sound without tearing the arms from the boss. On the question of cradles underneath transmission lines where they cross public highways or railways, Mr. Patchell mentioned a conference in America between railway and electrical companies with the object of avoiding their use, at which it was agreed that it was better to spend money in making the overhead lines stronger than to use cradles.

Mr. A. V. CLAYTON, in reply, said the figure of £7 15s. per h.p. mentioned in the Paper should have been turbine h.p. The price of energy per h.p.-year was very variable; in many cases it came down to 25 kronen (27s. 6d.) per h.p.-year, whilst in some cases with a 24-hour supply it would be 120 kronen. An average figure might be struck of 55 kronen (about 55 shillings) per h.p.-year, which would entitle the consumer to a 24-hour supply, so long as the water lasted, of course. This was provided for in the contracts. Some industries in Sweden, such as wood pulping, took power when the station had a surplus available, the conditions of such industries being that this did not seriouly interfere with the labour question. The figure for the regulation of the Graninge generators was partly due to the entire ring and poles being cast in one piece, as the density was driven up to an extraordinarily high figure so that the working part of the curve was practically flat. The air gap was only about 4 to 5 millimetres, and partially closed slots were employed. The figures for regulation were obtained by the Elektra Prôfnings Anstalten, the recognised testing authority of Sweden. He agreed with Mr. Stjernberg that short-circuit currents would be large, and if he were given a free hand he would advocate generators with large impedance and with automatic regulators. But such machines had not, as yet, made much advance in Sweden. He thought Mr. Stjernberg had been misinformed on the point that choking coils had been installed in connection with short-circuit effects. He knew they were used between the generator or transformer and the horn lighting arrester with the idea of choking the current from lighting discharge in the station, but he did not know of any instance in which they had been used for the purpose stated by Mr. Stjernberg. With regard to the criticisms of the circulation of oil in the transformers, careful tests had been made, and the circulation had proved to be very good indeed. The oil used was thin, and gave a better insulation than the heavier and cheaper oils. As to the water resistances, they were merely required instantaneously, and on the whole they had been more satisfactory than carbon, which suffered from inequality and cracked. The protective devices were put on in the summer and taken off during the winter. Mr. Patchell criticised the casting of the arms and ring in one piece. With iron he would not attempt to do such a thing, but with cast steel it was possible, the casting being carefully annealed afterwards to remove any internal stresses. There was a feeling in Sweden against the use of cradles when the pole line crossed railways and roads.

CORRESPONDENCE

THE COUNCIL OF THE INSTITUTION OF ELECTRICAL ENGINEERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Along, I presume, with other members of the Institution, I have received a letter signed by Mr. W. A. Chamen asking for my "vote and interest" on behalf of Mr. H. Faraday Proctor for the forthcoming election for the Council of the Institution of Electrical Engineers.

I think that with certain safeguards the participation of the members in the election of the Council has many advantages, but I am strongly of opinion that the innovation of circularising the general body of the members in favour of a particular candidate, however eminent that candidate may be, is one that cannot be too strongly condemned, and I sincerely trust that, for the well-being of the Institution, the present unfortunate attempt to influence the members by circular may receive such a set-back as may prevent any recurrence of it in the future.

If this practice is allowed to take root and grow, then I fear it will cause a rivalry between the members of the various Local Sections with regard to representation on the Council that will seriously detract from the usefulness of the Institution.

I do not say that the method adopted by the Council of putting forward a bare list of the names necessary to fill the vacancies on the Council is an ideal one, but I think that in nominating three prominent members of Local Sections they have taken a step in the right direction, and one that is likely to commend itself to the general body of the members.

I have no personal feeling with regard to Mr. Faraday Proctor, who, I believe, would make an extremely good member of Council, but I do think that this attempt to influence members is one that will seriously affect the influence of the Institution, and I trust therefore that it will not receive the support of the general body of the members.

Yours faithfully,

709 Tower Buildings, Water Street, Liverpool, May 14th, 1910. THOS. L. MILLER.

STORAGE BATTERIES.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—With reference to the notice of a pamphlet issued by the D.P. Battery Co. in your paper of April 28th, we notice that mention is made of the load-regulating plant at the Gary Works of the Indiana Steel Co., described in a Paper by Mr. Woodbridge, Chief Engineer of the Electric Storage Battery Co., Philadelphia, of which an extract was given in your issue of September 16th, 1909.

To prevent misunderstanding, we should like to mention that the plant described by Mr. Woodbridge consists of a battery of "Chloride Accumulators" and special A.-C. regulating apparatus, for which we hold the patent rights in this country. Your notice does not make this clear, and is therefore misleading.

The striking economies obtained from "Chloride" battery-booster plants are well known to engineers, and the number in operation runs into hundreds. It is satisfactory to note that the Gary plant is taken as a typical case by our friends the D.P. Battery Co.

Yours faithfully,

THE CHLORIDE ELECTRICAL STORAGE CO., LTD.

Pendlebury, May 14th, 1910. *W. S. Naylor*, General Manager.

GLASGOW MAIN DRAINAGE. SHIELDHALL OUTFALL WORKS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Many of the articles which have appeared lately in the Press on the above works contain a great deal of misleading information.

For example, it is stated that :—

"The machinery, buildings, and mechanical plant at the Southern Purification Works, Shieldhall, are on lines generally similar to the corresponding installation at Dalmuir for the North-western Works."

While it is quite true that it is precipitation methods that are adopted at Dalmarnock, Dalmuir, and Shieldhall, the general arrangements and details of sub-structures, super-structures, and correlative machinery as designed by me are quite original and entirely different in principle to the arrangements and details of the other works. An inspection and comparison of the three works above mentioned will obviate the necessity of further argument with engineers.

As a matter of fact, many of my details of the Shieldhall plans were completed before similar details were completed for the Dalmuir works.

Yours truly,

WM. D. HAMILTON, *Consulting Engineer.*

59 Bath Street, Glasgow, May 11th, 1910.

[The statement objected to did not appear in ELECTRICAL ENGINEERING.—ED. *E.E.*]

Institution of Mining Engineers.—A meeting of this Institution will be held in the rooms of the Geological Society, Burlington House, London, on June 2nd and 3rd, when the President (Dr. J. B. Simpson) will deliver an address. On June 2nd the following Paper of electrical interest will be read: "A Storage Battery Extension to a Three-phase Colliery Power Plant," by W. Maurice.

South African Institute of Electrical Engineers.—The *Transactions* of this Institute for March, 1910, contains a short Paper by Mr. A. E. Scott on "Rotary Converters." Mr. E. Dew contributes "Some Notes on the Erection and Maintenance of Electrical Plant on a Gold Mine." Abstracts from London engineering periodicals, including reviews of books, take up a large proportion of the publication.

Glasgow Local Section of the Institution of Electrical Engineers.—As no further nominations have been received, the candidates nominated by the Committee to hold office for the ensuing session, of whom a list was given on page 267 of ELECTRICAL ENGINEERING of April 21st, have been duly elected. The annual report of the section submitted at the general meeting on Tuesday records an increase during the year of the members of all classes from 299 to 304.

Free Trade v. Protection.—Mr. F. B. O. Hawes, Secretary of the National Electrical Manufacturers' Association, asks us to state that should any Member, Associate Member, or Associate of the Institution of Electrical Engineers not have received a ticket for the meeting at Caxton Hall on Monday, May 23rd, when the question of free trade and protection in relation to the electrical industry will be discussed, he will be pleased to forward one on hearing to this effect. It is feared that some of the tickets sent out may have miscarried.

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ANNUAL PATENTS REPORT

THE annual report of the Comptroller-General of Patents for the year 1909 contains some interesting matter. It commences with a brief survey of the history of patents legislation, concluding with the Act of 1907, which has now been in force for two years. Referring to Section 27, which provides for the revocation of patents insufficiently worked in this country, the Comptroller states that the provisions of this section are not so stringent as in some other countries. In both Germany and Canada the obligation to work after a definite period is directly enforced; and the jurisdiction of the Court to revoke is not dependent, as in this country, on proof of the fact that the patented article or process is manufactured or carried on mainly or exclusively outside the country. Up to the present, there have been 73 applications to revoke, and 17 patents have been actually revoked. The patents revoked relate to very various inventions, including steam generators and motor cars, but none of an electrical nature. Under the present practice the applicant for revocation must give some *primâ facie* evidence that the article is mainly or exclusively manufactured abroad. For this purpose the whole foreign manufacture is considered, and to found jurisdiction something more than a mere percentage below one-half of the total manufacture must be shown; the question for the tribunal is "Is the patented article manufactured in the United Kingdom to as great an extent as can reasonably be expected, having regard to the industrial developments of other countries?" If a *primâ facie* case on this point is made out by the applicant, the patentee must defend himself by showing what he has done with his monopoly rights in this country. He must prove "adequate working," or give satisfactory reasons for his inaction. It may be noted that an application may be repeated, if new facts emerge or new grounds for revocation arise. There appear to have been many indirect results of the Act. The cases already tried show that, even when the patentee does not manufacture himself, orders have been given to British firms, and licences offered for the manufacture or carrying on of the article or process in order to meet the requirements of the section. The operation of the section has, however, not diminished the applications for patents.

As in former years, locomotion in general is the subject claiming the greatest number of applications, and it is interesting to note that the applications relating to aeronautics are over three times as many as in the year 1908. Considerable attention has been given to electric railway signalling systems in which the track rails are electrically continuous, and are used for both the signalling and the power circuits. The textile industry is also responsible for a noticeable increase in invention. Applications dealing with conveyors and transporters are much in evidence, particularly in connection with the carrying of coal and ores in mines from the working face to the bottom of the shaft.

The number of applications in 1909 was 30,603, as against 28,598 in 1908, an increase of 7 per cent., as against a decrease of 3 per cent. last year. The largest number of applications made on any one day was 155, and the smallest 52. Applications received from women inventors numbered 648, as compared with 572 in 1908. The total number of specifications of both kinds (provisional and complete) received in the year was 40,258, as compared with 37,241 in 1908, an increase of 3,017. There was a large increase in the number of applications from England and Wales, a slight increase in those from Scotland, and a decrease in those from Ireland. There were 1,509 applications communicated from abroad; of these, 731 came from the United States of America, 431 from Germany, 54 from France, 42 from Canada, 30 from Switzerland, and 28 from Austria-Hungary. These represent an increase in the cases of the United States and Canada only. Out of 14,170 patents sealed upon the applications made in the year 1896, 470, or 3·3 per cent., were maintained for the full period of 14 years. The total number of patents which expired (chiefly owing to non-payment of renewal fees) in 1909 was 15,276, and the total number of new patents sealed 15,065. Thus the number of patents in force was decreased during the year by 211.

The receipts from patents fees were £267,985, as compared with £262,890 in 1908, an increase of £5,095, and from Designs and Trade Mark fees £23,825. The receipts from the sale of Patent Office publications were £12,029, as compared with £11,898, an increase of £131. The total receipts were £302,839, as compared with £297,335, an increase of £5,504. The total expenditure on behalf of the Office was £208,536, as compared with £179,531, an increase of £29,005. This increase is principally due to a payment of £30,000 in connection with the purchase of site for the new office buildings. The amount paid for salaries increased by £5,242, and the expenditure upon stationery, &c., decreased by £6,075. This results in a surplus of over £94,300. The total number of persons employed in the office was increased during the year from 648 to 664. The number of readers who made use of the library was 157,235, as compared with 152,221 in 1908, an increase of 5,014, or 3·3 per cent., and the largest number recorded in any one year. The names of nine patent agents were added to the register during the year, the total number on the register on December 31st, 1909, being 265.

During the last ten years the number of hearings upon oppositions to the grant of patents was 1,304, and the number of appeals to the Law Officer in these oppositions 254, of which 43 were withdrawn or abandoned and 32 are still outstanding, while in one case the application for the patent was abandoned. The number of appeals heard by the Law Officer in these cases was therefore 178. In 103 of these appeals the decision of the Comptroller was supported, in 52 varied, and in 23 reversed. During the same period the number of hearings upon oppositions to amendments in specifications was 61, and the number of appeals 24, of which five were withdrawn, and four are outstanding. In the 15 appeals which were heard by the Law Officer, the decision of the Comptroller was supported in 10 cases, varied in two, and reversed in three.

ELECTROMETALLURGY AND ELECTRO-CHEMISTRY

THERE is an interesting article on the South Chicago Electric Furnace Plant of the United States Steel Corporation in the April number of *Metallurgical and Chemical Engineering*. It will be remembered that in February of 1909 the United States Steel Corporation adopted the Héroult electric furnace for steel refining. It was decided, in the first place, to erect two furnaces, each having a capacity of 15 tons, one furnace at the South Chicago works of the Illinois Steel Co., and the other at the Washburn and Moen works of the American Steel & Wire Co., at Worcester, Mass. The furnace at South Chicago is employed to refine molten metal from the Bessemer Converter, the one at Worcester to refine molten metal from the basic open hearth furnace. The object of the first combination is to produce steel of the open-hearth quality (or better) at a lower cost. The object of the second combination is to produce steel superior to the best acid open-hearth quality, at a slightly greater cost. Before the advent of these furnaces the largest Héroult furnaces had a capacity of only 5 tons, so that these have three times the capacity. Another point of difference is that previously the Héroult furnaces in America had cold charges or molten metal from the open-hearth furnace. But in South Chicago the combination with the Bessemer converter has been adopted for the first time. But perhaps the most important point is that previously the Héroult process had been employed as a substitute for crucible steel, for the manufacture of high-grade tool steels, &c., but now it is being used for the manufacture of rails, axles, and wire.

The plant at South Chicago has been in continuous operation since last May, and the Worcester plant since the beginning of this year. With the advent of and the continuous operation of these furnaces the Héroult furnaces can no longer be said to be in the experimental stage, and there is no doubt that in a short time larger and larger furnaces will be built. The furnaces are operated throughout the whole week, except on Sundays, when the Bessemer converter plant is not working. On the average twelve heats are made each day. In cases where the furnace was employed to dephosphorise and desulphurise, the energy used was 194·5 kw.-hours per metric ton; where the original phosphorus content was low 103·8 kw.-hours per metric ton.

The electrical supply is obtained from gas-driven generating plant, run with blast-furnace gas. The charge for energy supply is ¼d. per kw.-hour. Some little trouble was at first experienced with the electrodes, which were of amorphous carbon. It was found a difficult matter to bake evenly such large electrodes, and they frequently cracked, and this caused great trouble. The difficulty has been got over by using the more expensive Acheson graphite electrodes. They are made up of rods 48 in. long and 8 in. in diameter. Three such rods are butt-connected to a total length of 144 in., and three such rods are arranged side by side to form a single electrode. The outer part of the electrode is kept cool by means of a water jacket.

Four attendants are required for working the furnace, one head melter, one assistant, and two workmen. During tapping a little extra help is obtained from other workmen in the works.

Arc Lamp with Mercury Electrode.—A patent has been taken out in America by Dr. C. P. Steinmetz for a flame arc lamp with mercury as one electrode, and iron or aluminium as the other. The arc is enclosed in a long glass vessel containing the mercury at the bottom, and is struck and regulated by moving the other electrode in a vertical direction by suitable electromagnetic mechanism. A silicon compound of lithium is introduced into the globe. This material dissociates and sets free lithium which improves the colour of the arc. Silica salts are formed on the interior surface of the globe, but these are translucent, and do not absorb any appreciable percentage of the light.

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A NEW TESTING SET

THE testing set illustrated below (Fig. 1) has been designed by Mr. R. W. Paul (New Southgate, London, N.) as a *multum in parvo* for the central station engineer and mains man to perform practically every test that can be required of a portable instrument.

It consists of a "unipivot" moving coil micro-ammeter and sets of resistances and switches. The pivoting arrangement of the instrument, which is particularly interesting, is shown in Fig. 2. The coil swings round a fixed iron sphere between the poles of the permanent magnet, and the pivot which supports it is at the centre of this core, and works in a jewelled cup. The top connection to the coil is a light spiral spring,

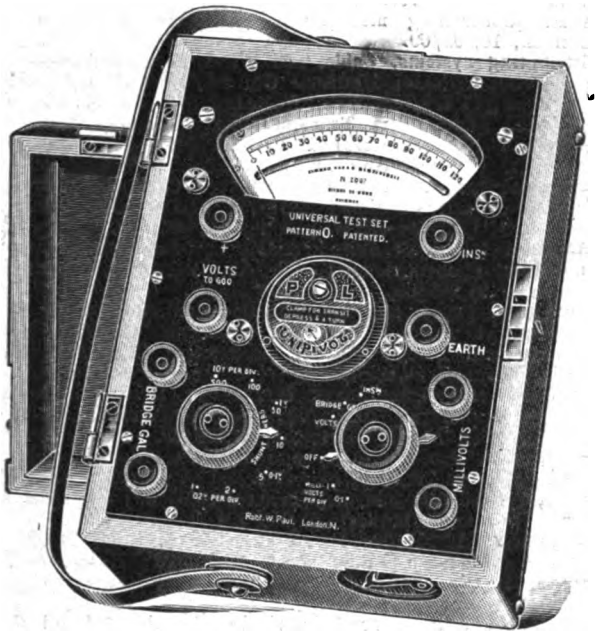


FIG. 1.—GENERAL VIEW OF SET; COVER REMOVED.

which tends to maintain the coil in its normal position when the instrument is tilted. This micro-ammeter has a resistance of 60 ohms, and reads from 0 to 120 micro-amperes on an equally divided scale.

A resistance of 20,000 ohms is connected in series with it, and a universal shunt is provided so that it may be used as a voltmeter reading from 0·02–2·4 volts (without a shunt) to 10–600 volts, with seven different ranges.

For use as an ammeter, two special low resistance shunts (one of which is shown in Fig. 3) are provided in the box, enabling currents up to 120 amperes to be measured, also in several ranges, so that it may be employed either for measuring the current through a single lamp or that taken by a whole consumer's installation. The screw part of the shunt terminals are bored conically so that a heavy cable may be inserted at the

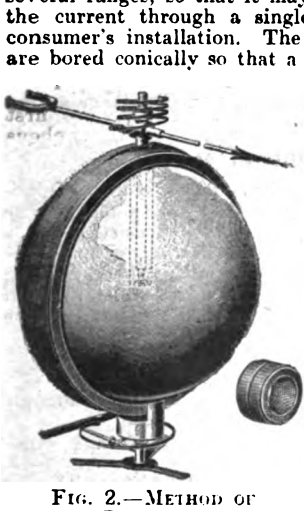


FIG. 2.—METHOD OF PIVOTING.

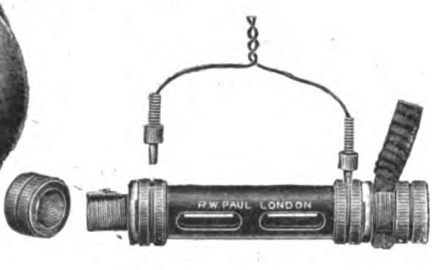


FIG. 3.—THE SHUNT.

end, and the milled nut, as it is screwed down, causes the split screw to come together and grip the cable.

For measuring insulation resistance, the instrument is first connected as a voltmeter across the battery or the mains employed for testing, and by turning a switch is then connected as a micro-ammeter in series with the insulation resistance to be measured: the insulation is then given by dividing the volts by the amperes, and, if necessary, subtracting the 20,000 ohms resistance which is in circuit with the instrument. By their being a high resistance permanently in circuit there is no danger of damage even if the proper shunt is not employed in the first instance; the resistance coil will withstand 600 volts. Small resistances may also be measured, from 10 ohms down to 0·00001 ohm, by the fall of pressure method.

By the use of switches the changes of connections for all these tests are of the simplest possible description.

Instructions are also given with the set for using it to localise faults on mains by the fall of potential method, or (by employing it in conjunction with a bridge) by the loop method.

An interesting detail is the provision of a small lamp, which can be inserted in the box beneath the micro-ammeter scale and can be lighted by a pocket 2-volt battery; it thus converts the instrument to an illuminated dial instrument, a facility which will be much appreciated, as tests have often to be carried out in dusky places.

Altogether, Mr. Paul's set is one of the handiest we have seen, and those mains men whose equipment is not complete in this respect should not fail to write to him for further particulars, which he will be happy to supply to any of our readers.

ELECTRIC WIRING IN MARYLEBONE

THE overhauling of the electric wiring of the Marylebone Baths, referred to on page 311 of our last issue, has been discussed at a special meeting of the Marylebone Borough Council. It will be remembered that the Electricity Department offered to do the work at cost price, *plus* a small sum for superintendence after completion, a rough estimate of the cost being £400. On the other hand, some Councillors are in favour of inviting tenders for the work from local wiring contractors. Councillor Duncan Watson, as usual, took a leading part in the debate, and complained that although the question was brought up some months ago, as a matter of urgency, it had been postponed from time to time.

Incidentally, Mr. Watson accused the Electricity Department of using foreign cables. Alderman Debenham denied this, but later in the discussion he admitted that he had been misinformed, and that the Marylebone Electricity Department did use foreign cable for the reason that there was a ring among British makers to keep the price up.

Mr. Watson further stated that, after an inspection of the baths, he would undertake to do the work in question for £250, and another Councillor later on suggested that this offer should be accepted. Mr. Watson pointed out, however, that this was impossible, as he, as a Councillor, is, of course, debarred acting as a contractor for the Council's work. This remark brought the unkind retort that this was probably why Mr. Watson had mentioned such a low price. Several members also ridiculed the suggestion that he could, in half an hour's inspection of the baths, arrive at an accurate estimate of the cost. Alderman Debenham said it had taken a man from the mains department—it was not proposed to do the work through the Sales Department—three days to work out the estimate of £400, but this was an outside price; the work would be thoroughly well done, and cost price charged as mentioned above.

The discussion also brought out an interesting conflict of opinion as to the duties of a municipal electrical engineer. Several members argued that Mr. Seabrook, having been appointed manager of the Electricity Department, should be at the service of all other Committees of the Council on electrical matters, and should not be allowed to say he would not draw up the specification if the Electricity Department were not given the work to do. This matter, however, was not pursued, and eventually the recommendation of the Baths Committee that the Electricity Department should be entrusted with the work was carried, only four voting against.

Institution of Electrical Engineers, Students' Section.—According to the annual report for the session just concluded, eleven meetings of the Students' Section have been held, the average attendance being twenty-five. The Papers read covered a wide range of subjects and elicited interesting discussions. The summer tour this year will take place from July 25th to 30th, when works and places of interest in and around Birmingham will be visited.

The Telewriter.—The Telewriter Syndicate will shortly open a public exchange for the use of subscribers to their system. A portion will be set aside for communication with the cable companies' offices. Subscribers will thus be able to transmit an urgent cable in writing direct to the cable companies' offices.

Russian Electrical Exhibition.—The Imperial Russian Technical Society is organising an exhibition to be held in St. Petersburg this year. The exhibition will run for three months, but the date of opening has not been fixed, but British electrical and other firms are being invited to send exhibits. The main intention of the exhibition is to demonstrate the application of electricity to steam railways; electric traction on main lines, on light railways, and on tramways; and the utilisation of waterfalls as natural sources of electric energy. Intending exhibitors are requested to communicate with the Organisation Committee, Panteleimonskaja-street 2, St. Petersburg.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 12th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

8,875/09. **Storage Battery Plates.** G. Okill. Plates for cells of the rolled grid pattern consist of lead grids with bars of triangular section. After the paste has been inserted the grids are converted into negative plates and successively charged and discharged at a high rate. After each reversal the plates are subjected to pressure. Two such plates, with a separating sheet of perforated celluloid, are then rolled up into a scroll, with the wider parts of the tapered spaces at the inner surfaces of the scroll. Finally, one of the plates is converted into a positive plate. The grids, which are intended for positive plates, are provided with slots in their margins to prevent buckling. Three claims, two figures.

11,304/09. **High-tension D.-C. Series System.** T. von Zweigbergk. When a number of H.-T. d.-c. motors are connected in series with one circuit-breaker, a flash-over may occur on the commutator of one machine without the breaker operating, as the back E.M.F. of the other motors may keep down the current. An arc may thus be formed across the commutator in question. In order to avoid this, insulated terminals connected direct to the circuit-breaker are provided above each commutator. Should any machine flash over, the arc is immediately transferred to the terminal above the commutator, and the circuit-breaker is operated. Four claims, one figure.

15,115/09. **Reflector Lamps.** C. C. Regnart. The trough is of porcelain, with the concave surface glazed. Bare wire conductors are arranged in longitudinal holes in the body, and terminate in split pins and sockets respectively at the two ends. The sockets for the lamps are integral with the porcelain body, and are provided with contacts in connection with the conductors. A metal reflecting surface may be added. By means of the pins and sockets, any number of these units may be connected end to end to form a long rigid trough. Two claims, four figures.

15,158/09. **Protection of Telephone Circuits from Disturbances Due to A.C. Traction Systems.** J. Sayers. Both electrostatic and electromagnetic induction are neutralised by providing an auxiliary insulated conductor parallel to the trolley wires and the telegraph or telephone wires to be protected. In the case of a double line railway with a trolley wire over each track, two insulated wires are run parallel to the trolley wires, and are connected at both ends so as to form a closed circuit. At the point where current is fed into the trolley wires, the auxiliary circuit is connected to one pole of a small A.C. generator, which charges it at the same frequency as that of the system, but at a lower pressure and 180 degrees out of phase. The other pole of this generator is earthed. Further to neutralise the electromagnetic induction, the auxiliary circuit includes the secondary coil of a transformer, the primary of which is connected to the secondary of another transformer, the primary of the second transformer being in series with the main trolley-wire circuit. By this means a low-pressure current proportional to the main traction current, but 180 degrees out of phase with it, circulates in the auxiliary circuit. Four claims, one figure.

3,400/10. **Telephone Exchange Apparatus.** Siemens Bros. & Co., Ltd. (*Siemens & Halske A.-G.*). In telephone exchanges in which a register records the time of conversation between subscribers, the operator completes the circuit of this register, which is worked by current impulses received at intervals from a rotating device common to all the registers of the exchange. In order that the register shall start recording only after speaking begins, two contacts are provided in the circuit; one is closed by the calling relay of the calling subscriber, and the other by the calling relay of the called subscriber. Further, to reduce the current required by the registers, they are sub-divided into groups with separate rotating devices to give the impulses. These devices rotate synchronously, but supply the current impulse to the different groups of registers in succession, so that current is required for one group at a time only. Three claims, one figure.

4,095/10. **Insulated Shaft Coupling.** J. R. Grundy. Each of the shafts to be coupled is provided with a flanged hub, apertures being cut in the flanges. A disc of leather, raw hide, or other suitable insulating material is placed between, and is provided with projections on both faces, which fit into the apertures on the flanges. The projecting pieces may be integral with the disc, or rivetted on. The lugs are undercut, and the sides of the apertures inclined so that the two flanges are drawn together, and a direct transmission of the torque through the faces of the flanges is effected. Two claims, four figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Brush Electrical Engineering Co. and Bastian [Vapour rectifiers] 10,409/09; Grote, 11,282/09; Weaver [Controlling mechanism] 14,674/09; Messenie and Slaughter, 16,292/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: British Thomson-Houston Co. and Wedmore [Distribution systems] 11,285/09; Sharp [Manholes] 22,187/09.

Dynamos, Motors and Transformers: Parsons, Law and Stockbridge [Commutators] 10,588/09; Siemens Schuckertwerke Ges. [Transporting machines] 25,627/09.

Electrometallurgy and Electrochemistry: Girtin [Electrolytic production of salt solutions] 20,192/09; Langbein-Pfanhauser Werke A.-G. [Ductile electrolytic iron] 24,841/09.

Incandescent Lamps: Felten & Guilleaume Lahmeyerwerke A.-G. [Metal filament lamps] 17,960/09; Zschocke [Metal filament lamps] 21,285/09.

Switchgear, Fuses, and Fittings: Jackson and Hurst [Controller contact fingers] 9,829/09; Electric Control, Ltd., Macmillan and Dryer [Switch mechanism] 12,395/09; Rush [Lighting fixtures] 24,599/09.

Telephony and Telegraphy: Mulligan [Driving automatic telegraphic apparatus] 10,223/09; Amalgamated Radio-Telegraph Co. (*Von Bronk*) [Detector] 27,689/09.

Traction: J. Stone & Co., and Darker [Electric lighting, heating, and ventilating of vehicles] 7,425/09, 10,511/09, 7,468/10, 7,470–1/10; Simpson [Brakes] 9,404/09; Gresham and Kiernan [Vacuum brakes] 11,236/09; Smith and Watson [Trolley head] 12,607/09; Rizzo [Electric braking] 21,669/09; Wheatley (*Hoadley*) [Brake shoes] 23,997/09; Herbert [Rail joints] 26,460/09; Elorza [Brakes] 27,086/09; Boirault [Automatic brakes] 30,088/09.

Miscellaneous: Perrett [Electrical extraction of oil from water] 26,477/08; Bailey [Aluminium solder] 9,654/09; Dyhr [Current generators actuated by movements of the body] 11,107/09; Reiner and Whitehead [Illuminated signs] 11,112/09; Zabski [Electric locks] 14,164/09; Michaelson [Trolley clips] 22,904/09; Robillot [Fire and burglar alarm] 26,623/09; Steiger and Besancon [Electric clock] 27,154/09; McElhinney [Electro-therapeutic apparatus] 1,883/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: Allgemeine Elektricitäts-Ges., 9,209/10.

Electric Ignition: Weckerlein and Stocker [Contact breakers] 6,033/10.

Electrochemistry: Politz [Protection of pipes from electrolysis] 9,094/10.

Incandescent Lamps: Beuttell, 9,615/10.

Telephony, &c.: Colin and Jeance [Wireless telephony] 18,436/09; Neuhold [Automatic telephone systems] 7,659/10.

Traction: Dibble [Air brakes] 8,953/10.

Miscellaneous: Akt.-Ges. Brown, Boveri et Cie. [Condensing plants] 19,295/09.

Opposition to Grant of Patent

12,844/09. **Magneto Massage Machine.** B. Seacombe. Opposition has been entered to the grant of this patent. The specification describes a massaging apparatus consisting of a roller with a corrugated metal surface, driving a magneto-generator through a gear train. By means of a contact-making device, an intermittent current is passed from the roller through the part being massaged, and back through the hands. Three claims, five figures.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: A. F. Berry [Insulation of transformer windings] 1,526/05.

Heating and Cooking: J. M. Herrgott [Fabrics with embedded heating wires] 2,377/02.

Switchgear, &c.: Otis Elevator Co. (*Otis Bros. & Co., U.S.A.*) [Push-button lift control gear] 1,883/98; N. Rowe [Transformer regulating switch] 18,366/98.

Telephony, &c.: P. Picard [Telegraph relays] 2,382/98.

Traction: G. T. Hyde (*New York Air-Brake Co.*) [Brakes] 2,158/03; S. A. Russell and E. Ford [Controller and brake mechanism] 1,732/05.

Miscellaneous: H. H. Cooper [Table-cloths with embedded conductors] 2,284/02; R. Taylor [Ventilation of tramcars] 2,286/04; R. Peters [Utilisation of carbon ends] 2,558/04.

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NEW GENERATING STATION IN WESTMINSTER

THE new station of the Westminster Electric Supply Corporation, which has been erected in Horseferry Road, Westminster, to replace the company's original station in Millbank Street, is now complete, and has been dealing with the whole of the load formerly supplied by that station since the beginning of the month.

The Millbank Street station was opened in 1890, but its site came within the area recently acquired by the London County Council for the extension of the Thames Embankment. The Bill under which the site was acquired contained clauses requiring the Council to provide an equivalent site for a new station for the Company, to bear the cost of erection of a new station equivalent to the existing station at the time of removal and of the necessary alterations of mains, and to make good by a lump sum as compensation any loss due to the facilities for coal supply and condensing water. The new site provided under these conditions is some 300 yards away from the river. Arbitration was resorted to in order to decide the sum payable to the Company in connection with the transfer, and Mr. J. A. Simon, K.C., M.P., who was umpire, awarded a total sum of £181,371, including £12,500 in respect of the cost of cartage of coal and £3,100 for other matters agreed upon between the parties. These sums do not include the cost of constructing a subway, in which the pipes for conveying condensing water from the River Thames are laid. The subway and pipe-work between the station and the river has been carried out by the Council itself, and under the arrangement the Council have acquired the plant and equipment of the old station, which was ready for handing over by the date specified, viz., May 1st. The two stations were run in parallel for a short period before the old station was given up, but the whole load was taken over by the new station on May 2nd.

The buildings of the new station are particularly substantial and elaborate, both as regards the exterior, with its ornamental stone frontage, and the interior arrangements. They were designed by Mr. C. Stanley Peach, architect, and were erected by Messrs. Mowlem and Co. A distinctive feature of the arrangement is the disposition of the plant in two floors. The lower floor contains the turbine-driven continuous-current generating plant, while the upper floor is devoted to motor generators for dealing with the additional supply from the station of the Central Electric Supply Co. at Grove Road. The station is thus a combined generating station and sub-station. Its ultimate capacity is 6,600 kw. of generating plant, of which 3,600 kw. are already in place, and 15,000 kw. of converting plant, of which 3,000 kw. has already been put down. The building is of considerable height, for even though it has another floor above it, the engine-room is commodious, lofty, and particularly well lighted by large windows. Otherwise the general arrangement calls for little remark; the boiler-house is parallel to the engine-room, and the switchgear and offices are on the opposite side. Upstairs, in addition to the motor generators, there is a battery-room and provision for the booster and other auxiliary plant.

All coal has to be carted, but, as already mentioned, the company are compensated for this disadvantage. The coal-conveying arrangements are simple and straightforward; coal is tipped from the carts into a hopper, and taken direct to the bunkers over the firing floor by a bucket-conveyor. This does not pass under the boilers for reception of the ashes, as is often the case, but these are hoisted in skips and taken away by a small transporter.

The boilers at present installed are four in number, arranged in a single row, and each consisting of a double-drum Babcock & Wilcox water-tube land-type unit, capable of evaporating 20,000 lbs. of water per hour, with a working pressure of 200 lbs. per sq. in., and a superheat of 150° F. They are fitted with internal superheaters without any means of adjusting the superheat, but the novel arrangement is adopted of providing a mixing valve by which the superheat of the steam supplied can be kept constant by adjusting the proportions of saturated and superheated steam delivered. A thermometer dial is provided at each boiler front for that purpose. Chain-grate stokers are used, and positive clutches permit of the stoker shaft being driven by a motor from either end. The economisers are made with steel tubes that do not require continual scraping. Provision is made, however, for their being cleaned occasionally by compressed air. They are fixed immediately behind the boilers, and embody the counter-flow principle. A special feature is the use of steel-cased flues, lined with slabs of firebrick, bolted on to the steel casing with a packing of sand at the top. Messrs. Kennedy & Jenkin, the consulting engineers, have used this type of flue with great success elsewhere, and believe that it secures a considerable saving in upkeep, and is considerably more airtight than the more usual brick construction. The steam piping arrangement permits of each boiler being used, either on its own turbine or to supply a common steam main. The feed-pump room is at the end of the boiler-house. In addition to a pair of ordinary Wier steam pumps there is a specially designed vertical shaft electrically-driven centrifugal pump, supplied by Messrs. W. H. Allen, Son & Co., of Bedford. A long shaft permits of the motor being mounted well away from the pump on a sort of upper floor of the pump-room. Lea recorders measure both the air-pump discharge and the make-up feed, and the whole feed is further passed through a Kennedy water meter, and heated by the feed-pump exhaust. The make-up feed water is passed through the oil-coolers of the turbines. Feeder water can be obtained either from a well, or in emergency from the town mains. Both steam and electric pumps are provided for the well, and another electric pump drains the hot sump into which the boilers are blown down.

The three main turbines are on the Zoelly principle, constructed by Messrs. James Howden & Co., of Glasgow, and each drives a pair of 500-kw. continuous-current generators, manufactured by Messrs. Siemens Brothers Dynamo Works, Ltd. Two smaller turbines of similar construction are used for the steam balancers. (A description of the Howden Zoelly turbine was given in ELECTRICAL ENGINEERING, Vol. V., p. 927.) The condensing plant is placed immediately under the turbines in the usual way, and a water-sealed expansion joint is provided between each exhaust flange and condenser. The condensers are of Messrs. Willans & Robinson's "contraflo" type, with electrically-driven Edwards' air-pumps, and can easily maintain a 95 per cent. vacuum without any vacuum augmenting devices.

The circulating water is obtained from the river through four 20 in. pipes about 300 ft. long, laid in a subway constructed by the County Council from designs of Mr. Maurice Fitzmaurice. These are arranged on Messrs. Bailey & Jackson's principle, so that the direction of flow in either can be altered at will. Fixed and rotary strainers are used, and steam ejectors are provided for priming the pipes. Very complete precautions are taken for avoiding air locks in the pipes by the provision of connections at suitable points, taken to a sealed catchpot on the roof, which is kept exhausted by a vacuum pump, and drained by a barometric leg.

The main generating sets, as already mentioned, consist each of a pair of 500-kw. machines in tandem. We understand that Messrs. Siemens Brothers Dynamo Works, Ltd., were willing to supply single machines for the output, but for various reasons double sets were preferred. Each machine is quite independent from its fellow, and has entirely separate switchgear. The machines are shunt wound, but can be separately excited from the battery if desired. Each pair is designed

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for an output of 1,000 kw. continuously, or 2,440 to 2,175 amperes at from 410 to 460 volts respectively at a speed of 1,850 r.p.m., 25 per cent. overload for half an hour, and 40 per cent. overload for three minutes. They are provided with compensating windings, as well as commutating poles, and carbon brushes only are used. The machines are enclosed and ventilated by fans carried on the armatures. Air is drawn in through a series of filters through ducts from a closed chamber under the switchboard containing the rheostats, &c., and fed by further ducts from the roof. The hot air rises from the "chimneys" of the machines into the engine-room. A steam consumption of 17·1 lbs. per kw.-hour has already been obtained on full load, and even better results are anticipated. The two steam balancers are similar to the main sets, but of 300-kw. capacity each.

Turning now to the converting plant, we find in the motor-generator room on the first floor three 1,000-kw. Oerlikon induction motor-driven sets. The motors are of the slip ring type, with the resistances attached to the rotors, and a very neatly designed internal starting short-circuiting and brush-lifting arrangement. There is also a 300-kw. balancer, driven by an induction motor from the Grove Road supply. This, like the steam balancers, is entirely hand regulated. Further auxiliary plant comprises two battery booster sets by the British Thomson-Houston Co., Ltd., and a small milking booster.

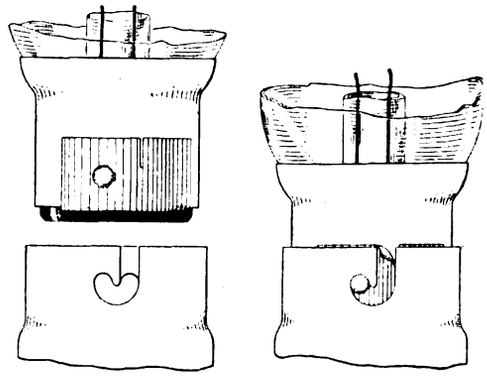
The battery is arranged in two sections of 100 cells each, one for each side of the three-wire system, and the boosters are connected to the middle wire side of each section of the battery. It was supplied by the Tudor Accumulator Co., and its rated capacity is 950 amperes for three hours, 1,200 amperes for two hours, and 2,100 amperes for one hour. Although the actual connections to the cells are of copper, the leads from the battery to the switchboard are entirely of solid aluminium. The battery can be used to assist in the peak load if desired, but its main function is to serve as a stand-by to maintain continuity of the station auxiliary service and the supply to the Houses of Parliament in cases of emergency. It should be mentioned here that all the battery and booster regulation is entirely by hand, and indeed the complete absence of any form of automatic electrical regulation is an important feature of the station.

The continuous-current switchgear is necessarily somewhat intricate, as it has to provide for both the generating and converting plant, the battery and its boosters, the balancers, and the outgoing feeder arrangements, including a special independent feeder to the Houses of Parliament. The arrangement, however, is really simple and straightforward, and without undue complication. Practically the whole of the main D.C. switchgear is together on a large board in a gallery in the turbine house, and the motor-driven balancers, the boosters, and the battery are all controlled from this point. What may be regarded as extensions to the bus-bars is taken up to the board in the motor-generator room, but the whole direct current feeder arrangements are downstairs. The battery and its boosters are also controlled entirely from the main board. It is not necessary to describe each panel in detail. The whole gear was supplied by the British Thomson-Houston Co., and is of the ordinary vertical board type with slate panels. One point of special interest is the extensive use of aluminium connections supplied by the British Aluminium Co. Although for the sake of compactness the actual bus-bars and actual connections on the backs of the panels themselves are of copper, all other connections, including the main connections to the generators, &c., are of aluminium rod. On the board itself mechanical connections are used, but elsewhere the rods are all connected by butt welded joints. The bus-bar system is arranged in two sections, which can be coupled together or worked separately. Vertical plug-bars permit of any generator, balancer, or feeder being connected to either bar through its main automatic cut-outs. These in the case of the generators are fitted with reverse current releases, and in the case of the feeders with overload releases. The special House of Commons feeder is connected to the lower bus-bar without plug-bars, and this part of the bar can be isolated, so that the supply can be given independently from the rest of the system by two balancers or the battery. The battery main circuit-breaker is arranged to cut it off from the upper bus-bar in case of overload, but to leave it connected to this section of the lower bar. At the House of Commons there is a change-over switch, so that the supply can be taken either from the general network or from its special feeder. There are in all six generator panels, twelve feeder panels, two steam-balancer panels, one motor-balancer panel, one middle-wire and bar-coupling panel, the House of Commons feeder panel, two battery panels, two booster motor panels, an excitation-circuit panel, and two auxiliary-circuit panels. The high-tension switchgear in the motor-generator room is of the British Thomson-Houston Co.'s standard pattern, with all H.T. gear in cells behind the board. It is combined with the D.C. motor-generator switchgear by arranging the oil-switch operating levers between the D.C. panels. There is also a small milking booster board in the motor-generator room.

In conclusion, we wish to express our thanks to Mr. C. O. Grimshaw, Chief Engineer to the Westminster Electric Supply Corporation, Ltd., and to Messrs. Kennedy and Jenkin, the consulting engineers, to whose designs the station was built, for permission to describe the station and for much kind assistance.

A SIMPLE LAMP LOCK

A VERY simple device known as the "Lamlok," which has recently been introduced, is illustrated here. It consists of a small curved piece of sheet metal of such a thickness as to fit in between the lamp-cap and the holder, and provided with a hole to pass over one of the lamp pins, and an ear to lie over the edge of the cap, and so to keep the plate straight. There is a slit in one side of the plate, and when the lamp has been put in it can be locked by turning up the side of this slit in the plate by a knife in the manner shown in the figure. The



LOCK READY FOR INSERTION. LAMP LOCKED.

lamp can then only be removed by bending the plate down again with a suitable tool, but to anyone not knowing how the lamp is locked, this method would not be likely to suggest itself. The joint patentees of the device are Messrs. C. M. Bennett and C. N. Jeffcoat. All inquiries should be sent to the latter at 2 Marchmont Court, Addison Gardens, W. The patent, which has been applied for, also covers an alternative method of locking by forming an L-shaped slit in the lamp-cap itself, which can be bent up in a similar way.

The Society of Engineers.—We have been requested by the Secretary of the Society of Engineers (Incorporated), 17 Victoria Street, S.W., to remind our readers that the last date on which essays in competition for the Status Prize can be received is Tuesday, May 31st, 1910.

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LOCAL NOTES

ACTON: *The Electricity Undertaking.*—The Electricity Committee have had under consideration the position of the Electrical Engineer, and the electrical undertaking generally. As announced in our last issue the Council referred back a recommendation that the electrical engineer should hand in his resignation. At the last Committee meeting the Chairman said the real question was whether the undertaking should be transferred to the Metropolitan Electric Supply Co., and a resolution was passed recommending the Council to come to an immediate decision in connection with the matter.

AUSTRALIA: *Melbourne: Tramways.*—The tramways in Melbourne and its suburbs were constructed by the Melbourne Tramways Trust, representing the various municipalities, and were leased to the Metropolitan Tramways & Omnibus Co. for 32 years from July 1st, 1884. There are thus six years unexpired. At present the lines are mainly cable, with a few miles horse tramway. A movement is being made to take over the undertaking and convert it to electric traction without waiting for the natural expiry of the concession.

COVENTRY: *Electricity Accounts.*—The profit for the year to March 31st was £10,238, compared with £3,765 in the previous year. After handing over £2,500 to the relief of rates, the balance is to be applied to writing off the cost of superseded and obsolete plant. In view of the satisfactory result of the year's working, each employee is to receive a bonus of a fortnight's pay.

FIFE: *Tramway Extensions.*—An inquiry was held last week at Edinburgh, under the Private Legislation Procedure (Scotland) Act concerning the extensions proposed by the Dunfermline & District Tramways Co. The main extension will be from Dunfermline to Rosyth. Mr. W. C. C. Hawtayne gave evidence on engineering questions, and the promoters having agreed to carry out certain road widenings, the preamble of the provisional order was found proved.

FROME: *Proposed Transfer of Electricity Works.*—A large sum of money has been due from the Council to Messrs. Edmundson's Electricity Corporation, Ltd., in respect of the electricity works for about two years. Recently a proposal was made that the company should take the works over, but the Council has delayed coming to a definite decision. The company is now getting impatient at the delay in a settlement one way or the other, and has demanded a settlement.

GLASGOW: *New Telephone Exchange.*—The Commissioners of H.M. Public Works and Buildings are arranging for the erection of a new telephone exchange in the Bridgeton district.

Smoke Abatement Exhibition.—A smoke abatement exhibition, under the auspices of the Corporation, will be held in Glasgow from Friday, September 16th, to Saturday, October 8th. Electric or gas power will be supplied to exhibitors free of charge. The charge for space will be 2s. 6d. per square foot.

GRIMSBY: *Street Electric Lighting.*—It is proposed to convert 282 street gas lamps to electric lamps. The Council intend to convert all gas lamps in streets where electric mains are laid, and to charge the same price as for the existing gas lamps. Mr. Hooper, of the Local Government Board, who recently held a local inquiry, said the Board desired to have evidence that the present lighting was defective, or at any rate that the new lighting would be equally effective at no greater cost. Mr. W. A. Vignoles, the Borough Electrical Engineer, said information on this point had already been sent to the Local Government Board, and he did not wish to read out the detailed figures in public. The Inspector agreed.

LEICESTER: *Proposed Tramway Extensions.*—A scheme for extending the tramways will shortly be considered by the Tramways Committee.

LIMERICK: *The Electricity Undertaking.*—At the last meeting of the Corporation it was decided to obtain the services of a competent expert, "with a practical knowledge of the working of a successful power station," to examine and report on the municipal electric lighting station.

The loss on the undertaking for the year to March 31st was £1,255, making a total deficit since the commencement of the undertaking of £8,140.

LONDON: *London County Council: Through Tramway Running.*—Arrangements have at last been concluded for a through service of tramways from Aldgate to Ilford, over the lines of the West Ham, East Ham, Walthamstow, Leyton, and Ilford Councils.

Fulham: Free Wiring.—The Borough Council has sanctioned a proposal for the free wiring and fitting of consumers' premises. The Council will wire for approximately six lights per house or flat, and supply the necessary plain fittings, free of charge, in connection with the prepayment meters. The wiring will be done by local contractors. The wiring will, if necessary, be upon the "Stannos" system. The estimated capital cost of wiring and supplying the necessary fittings for six lights, including a transformer, is £3 3s. per consumer. If the landlord undertakes to be responsible for all renewals of lamps, other than those necessitated by fair wear and tear, the charge will be 5½d. per unit; but where the provision and renewal of lamps is not included in the scheme, the charge will be 5d. per unit. It has been ascertained, as a result of preliminary circular and canvass in some four streets, that about 112 new consumers may be expected to at once adopt electric light if this system is introduced, and the probabilities are that a very much larger number will be connected to the mains within the first year. The Committee recommend making provision in the first instance for wiring 500 houses at a total estimated expenditure of £2,000, made up as follows:—Wiring and fitting, 500 at £2 8s., £1,200; 500 transformers at 15s., £375; 3,000 lamps at 2s., £300; provision for extra points where required, £125.

Hackney: Sales Department.—The Electricity Committee have been inquiring into the possibility of extending the usefulness of the sales department. Since 1908, when this was commenced, over £6,000 worth of work has been executed at a profit. The department, however, possesses no show-room, and there is only one permanent staff officer, assisted by a temporary clerk and an assistant engineer. Premises have now been taken in Mare Street, Hackney, for the purposes of a show-room.

Hampstead: Street Lighting.—A proposal by the Electricity Committee to convert all the remaining street gas lamps to electric lamps has been referred back in consequence of an offer by the Gas Light & Coke Co. to fit up a trial installation of twenty inverted gas burners. There are already 340 lamps lighted by electricity in Hampstead, and the Council have sanctioned the conversion of 700 more. Apart from the fact that new lighting consumers are immediately secured when mains are laid for street lighting, the proposals of the Electricity Committee were such that after 1918 the cost of lighting the borough would be £3,747 against £7,242 at present. The recommendation to refer back was carried by one vote, the figures being 18 to 17.

PENMAENMAWR: *Electric Lighting.*—The Council have been granted an extension of twelve months in which to put their electric lighting order into force. Negotiations are being carried on with the North Wales Electric Power Co., who will shortly be extending their transmission lines into the district.

READING: *Tramway Profits.*—The net profit on the tramways for last year was £3,159, which the manager recommends should be carried to reserve.

SOUTHAMPTON: *The Barber Radial Truck.*—The Tramway Manager reports having obtained very satisfactory results with the "Barber" radial axle truck, its behaviour round curves having exceeded his expectations.

SOUTH SHIELDS: *Tyne Tunnel Railway.*—The proposition of the Parliamentary Committee that the promoters of the North and South Shields Electric Railway Bill should deposit a sum of money equal to two years' interest on the purchase price of certain land required, such sum to be forfeited in the event of the promoters not putting into force the compulsory powers of purchase, has not been accepted. The Bill is consequently to be opposed.

STOKE-UPON-TRENT.—*Management of Electrical Undertakings.*—The Electricity Supply Committee of the new County Borough of Stoke-upon-Trent have selected a sub-committee to consider the appointment of a chief electrical engineer. In the meantime, the appointment of the existing chief engineer is being continued.

TORQUAY: *Stud Tramway System.*—It is reported that an intimation has been received at Torquay that the Board of Trade will not renew the licence for the present surface-contact system of tramways unless considerable improvements are effected, especially in respect of the working of the studs, after October 30th next, when the present term expires. It may be remembered that the National Electric Construction Co. some time ago recommended the Council to allow them to replace the Dolter system by the overhead system.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BATLEY.—A lighting and traction switchboard is required for the electricity works. Particulars from the Borough Electrical Engineer, and tenders by June 2nd.

BELFAST.—The Local Government Board have authorised a loan of £6,000 to the Board of Guardians in connection with an electric power-house at the White Abbey Sanatorium.

In connection with certain extensions of the tramways, the Electrical Engineer is to prepare estimates of cost of the additional generating plant.

BRIDLINGTON.—An inquiry has been held concerning a loan of £3,000 for extensions at the electricity works.

BULGARIA.—It is reported that the communal authorities of Philippopolis will shortly invite tenders for an electric light installation and for the construction of electric tramways.

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BURY.—A proposal of the Electrical Engineer for extensions to the generating plant was reported upon unfavourably by the Electricity Committee at the last meeting of the Council. The view of the committee is that the spare plant is sufficient for the present, but an amendment to adopt the Engineer's proposal was carried.

COPENHAGEN.—The Corporation require two 1,000-kw. converters or motor generators. Particulars from Elektrisk Station, Gothersgade 30, Copenhagen, and tenders by June 2nd.

CORNWALL.—The Cornwall Electric Power Co. are about to erect a power station at Hayle.

COVENTRY.—A 2,500-kw. turbo-alternator with condensing plant, four water-tube boilers, and two fuel economisers are required. Particulars from the Borough Electrical Engineer, and tenders by May 30th.

DUBLIN.—Howth Castle, the ancient seat of the now defunct Earls of Howth, is to be electrically lighted, under a scheme prepared by Mr. A. M. Porte.

DUNDEE.—Notice has been received from the Scottish Office granting the Electricity Department increased borrowing powers to the extent of £50,000.

RHYL.—The Council have sanctioned mains extensions, at an estimated cost of £642.

ROTHERHAM.—Mains are to extended in Wellgate, Gerrard Road, and Moorgate at an estimated cost of £620.

SHEFFIELD.—Mains are to be extended in the Meersbrook district at an estimated cost of £925. Other extensions to cost £485 are to be carried out.

WAKEFIELD.—An inquiry was held on Thursday concerning a loan of £7,150 for extensions at the electricity works. Mr. H. R. Hooper, the Inspector, questioned whether the Local Government Board would grant a further loan until the present loss on the undertaking had been cleared off. He also required further information with regard to the accounts. The inquiry was consequently adjourned *sine die*.

WALSALL.—The Local Government Board has sanctioned loans for £8,345 for the following purposes :—Land, £1,000; sub-station, £1,250; sub-station plant, £1,404; mains, £3,691; services, £1,000.

Miscellaneous

LYNTHWAITE.—The Local Government Board have sanctioned a loan of £30,000, repayable in 30 years, for the reconstruction of the tramway track, a matter which has been in dispute with the Huddersfield Corporation for some time.

YARMOUTH.—It is proposed to convert 192 gas lamps to electric lamps. The Surveyor suggests converting 186 arc lamps to flame arcs, with some 400 candle-power glow lamps, which will effect a saving of £200 per annum.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

PROVINCES.

BOURNEMOUTH.—Library, Lansdowne (£7,000). F. W. Lacey, Surveyor, Town Council.

BURNLEY.—Partial reconstruction of works (£2,400) for the Burnley Paper Works Co.

CREWE.—School (800 places), Derby Street. Education Committee.

Theatre, for the Crewe Theatre Co.

CROYDON.—Enlargement of Central Polytechnic (£5,600). Geo. F. Carter, Engineer, Town Council.

GATESHEAD.—School, Brighton Avenue (£6,808). Education Committee.

NORTH SHIELDS.—Theatre (£3,700). H. Gibson & P. J. Steinlet, Architects, 56 Camden Street, North Shields.

PETERBOROUGH.—School (£7,250). Architect, A. H. Brownrigg, Hazelmere.

POOLE.—School, South Road (£7,300). Education Committee.

WATFORD.—Grammar-school, Cassiobury Park. Russell & Cooper, Architects, 11 Gray's Inn Square, W.C.

YARMOUTH.—Rebuilding refreshment rooms, Fish Wharf (£2,500). Borough Surveyor, Yarmouth Town Council.

A Rapid Piece of Emergency Work.—Mr. P. P. Wheelwright, Engineer and Manager, Blackburn Electricity Department, has sent us some particulars of a temporary installation of motors totalling 186 h.p., which his department has recently put down at the Struan Mill of 870 looms. Part of the main driving gear of the mill had broken down. Information of the breakdown was given to the Electricity Department on the Saturday at noon, and by Monday morning a motor in the top shed was driving 100 looms; on the Tuesday another 100 looms were started by another motor, and by the Thursday 500 more looms were at work. In one case a single motor could not be obtained large enough for the work, so two motors were belted to one shaft, care being taken to adjust the sizes of the pulleys so that the load was properly shared.

TENDERS RECEIVED AND ACCEPTED

BELFAST.—The tender of Messrs. Hamilton & McMaster (Belfast) has been accepted for alterations to the circulating pumps at the electricity works.

BRISTOL.—The Corporation have accepted the following tenders :—General Electric Co., Ltd., annual supply of meters, £546 4s.; Bruce, Peebles & Co., Ltd., 500-kw. converter for Underfall Yard sub-station, £1,230.

DARTFORD.—The Council have accepted the following tenders :—Messrs. Johnson & Phillips, Ltd., 900 yards 0·15 sq. in. and 450 yards 0·07 sq. in. lead-covered and paper-insulated cable, £141; The Universal Electrical Manufacturing Co., one 12-way feeder pillar, £31.

DUNDEE.—The electric lighting contract for the lighting of St. Paul's Cathedral has been given to Mr. T. C. Keay.

LONDON: *London County Council.*—The Highways Committee recommend the acceptance of the tender of Mr. A. N. Coles at £123,676 for the roadwork and platelaying of Tooley Street to Greenwich tramways.

The tender of Messrs. David Bridge & Co., Ltd., for shafting, bearings, brackets, pulleys, &c., at the Central Car Repair Depôt at £457 is recommended for acceptance.

The tender of Messrs. Alley & MacLellan, Ltd., at £187 10s. for air compressor and receiver is also recommended for acceptance by the Highways Committee.

The tender of the Patent Shaft & Axletree Co., Ltd., for the supply of 4,800 steel driving-wheel tyres at 21s. 6d. each, and Messrs. John Batt & Co., Ltd., for 1,600 steel pony-wheel tyres at 15s. 9d. each, are recommended for acceptance by the Highways Committee.

Hammersmith.—The Council received the following tenders for cables :—Standard Cable Co., £625 (foreign); Union Cable Co., £658 (Germany); Western Electric Co. (accepted), £660; Aubert Grenier & Co., £672 (foreign); Callender's Cable & Construction Co., £700; Siemens Bros. & Co., £700; Johnson & Phillips, £700; British Insulated & Helsby Cables, Ltd., £705 9s. 4d.; W. T. Henley's Telegraph Works, £710; W. T. Glover & Co., £715; General Electric Co., £735 8s. 9d.; Craigpark Electric Cable Co., Ltd., £948 16s. 6d.

Hampstead.—The Council have accepted a tender for a 350-kw. "disc and drum" type turbine from Willans & Robinson, Ltd., Rugby. The turbine is intended for working both with exhaust and high-pressure steam.

Woolwich.—The tender of Messrs. Ferranti, Ltd., for the annual supply of A.-C. meters has been accepted as follows :—3-ampere, £1 8s.; 5-ampere, £1 9s.; 10-ampere, £1 10s.

NEWPORT.—The Corporation have decided to instal a 1,500-kw. turbine of the "disc and drum" type, running at 1,500 r.p.m., built by Willans & Robinson, Ltd., of Rugby, and coupled to an alternator built by the General Electric Co., Ltd.

NORWICH.—The Corporation have accepted a tender for a 500-kw. "disc and drum" type turbine from Willans & Robinson, Ltd. The turbine is intended for working both with exhaust and high-pressure steam.

NUNEATON.—The Electricity Committee have accepted the tender of Messrs. E. Danks & Co. for a water-tube boiler at £710, and that of Mr. Friedenthal for a feed pump at £109.

WALSALL.—The Council have accepted the following tenders :—Rees Roturbo Manufacturing Co., Ltd., transformer and switchgear, £715; Callender's Cable & Construction Co., Ltd., trunk main, £1,286 14s. 2d.; extending feeders and laying L.T. cables, £1,075 13s. 7d.

COMPANIES' MEETINGS AND REPORTS

RIVER PLATE ELECTRICITY CO.—At the annual meeting last week, it was stated that the company have entered into a contract with the La Plata Electric Tramways Co. for the supply of power required by that company.

ELECTRIC SUPPLY CORPORATION.—Mr. J. Stone, presiding at the annual meeting last week, said that the introduction of the metal filament lamp soon after the flotation of the company had upset all their calculations, which had been based upon the use of carbon filament lamps. In future the company will have to depend upon its earnings, as the final payment under the debenture guarantee has now been paid.

CITY OF BIRMINGHAM TRAMWAYS CO.—After meeting debenture interest and preference dividend, there was a profit for 1909 of £38,516. The directors recommend a dividend of 10 per cent. for the year on the ordinary shares, and to repay £4 per share in reduction of capital upon 6,047 ordinary shares. The arbitrator fixed the purchase price of the Handsworth tramways at £72,174, and the Council have paid this sum over. Negotiations are in progress for taking a lease of the lines when they are electrified.

CALLENDER'S CABLE & CONSTRUCTION CO.—The accounts for 1909 show a net profit of £68,452. After paying a dividend of 10s. per share and a bonus of 5s. per share on the ordinary shares, there is a balance of £42,202 to be carried forward. The report mentions that no new contract of any magnitude was carried out at home during the year, and that the orders for extensions to existing mains were less in number and smaller in value than usual. Although foreign and Colonial

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business was not so extensive as in previous years, it did not suffer to the same extent as the home trade. During the year several important contracts were secured in Belgium in face of the strong Continental competition. Both factories at Erith and Leigh are well supplied with orders at present.

JOHNSON & PHILLIPS.—At the annual meeting last week it was stated that during the last four or five months of the year all orders seemed to cease, and business was practically at a standstill. Furthermore, the price of copper and rubber ruled very high. Satisfaction was expressed at the return of Mr. Claude Johnson to the Board, together with Mr. Thomas Dence. The latter gentleman said he did not regard electrical engineering as an effete industry, but a thing of the future. He looked forward to great progress and to the company securing a fair share of the new business which was bound to come. Without paying any dividend on the ordinary shares, the net balance is £942, which is carried forward. The shops are busier at the present time than they have been for a long while.

BERGMANN-ELEKTRICITATS-WERKE A.-G.—The report for the past year recommends a dividend of 18 per cent., as in the previous year. The turnover was 60 per cent. greater than that of the previous year. It is proposed to raise the share capital from 21 to 29 million marks, in order to allow the firm to carry out new schemes and extension of their works. The contracts secured in the present business year are said to exceed in value those of the corresponding period last year by 30 per cent.

DELHI ELECTRIC TRAMWAYS & LIGHTING CO.—At the annual meeting on Thursday, it was stated that a Diesel engine and other plant has arrived at Delhi and erection is nearly completed. The cost of this plant has been about £5,000. Whilst the tramway receipts have been unsatisfactory, the electric supply portion of the undertaking shows satisfactory increases month by month. An agreement has been made with the municipality for public lighting for three years, and negotiations are in progress with a Government department for a large extension of lighting.

PARA ELECTRIC RAILWAYS & LIGHTING CO.—The profits for 1909 enable the directors to pay the arrears of dividends on the preference shares for the years 1906 and 1907, and to carry forward a balance of £954, after providing for debenture interest and preference dividend for 1909.

MUSSELBURGH & DISTRICT ELECTRIC LIGHT & TRACTION CO.—After providing for debenture interest, there is a balance of £3,811 for 1909. The sum remaining, after transferring £2,000 to renewals, will permit of a dividend of 2½ per cent. on the preference shares.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 15s. to £59 5s. per ton (last week, £58 to £58 10s.).

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—The Davey Electric Co., Ltd., 706 Tower Building, Water Street, Liverpool, is to be wound up voluntarily. Mr. J. Andrews, 20 North John Street, Liverpool, is liquidator. The first meeting of creditors was on May 17th, at 3 p.m., at 112 Whitechapel, Liverpool. Particulars of claims by June 9th.

The last day for receiving proofs in the bankruptcy of J. G. Cunnington, electrical engineer and contractor, 7 Newport Street, London, is May 24th. Mr. Alfred Page, 28, King Street, Cheapside, London, is the trustee.

The statement of affairs in the bankruptcy of R. E. Joy, 143 Cheltenham Road, Bristol, trading as the Bristol Electrical Co., shows gross liabilities amounting to £649 and a deficiency of £514. The cause of the failure is said to be "keen competition, taking contracts at unremunerative prices, and being unable to purchase materials at low cost through want of capital."

The last day for receiving proofs in the bankruptcy of W. H. Jenkinson, electrical engineer, Rodbury, near Stroud, Gloucester, is May 24th. Mr. Charles Scott, Station Road, Gloucester, is trustee.

The public examination of W. H. Palmer, electric light contractor, late of Great Castle Street, London, W., was concluded last week. In April, 1909, his business was sold to a company, which took over the assets but not the liabilities. The debtor stated that he owed £1,070 to unsecured creditors and has no assets.

HART ACCUMULATOR CO.'S LONDON OFFICE.—For the convenience of their customers in the South-west London district, the Hart Accumulator Co., Ltd., have opened a branch at 36 Victoria Street, Westminster, S.W., which is in charge of Mr. W. Howard Tasker, M.I.E.E. The branch is in telephonic communication with the works at Stratford.

Obituary.—We regret to hear of the death at Port Said, from appendicitis, of Mr. W. G. Moore, a sea-going member of the P. & O. Batti-Wallahs' Society. Mr. Moore leaves a widow and family.

APPOINTMENTS AND PERSONAL NOTES

The salary of Mr. G. A. Tough, the Borough Electrical Engineer at Coventry, is to be increased from £350 to £450 per annum.

The salary of Mr. E. M. Hollingsworth, Borough Electrical Engineer at St. Helens, is to be increased by increments of £50 per annum from £400 to £500 per annum.

The salary of Mr. F. Ayton, Borough Electrical Engineer and Tramways Manager at Ipswich, has been increased from £500 to £600 per annum.

The salary of Mr. F. V. L. Mathias, Borough Electrical Engineer at Warrington, has been increased from £350 to £400 per annum.

MISCELLANEOUS CITY NOTES

COMPANIES STRUCK OFF REGISTER.—The names of the following companies have been struck off the register of Joint Stock Companies :—Electrical Bleaching Co.; Electrical Regulating & Lighting Syndicate; Electrical Supplies, Rubber & Ebonite Co.; Electric Lamp Regenerating Co.; Electric Railways Co.; Electrical-Voelker Co.; and Meyra Electric Co.

DIVIDENDS ANNOUNCED.—Chloride Electrical Storage Co., 6 per cent. per annum upon preference shares.

CANADIAN GENERAL ELECTRIC CO.—The Board have decided to issue 9,400 of the 10,000 $100 shares at present held in reserve. The new shares will be offered at par in the proportion of one for every five shares now outstanding, the current price of which is $110.

Wireless Telegraph Notes.—The Marconi Wireless Telegraph Company of America are reducing their share capital by writing the shares down from $100 to $25. The present capital is $6,650,000.

Wireless telephone equipments on the Colin and Jeance system have, according to *l'Electricien*, been installed on the French battleships *Justice* and *Vérité*.

In a short time communication between Paris and all the French colonies and dependencies in North and North-West Africa will be effected from the Eiffel Tower station. Stations have already been established at Oran and Bizerta on the north coast and at Port Etienne, Dakar, and Rufisque on the west coast. Additional stations are being constructed at Timbuktu, Konakry, and Monrovia. It is also proposed to establish communication between Port Etienne and the South American continent.

Experiments have been carried out between the Eiffel Tower and ships at Brest to determine the practicability of the scheme formulated by MM. Guyon and Bouquet for transmitting hourly signals from the Paris Observatory to ships at sea. According to the *Matin*, these have been successful and a regular service is to be inaugurated on Monday next. A special clock will be used to send out three successive signals at midnight every night, and it is also stated that apparatus is to be installed for sending out signals regularly every second. This arrangement will enable ships at sea fitted with wireless apparatus to determine readily their bearings without recourse to the chronometer. Similar experiments are being carried out by MM. Claude and Driancourt at Paris with a view to determining accurately the longitudes of various wireless stations in Africa and elsewhere.

The Times states that the French Government has announced that in accordance with the International Convention, all French wireless stations are now open to receive communications for or from ships at sea. The following stations are open day and night :—Boulogne, Ushant, Porquerolles, Sainte-Marie-de-la-Mer for Marseilles, and Fort de l'Eau for Algiers. The naval stations at Ajaccio, Brest, Cherbourg, Dunkirk, Lorient, and Rochefort will be open for public messages only from 7 a.m. until 10 p.m. Rates are fixed at 40c. a word for all messages with certain exceptions.

Telegraph Traffic.—The "*viâ* Hanekin" route was interrupted on the 10th inst., but was repaired on the 13th inst.—The Bagdad-Bassorah line was restored on the 12th inst.—Communication between Madagascar and Reunion was interrupted on the 12th inst., messages being sent at sender's risk to Madagascar by the best means available, without change of rates.—Reductions in charges have been made on all routes to Uruguay, Argentine, Paraguay, Chili, Peru, and Bolivia. This may be due to the new German competition in the Western Co.'s territory.

OSRAM-LAMPS

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Wiring Contractors

The following firms will be pleased to submit estimates to carry out electric light and power installations, and also extension and repair work:—

LONDON.

Electrical Installations, Ld., 27, Martin's Lane, Cannon St., E.C.
F. A. Glover & Co., Ltd., Vine Street, E.C.
Rashleigh Phipps & Co., 147, Oxford Street, W.
Rawlings Bros., Ltd., 82, Gloucester Road, Kensington, W.
Rowland & Hulton, Ltd., 62, King William Street, E.C.
Speedy, Eynon & Co., 6, Duke Street, Adelphi, W.C.
F. Troy & Co., 194–196, Finchley Road, N.W. (opposite L. & N.W. Railway Station).

ABERDEEN.

Aberdeen Electrical Engng. Co., 17, Belmont Street
Claud Hamilton (Aberdeen), Ltd., 254, Union Street.

BURNLEY.—Simpson Brothers, Curzon Street.

CARDIFF.—R. Nance, 2, Dock Chambers.

EDINBURGH.—Cole & Co., 42, Frederick Street.

GLASGOW & DISTRICT.

J. A. Allan, 241, Main Street, Bellshill.
Grindlay, Ross & Co., 278, St. Vincent Street.
R. D. Livingston & Co., 3 & 5, Buchanan Court.
Wm. McWhirter & Son, 212, 214, & 216, Holm Street.

HULL.—Alexander Shaw, 18, Story Street.

MANCHESTER.—G. Harland Bowden & Co. (Wiring Dept.), 196, Deansgate, also London and Glasgow.

NEWCASTLE-ON-TYNE.—Falconar, Cross & Co., 7 & 9, Ridley Place.

WINDSOR & SLOUGH.—The Windsor & District Electrical Co., 53, Thames Street, Windsor.

WOLVERHAMPTON.—Wolverhampton Electric Fittings & Installation Co., 28, Darlington Street.

Firms desiring to have their names added to the above List should communicate with the Kilowatt Publishing Co., Ltd. (Publishers of "Electrical Engineering"), 203-206, Temple Chambers, Temple Avenue, London, E.C.

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ELECTRICAL ENGINEERING

No. 178 [Vol. VI., No. 21] THURSDAY, MAY 26, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

An example of the latest pattern of the Moore vacuum tube lamp, adapted by the use of carbonic dioxide in the tube, for colour matching, has recently been installed at Bradford. (Page 339.)

A Paper by Mr. G. W. Worrall, read recently before the Birmingham Local Section of the Institution of Electrical Engineers, contained the result of an investigation into commutation in continuous-current machines by observations of the magnetic oscillations produced in various parts of the machine. (Page 340.)

The following books are reviewed in this issue:—"The Central," memorial number; "Dynamo Electric Machinery" (vol. ii.), by S. Sheldon, R. Mason, and E. Hausmann; "Wireless Telegraphy and Wireless Telephony," by A. E. Kennelly. (Page 341.)

A photograph of a shop wrecked by a gas explosion appears on page 341.

An apparatus for automatically recording the deviations of a ship from the true set course has been introduced. The compass card is slotted, and is suspended in a conducting liquid. Any movement varies the resistance between fixed electrodes above and below the card, and the resulting fluctuations in current are caused to influence mechanism, so that any deviation is recorded. (Page 342.)

A wireless station has been erected at the Crystal Palace by the Helsby Wireless Telegraph Co., who have developed a system embodying several novelties. The spark gap used is comparatively noiseless. By an ingenious method of supplying the oscillatory circuit with impulses at a definite frequency, a continuous series of wave trains is generated at a high group frequency. This results in a pure musical note in the receiving telephone. The Company has also developed a system of wireless telephony by earth conduction, with which communication has been established over a considerable distance with the expenditure of only a few watts and with very simple apparatus. (Page 342.)

The Key Engineering Co. have now fully developed the metal conduit system of surface wiring which was shown at the Manchester exhibition. The conduit is divided longitudinally, the top half being sprung over the lower portions after the cables have been inserted. (Page 344.)

We give details of the programme of the Glasgow Convention of the Incorporated Municipal Electrical Association, which will be held from June 14th to 17th. (Page 344.)

Several lawsuits of interest to the electrical industry are down for hearing during the Trinity Sittings which commenced on Tuesday. (Page 345.)

Marconi's original wireless telegraph patent will have completed its fourteen-year life next Thursday, and will expire in the ordinary course unless an ex-

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tension is granted. Application for an extension has been made in the ordinary course, but the date for the hearing is not yet fixed. The ground upon which an extension of the term of a patent may be granted for a period not exceeding seven years, or in exceptional cases fourteen years, is that the patentee has been inadequately remunerated for his patent. (Page 346.)

AMONG the Specifications published by the Patent Office on Thursday last was one by C. A. Parsons and others for commutators for high-speed machines. Dove-tail projections on the hub fit into corresponding recesses in the bars, and no external rings are required. —A simple flame arc lamp mechanism is covered by H. D. Weaver. This has no clockwork, but the carbons are hung freely, and not supported from below.— The Felten & Guilleaume Lahmeyer Werke A.-G., cover the introduction of a nitrogen compound free from hydrogen into metal filament lamps to prevent disintegrating. (Page 346.)

A DISCUSSION upon the question as to whether a free trade or protectionist policy would be of greater benefit to the electrical industry, took place at the Caxton Hall, Westminster, on Monday. Mr. J. E. Kingsbury, Mr. J. S. Raworth, and Mr. E. Cowan spoke in favour of free trade, and Mr. H. Hirst, Mr. J. Harland Bowden, and Mr. Russell Fitch were in favour of protection. (Page 347.)

AN effort to compel the Aberdeen Corporation to supply an hotel company, which is in arrears with its payments, has been unsuccessful.—Perth (W.A.) City Council propose to acquire the Perth Tramways Co.— Birmingham Corporation Electricity Department is contributing £10,000 to relief of rates, and the Tramways Department £33,000.—Edinburgh Corporation have fixed the charge for supply for tramway purposes at 1½d. per unit.—Construction of tramways in Watford has been postponed in order to gain experience of the trackless trolley system.—There was a net profit of £15,000 on the Newcastle tramways last year.—It is said that the Victoria Falls Power Co. are to construct a new power station at Vereeniging. (Page 348.)

NEW plant will shortly be required at Birmingham and Barking.—Cable is required at Barnes, and a fuel economiser at St. Anne's-on-Sea.—Extensions of plant are proposed at Fleetwood, Wimbledon, and Wolverhampton.—Tramway extensions costing £300,000 are contemplated at Belfast.—An electric power station will shortly be erected by the Waihi Gold Mining Co. (New Zealand).—Stores are required by the Liverpool Overhead Railway Co., and motors and starters by the Swansea Corporation. (Page 348.)

THE Anglo-Argentine Tramways Co. propose to raise an additional £8,000,000 capital.—The Typewriting Telegraph Corporation is to be wound up. (Page 350.)

An Electrical Violin Player.—The ingenuity of an American inventor named Sandell has been applied to the elaboration of a complicated apparatus for "playing" a violin from a perforated music roll, which is described in the *Electrical World* (New York). A group of 60 fingering magnets take the place of the performer's left hand, and the bow is represented by a set of four revolving discs ¾ in. diameter, each made up of a bundle of 50 flexible celluloid washers. One of these discs acts on each string, and electromagnetic devices controlled by contacts governed by the perforation of the roll produce expression by varying the speed of the discs and their pressure on the strings, and a special magnet provides a bouncing bow action when required. There is also a set of four magnets for pizzicato effects, while a vibrato effect is obtained by the action of a large magnet with a weighted armature arranged to shake the tail-piece sideways. The same roll actuates the contacts of electrical piano player movement in the same case, which provides the accompaniments. The apparatus is stated to take about half an ampere at 110 volts.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MAY 26TH.

Institution of Electrical Engineers.

8 p.m. Annual meeting at the Royal Society of Arts.

FRIDAY, MAY 27TH.

Physical Society.

5 p.m. At Imperial College of Science, South Kensington. (1) "On an Oscillation Detector actuated solely by Temperature Variation of Resistance," by Dr. W. H. Eccles. (2) "Exhibition of a Resonance Transformer," by A. Eagle. (3) "The Limitations of the Weston Cell as a Standard of Electromotive Force," by S. W. J. Smith.

SATURDAY, MAY 28TH.

Institution of Mining Electrical Engineers.

3.30 p.m. Notts and Derbyshire Branch at University College, Nottingham. "Rule 8 and the Use of Electricity," by L. W. de Grave.

4 p.m. Lancashire Branch at Grand Hotel, Manchester. "Colliery Cables," by W. Bolton Shaw.

MONDAY, MAY 30TH.

Institution of Electrical Engineers: Newcastle Section.

8 p.m. Annual General Meeting at Armstrong College.

TUESDAY, MAY 31ST.

Faraday Society.

8 p.m. In Chemical Society's Rooms, Burlington House, Piccadilly, London. Messrs. C. V. Biggs and W. Pollard Digby will exhibit and give short demonstration of (1) Apparatus for the Rapid Determination of the Resistance of Liquids; (2) Apparatus for the Determination of Specific Resistance of Oil.

THURSDAY, JUNE 2ND.

Institution of Mining Engineers.

10 a.m. In Geological Society's Rooms, Burlington House, Piccadilly, London. "A Storage Battery Extension to a Three-phase Colliery Power Plant," by W. Maurice.

Röntgen Society.

8.15 p.m. At 20 Hanover Square, London. (1) "Practical Observations on Everyday X-Ray and Electrical Work," by Dr. Howard Pirie: (2) "Recent Improvements in Radiographic Technique," by Dr. R. Knox. A new form of apparatus for producing rhythmical variations in the strength of electrical currents will be shown by Dr. Hampson.

FRIDAY, JUNE 3RD.

Institution of Mining Electrical Engineers.

Lancashire Branch. Visit to the Harlton Colliery, Bolton.

SATURDAY, JUNE 4TH.

Institution of Mining Electrical Engineers.

Lancashire Branch. Visit to the Manchester School of Technology.

Royal Institution.

3 p.m. Tyndall Lecture I. "Electric Heating and Pyrometry," by Prof. J. A. Fleming, F.R.S.

Telegraph Traffic and Movements of Cable Ships.—All provincial telegraph offices, except Bristol, are, for the present, sending telegrams for Guernsey *via* London, and not *via* Bristol. —The Bagdad–Bassorah line was down on the 17th inst., and the El Arich route followed suit on the 19th inst., the break being between Gaza and El Arich.—The lines of the Indo-European Telegraph Co. were disorganised between Tiflis and Tauris on the 21st inst.—The German South American Telegraph Co. has reduced its rates to the Republics on the west coast of South America, including the Argentine Republic.—In the Canadian Parliament an Act to incorporate the Maritime Telegraph & Telephone, Ltd., has been passed. The telegraph companies have succeeded in gaining exemption from the Act regulating the number of hours of work in the Province of Nova Scotia.—The Bill introduced in the Canadian House, providing for the control of cable rates, &c., by the Board of Railway Commissioners, was passed on March 30th, and by the Senate on April 26th, with two amendments. One of these provides that the Act shall come into operation conditionally on the passing of similar legislation in Great Britain, and the other deletes the clause repealing privileges accorded in special Acts to cable companies, which would be inconsistent with the control of rates of the Railway Commission.—The Atlantic cable companies were all represented at Ottawa at a hearing of witnesses by the Railway Committee.—The Hon. Fielding, in the Canadian House, has given notice of a resolution providing for the payment of subsidies towards a press cable service from Great Britain to Canada for five years. They will be paid yearly in the following amounts: $12,000, $10,000, $8,000, $6,000, and $5,000.—The c.s. *Mackay Bennett* has been engaged on the repair of the short section between Canso and Coney Island at a distance of about 240 miles from Halifax, N.S. It is reported that the cable was found to be in a very bad mechanical condition, and that it was impossible to lift it. A gap of very nearly 50 miles was made in the attempted repair.—The c.s. *Minia* left for a repair at the end of last month.—The *Contre Amiral Caubet* of the French Atlantic Cable Co. did not leave port during April.

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THE MOORE VACUUM LIGHT FOR COLOUR MATCHING

COMPARATIVELY little has been seen of the Moore vacuum tube method of lighting in this country, apart from one or two temporary experimental installations, but it appears that a good deal of progress has been made with this form of illumination in America, particularly in the direction of producing a pure white light suitable for colour matching. This is a matter of considerable importance in the dyeing industries, and an installation for demonstrating its uses for this purpose has recently been put up at Bradford at the new offices of the Electricity Department in the extension to the Town Hall Buildings.

The first installation was, however, a rectangular tube about 110 ft., giving a yellowish light for illumination of the large general office; and it was after this had been proved satisfactory that the special colour matching tube, which is about 98 ft. long, and arranged in zig-zag fashion, was put up in an adjoining room. The lamp in the general office is illustrated in Figs. 1 and 2.

A general description of the Moore system of lighting was

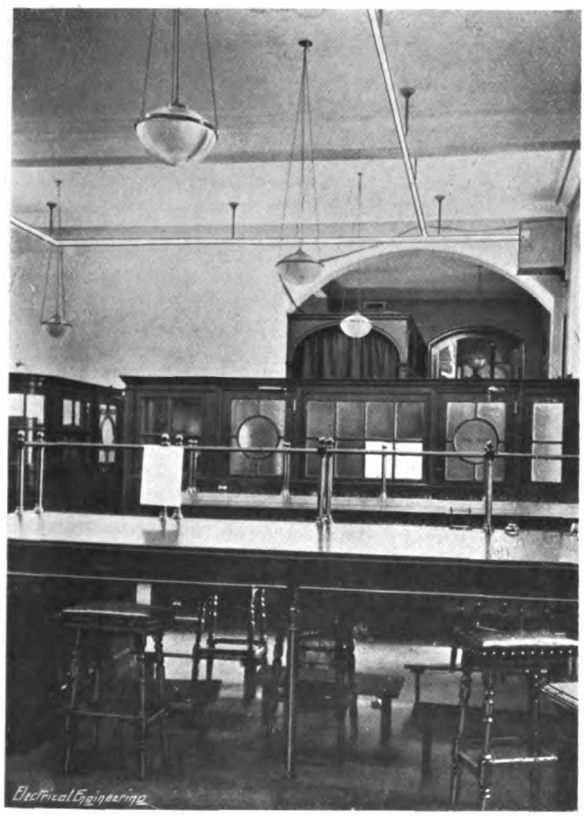


FIG. 1.—MOORE TUBE LAMP IN GENERAL OFFICE.

given in ELECTRICAL ENGINEERING, Vol. II., page 138 (July 25th, 1907), in an abstract of a Paper read by Mr. D. McFarlane Moore before the American Institute of Electrical Engineers. The long, continuous exhausted glass tube is arranged with the ends containing the electrodes inside a box, which also contains the step-up transformer for exciting the tube and an automatic valve for allowing a small quantity of air to enter the tube whenever the absorption of gases within the tube causes the vacuum to be too high to allow a sufficient discharge to pass. This valve is controlled by the strength of the current in the primary of the transformer. The colour of the light emitted depends entirely on the nature of the gas in the tube, and an effect most akin to daylight is obtained by the use of carbon dioxide. In order to obviate changes in the colour of the light, it is necessary to prevent the entry of air through the feed valve and to keep up a small supply of carbonic acid. Various ways in which Mr. Moore sought to accomplish this are described in a Paper read before the American Illuminating Engineering Society last March.

In the latest Moore lamps for white light which appear to have stood the most exacting tests from the colour matching point of view, a special carbonic acid generator is attached to the feed valve as shown in Fig. 3. On the right is seen the feed valve, which acts by the lifting of a plunger by a solenoid, causing the top of a porous carbon plug to be uncovered by the mercury normally sealing it. In practice, the feed valve comes into action for a second or two about once

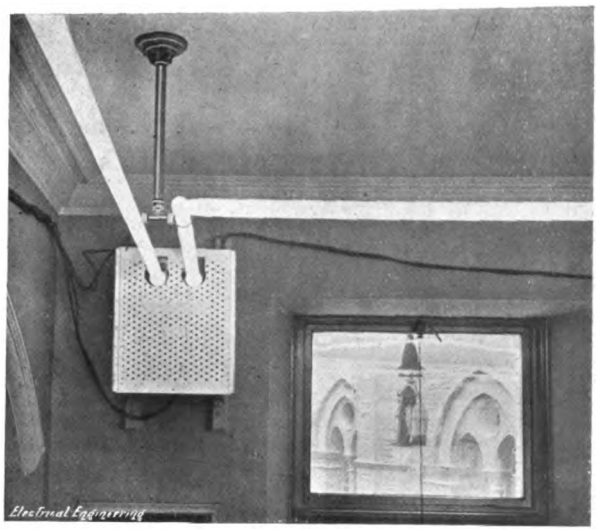


FIG. 2.—ENDS OF TUBE AND BOX CONTAINING TRANSFORMER AND FEED VALVE.

a minute. The action of the gas generator is very simple. When the gas above in the upper part becomes rarefied, due to the action of the valve, atmospheric pressure causes the hydrochloric acid to rise and to come in contact with the calcium carbonate in the upper part, and a sufficient amount of carbonic

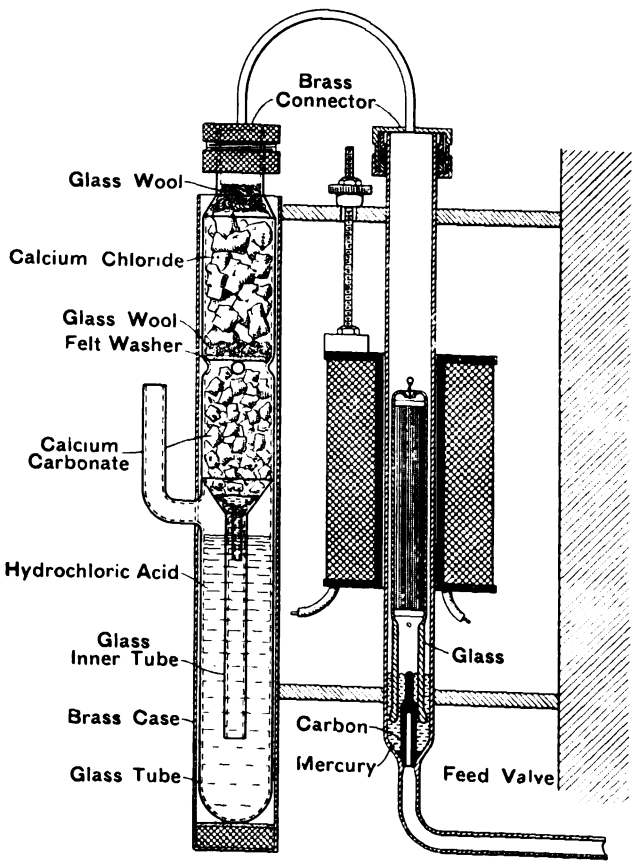


FIG 3.—CARBONIC ACID GENERATOR AND FEED VALVE.

dioxide is set free to equalise the pressure. The gas is dried by passing through calcium chloride in the top of the vessel. The working pressure is from about 0·085 mm. to 0·1 mm. of mercury, and at the latter pressure the efficiency of the tube is about 1·5 watts per Hefner c.p. The candle-power produced

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is about 11 Hefner c.p. per ft. run of tube. It is said that the colour value remains constant throughout a life of about 5,000 hours, after which new electrodes may be required.

The value to the textile and dyeing industries, as well as to other arts and crafts, of a source of light which will enable colour matching to be done at night as well as by day cannot be over-estimated, and to judge by reports as to its use in America, the latest Moore lamp has gone further than any other method of illumination to accomplish this.

The Bradford installation was put in by Messrs. Heymann & Alexander, 80 Emm Lane, Bradford, and Mr. E. A. Lassen, manager of this firm, will doubtless be pleased to give fuller information of this method of lighting to any of our readers mentioning this article.

COMMUTATION AND MAGNETIC OSCILLATIONS IN CONTINUOUS-CURRENT MACHINES

A LONG Paper by Mr. G. W. Worrall, read before the Birmingham Local Section of the Institution of Electrical Engineers, on Wednesday, April 27th, described a series of experiments upon commutation phenomena and magnetic oscillations occurring in continuous-current machines.

The magnetic oscillations were observed by means of E.M.F.'s induced in search coils placed on the machine parts in such positions as to link the oscillating flux. The E.M.F. waves were photographically recorded by means of a Duddell high-frequency oscillograph and revolving drum camera. The machine employed in the investigation was a two-pole generator with adjustable commutating poles; the brushes were of carbon, and of a width equal to one commutator segment plus insulation.

The experiments were confined chiefly to oscillations due to the commutation of the armature current in the short-circuited coil. The nature of these oscillations depends upon the nature of the commutation taking place, and since the flux at each instant is proportional to the current in the short-circuited coil, the E.M.F. induced in a search coil linking the flux forms a picture of the commutation taking place.

Before describing the experiments, the author goes into some theoretical considerations regarding commutation which he summarises as follows:—In order to neutralise or render non-existent the self-induction E.M.F. of a coil at any instant the relative movement of the field and coil side must take place along the line of action of the resultant field at that instant. Efficient commutation may be effected by a suitable adjustment of the natural period of the coil, and this may be done by properly disposing the contact resistance over the brush surface. When the contact resistance is properly disposed the resistance to the forward segment is relatively high at an early stage of the commutation period. Sparking at the forward tip of the brush is due to the available period being shorter than the natural period. For every machine there is a critical speed at which the available and natural periods are just equal to each other, and below which the machine runs sparklessly. A reduction of the natural period accelerates commutation during the early part of the short-circuit period, and increases the efficiency of commutation by lowering the maximum rate of change of the current, thereby causing a better distribution of current over the contact surface, accompanied by a reduction of temperature. The acceleration may be effected by a commutating E.M.F. If the natural period exceed the available period and the commutating E.M.F. be too small, sparking takes place at the forward tip of the brush, and if the commutating E.M.F. be gradually increased, the commutation is shifted backwards until sparking takes place at the rear tip of the brush. The natural period of the coil when short-circuited by the positive brush is not necessarily the same as when short-circuited by the negative brush.

These theoretical conclusions were found to be experimentally true, but some difficulty was experienced in finding a brush-holder which gave sufficiently constant and evenly distributed contact pressure to ensure regular results. The commutation phenomena were studied by search coils placed on various parts of the pole-shoes. Oscillations due to the movement of the teeth in the main magnetic field were superposed upon those due to commutation, but were easily distinguishable. The commutation oscillation consists of a single peak; the magnitude of the peak is proportional to the maximum rate of change of current in the short-circuited coil, and its magnitude and position in relation to the contact-maker indicates the nature of commutation taking place. When the peak is small and occurs early, the commutation is efficient, but when the peak is large and occurs late in the period, the commutation is completed by a rush of current, and sparking is liable to take place.

The experiments were directed to investigation of the influence of contact resistance and speed on commutation, the effect of a commutating E.M.F., due to auxiliary poles, the difference in the behaviour of wide and narrow commutating poles, and the cause of the difference in behaviour of the positive and the negative brushes. In connection with the last-mentioned subject, some observations of brush temperature were taken. The general conclusions arrived at from the results of the experiments are given below.

The natural period of the short-circuited coil may be varied by varying its contact resistance, or by properly disposing the resistance over the brush surface. Sparking depends upon the relation of the natural period to the available period. The maximum rate of change of the current during commutation may be reduced by reducing the natural period, and at the same time the overload capacity of the machine as regards sparking will be improved. The maximum rate of change may also be reduced by accelerating the commutation during the early portion of the short-circuit period by means of a commutating E.M.F., and this has the same effect as reducing the natural period of the coil. The ampere-turns necessary on the commutating poles may be reduced if the flash across the slot be used to generate the commutating E.M.F. The E.M.F. generated in such a manner possesses approximately the correct wave shape, and the magnetic oscillations in the armature teeth during commutation are thereby reduced. If only one commutating pole be fitted, the ampere-turns necessary are less than when two are in use. The commutating pole flux fulfils two functions: (1) to generate the commutating E.M.F., and (2) to oppose or press back the armature reaction flux.

The negative brush is hotter than the positive; the higher temperature causes the negative to take a higher polish than the positive, thereby reducing its contact resistance. The lower contact resistance increases the natural period, and renders the negative brush more liable to sparking than the positive. The higher temperature of the neagtive brush caused it to expand more than the positive. The forward tip is generally the hottest part of the brush surface because it is shielded from draughts. The forward tip is alternately heated and cooled as the segments pass under it, and vibrates with the frequency of the segments. This vibration renders the brush unstable and the commutation irregular. The importance of keeping the front tip cool cannot, says the author, be over-estimated, for in it lies to a very great extent the secret of successful commutation. The overload capacity of a machine can be very greatly increased if the brush-tip be kept cool. The metal case in which the brush is usually fitted is not sufficient unless the case almost touches the commutator, and is in very good contact with the carbon. The forward tip may be cooled, the vibration avoided, the commutation made regular, and the sparking limit raised by a piece of metal in good contact with the brush at the forward tip and provided with a relatively large radiating surface. The results in 10 may also be obtained by preventing the rush of current at the end of commutation, either by reducing the natural period of the coil or by accelerating the commutation during the early stages by means of a commutating E.M.F. The vibration of the forward tip of the brush causes a minute arc to be periodically set up between the carbon and the commutator, which causes a brown band to form on the brush and a deposit on the commutator.

The Paper also contained some results of experiments on the oscillations occurring in the main poles due to the teeth of the armature, and on the oscillations in the armature.

DISCUSSION.

The discussion was opened by Dr. KLOSS (Siemens Bros. Dynamo Works, Ltd.). He asked whether it was possible to eliminate the oscillations due to the teeth of the armature so as to obtain only the oscillations due to the changes of current during commutation. If instead of a two-pole, a four-pole machine with lapwound armature were used with one pair of brushes in commission and the other pair removed, it might be feasible by connecting up in series the search coils placed on the two negative pole pieces to obtain the curve due to commutation alone, since the coil on the pole piece with the brush would record the oscillations due both to teeth and commutation, whilst the coil on the pole piece without brush would only show the oscillations due to the teeth. In practice it was not usual for the brush to cover only one segment, and it would be of interest to know what effect would be caused by the brush covering, say, two segments at once. Good commutation depended on the proper distribution of contact resistance over the surface of the brush and not entirely on the current density, as was often assumed to be the case. In fact, it was often

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found that commutation was better with a higher current density, and it was a mistake to handicap design by too rigidly specifying the current density in the brushes.

Mr. T. F. WALL (Messrs. Siemens Bros. Dynamo Works, Ltd.) observed that from the records of oscillations occurring in different parts of the machine, it was obvious that the field coil shields the pole piece and yoke, since the search coil on the magnet ring showed practically no oscillations at all. It therefore occurred to him that by altering the constant of the field coil the commutation might be improved. Mr. Wall also discussed the question whether the coil during the period of commutation has any self-induction, and was of opinion that it was very probably in a zero magnetic field.

Mr. WORRALL replied briefly.

REVIEWS OF BOOKS

The Central. Memorial Number. Part I. (The City and Guilds of London Central Technical College Old Students' Association.) 2s.

THIS special number of the magazine of the old students of the Central Technical College of the City and Guilds of London Institute, South Kensington, is devoted to an interesting series of articles dealing with the life and work of the late Prof. W. E. Ayrton. It opens with a brief sketch of the professor's life, from the pen of Mr. Maurice Solomon. This is followed by a most interesting article on his work by his colleague and successor, Prof. T. Mather, divided into sections, dealing respectively with his personality, his method of teaching, the college course which he initiated, and his joint work with Prof. Perry and with the writer of the article. There is also a complete list of Ayrton's published works, compiled by Mr. F. E. Meade.

Dynamo Electric Machinery: Vol. II. Alternating-Current Machines. By S. Sheldon, R. Mason, and E. Hausmann. Eighth Edition. 353 pp. 8 in. by 5¼ in. 236 illustrations. (London: Crosby, Lockwood & Son.) 12s.

THIS book has been extensively adopted in American colleges as the standard text-book on alternating-current working for students in electrical and other engineering courses, and this, the eighth edition, has been completely rewritten to bring the matter up-to-date. Numerical examples have been inserted at the conclusion of each chapter, and a quantity of new matter has been introduced. Somewhat over a quarter of the book is devoted to the principles of alternating-current working, and though graphical methods are employed to a certain extent, the reader will require a good knowledge of mathematics, including the elementary calculus. With the exception of a short chapter on power transmission, which includes methods of calculating line drop and capacity, and the most economical section of conductor, the rest of the book is concerned with alternating-current machinery and transformers. Only American alternators are described, and these are by no means representative of modern practice, all of them being slow-speed machines. There is a good chapter on transformers, and the induction motor is dealt with in a very thorough manner. The theory of the synchronous motor and the rotary convertor is given at some length, and various types of single-phase commutator motors are briefly described.

Wireless Telegraphy and Wireless Telephony. By A. E. Kennelly. Second edition. 271 pp. 7¾ by 5¼ in. 84 illustrations. (London: T. Fisher Unwin.) 4s.

ONE may divide this book into three parts, dealing with electromagnetic waves, wireless telegraphy, and wireless telephony respectively. The first part is a remarkably clear introduction to the difficult subject of electromagnetic theory, and can be recommended to anyone who wishes to obtain such knowledge of the nature, method of generation, and propagation through space of electromagnetic waves, as will enable him to understand the principles of wireless telegraphy and telephony. No mathematics are employed, the various phenomena being explained by means of well-chosen analogies and diagrams. The latter are, however, badly reproduced, the reference letters, in some cases, being hardly legible. The second part is somewhat out of date, and does not seem to have been well revised. The only form of transmitter described is the ordinary induction coil, and the reader is left with the impression that the spark method is the only system of wireless telegraphy, although the arc oscillation generator is described later in connection with wireless telephony. The different types of detectors are very clearly explained. The complete suppression of names of inventors and systems throughout the book seems to be a mistake, as the reader has no means of identifying the different systems. There is an interesting chapter on tuning and selective signalling. In the last part the production of continuous oscillations by means of an arc generator or a high-frequency alternator is explained, and an outline of the principles of wireless telephony is given. Apart from the shortcomings mentioned, the book is an excellent and reliable introduction to the subject, and affords most interesting reading.

GAS EXPLOSION IN DERBY

THE illustration below is from a photograph showing the disastrous results of a gas explosion which took place on Monday last week in Derby. It is not our practice to make capital out of the misfortunes of our gas rivals, yet in this case we cannot refrain from calling attention to this explosion in view of one particular circumstance. We are informed that



the shop in which the explosion occurred is the only one of the Midland Drapery Company's extensive premises which was not yet lighted by electricity. The photograph is an excellent one, taken by the Dereské Studio of Derby, and gives a good idea of the shop after the accident. The shop was closed at the time, although there is no trace of the roller shutters on the photograph; these were blown into a shop across the road.

Electrical Association of Victoria.—A proposal to change the name of this association to the Australian Institute of Electrical Engineers, is under consideration.

Birmingham Local Section, I.E.E.—The report of the committee for the past session records seven meetings and nine Papers, including that read yesterday by Mr. H. W. Kefford on the standardisation of fuses. The average attendance at the meetings has been 54. An increase in membership from 330 to 398 is recorded. The committee for 1910-11, given in our issue of May 5th, has been duly elected.

The Institution of Civil Engineers.—In consequence of the death of His Majesty King Edward VII., the Council have decided that the Institution conversazione will not be held this year. The eighteenth "James Forrest" lecture will be delivered at the Institution on June 22nd, at eight p.m., as already announced.

Electric Power in South Africa.—A Government Commission, appointed to inquire into the use of electric power on the Witwatersrand Gold Fields, have issued a report stating that the supply of cheap power would lead to an expansion of the mining industry. Evidence was put before the Commission that the application of electric drive to the ore crushers would increase the output by 40 per cent. over the whole of the reef. This would make it profitable to work low-grade ores, and increase the life of the reef.

Steel Manufacture in South Africa.—An official report on the possibility of developing an iron and steel industry in South Africa has been prepared by Mr. F. W. Harbord. He states that though there are large iron ore deposits, the quality is poor, and the demand for pig iron very small. It would be necessary to instal steel plant, and, taking all things into consideration, Mr. Harbord concludes that the manufacture of steel would not be commercially successful. Export would be out of the question, and competition with imported material near the ports only possible with the financial support of the Government. Even pig-iron could not be manufactured commercially in the electric furnace with current at the present price in the colony.

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SHIP'S COURSE RECORDER

AN interesting piece of apparatus known as the Hennah and Rissel course recorder and indicator has been introduced by Messrs. Sharland & Co. (Eldon Street House, London, E.C.). The device is for the purpose of recording and indicating the fact of a vessel deviating from the true set course, and for ringing an alarm bell when the deviation exceeds a certain pre-

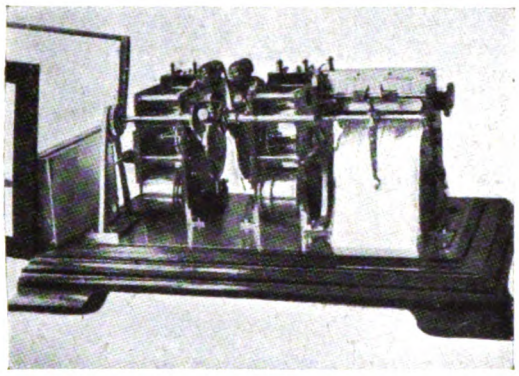


FIG. 1.—RECORDING MECHANISM.

arranged limit. It consists of a clockwork-driven recording mechanism controlled by a special compass placed in the commander's cabin. The recording mechanism illustrated in Fig 1 comprises two clockwork movements with fusee drive to ensure a constant speed, geared differentially to a horizontal shaft. The latter rotates if there is any difference in the speed of the two clockwork movements, and produces a lateral movement of the recording pen. This pen marks a line on a band of paper, which moves under it at the rate of about 4 inches per hour. Two alarm contacts are placed above the pen, and are capable of being set in the required positions by means of a right- and left-handed screw. The last wheel of each clock movement is provided with an iron rim and rotates at a high speed between the poles of an electromagnet. Should the electromagnets be unequally excited, one wheel will go faster than the other, and the recording pen will, if the difference continues long enough, move laterally.

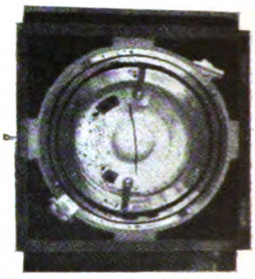


FIG. 2.—COMPASS.

The compass, illustrated in Fig. 2, has a disc of mica slotted at the periphery in two places as shown. This is freely suspended in a dilute solution of copper sulphate, and has the magnet needles attached to it in the usual manner. Above and below each slot is an electrode, and, when set correctly, equal currents pass through the slots. The two sets of electrodes are connected in series respectively with the two electromagnets, and the two circuits are connected in parallel across a battery of such a pressure that the voltage across the electrodes is insufficient to produce electrolytic action. Only a current of some 45 to 90 milliamperes passes under normal conditions. Should the vessel deviate from its course after the compass has been set, the disc will move, and one slot will come towards its pair of electrodes, while the other will move farther away from its pair. This will result in an increase of current in one circuit and a decrease in the other. One clockwork movement will be retarded and the other accelerated; a large deviation is sufficient to stop one movement entirely. A continued deviation or a succession of deviations will cause the pen to touch the limit contacts and ring the alarm. As the pen records the angle and time of the deviation, the actual distance out of the true course can be readily calculated.

THE HELSBY WIRELESS TELEGRAPH AND TELEPHONE SYSTEMS

A WIRELESS station equipped with apparatus differing in many important respects from that of the systems at present in use, has been erected in the grounds of the Crystal Palace, at the base of the North Tower. The station is solely for experimental purposes, and is the property of the Helsby Wireless Telegraph Co., which has been formed jointly by British Insulated & Helsby Cables, Ltd., and Telegraph & Telephone Instruments, Ltd. The latter is a syndicate owning the patents of Mr. A. W. Sharman. These cover various improvements in wave telegraphy, as well as a new system of telegraphy and telephony by earth conduction. On Monday last we were given an opportunity of inspecting the station, which, we understand, has been in working order for some two months.

Wave Telegraphy.

One of the most important features of the Helsby system consists in the production of a spark discharge with a high and uniform group frequency by an electrical method instead of by mechanical means as in other systems. Not only does this give a very high efficiency, but a pure musical note is obtained, enabling the operator to differentiate readily between signals and accidental disturbances and also between messages from stations using the same wave-length. The method consists in rectifying high-tension alternating current and charging condensers with a high D.C. potential, a small proportion of the charge being withdrawn continuously to energise the actual oscillatory circuit. In the diagram of Fig. 2 the secondary circuit of a transformer supplied at a normal frequency is connected to two condensers, A, A, and two electric valves, B, B, in such a manner that the condensers are kept charged to constant direct potential. As the condensers are in series, the total potential across the spark-gap G is equal to twice that of the rectified A.C. potential. The condensers are connected to the spark-gap through resistances R, which determine the rate at which the potential rises across the gap. Thus the group frequency or the interval between the discharges or the successive wave trains is governed by the capacity of the condensers A, A, the break-down voltage of the spark-gap, and the value of the resistances R. A group frequency of about 4,000 per second can be obtained which corresponds to a fairly high note. The wave-length of the transmitted radiations is

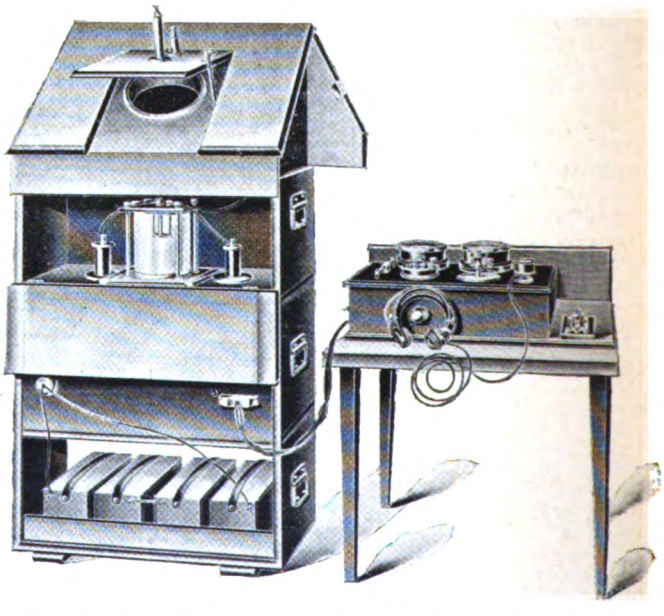


FIG. 1.—SEMI-PORTABLE WIRELESS APPARATUS FOR SHIPS.

determined mainly by the dimensions of the aerial which is inductively coupled to the oscillatory circuit in the usual manner. Resistances formed by distilled water, covered with vaseline to prevent evaporation, are employed for R, R, but rotary carriers can be used for transferring the charge from the condensers A, A, to the spark-gap electrodes thus obviating C²R

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losses. The apparatus was shown in use on Monday with Lodge valves, and valves of a German type have been also used with success. Condensers of French glass with copper electrodes immersed in vaseline are employed, and relief gaps are provided to prevent the perforation of the glass.

A novel feature of the apparatus is the multiple spark-gap. The discharge is broken up into four portions in series. The central rotating system of knobs is adjusted by means of a lever, and it will be seen that there are no contacts on this, the only moving part. The device is enclosed in a glass cylinder, and though no precautions are taken to prevent noise, its

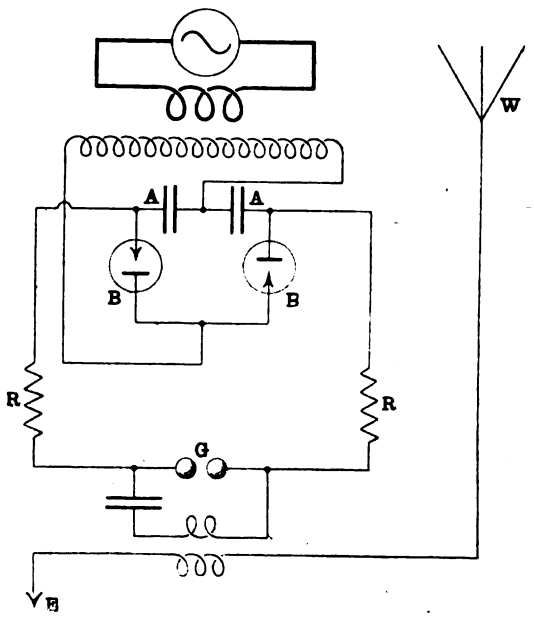
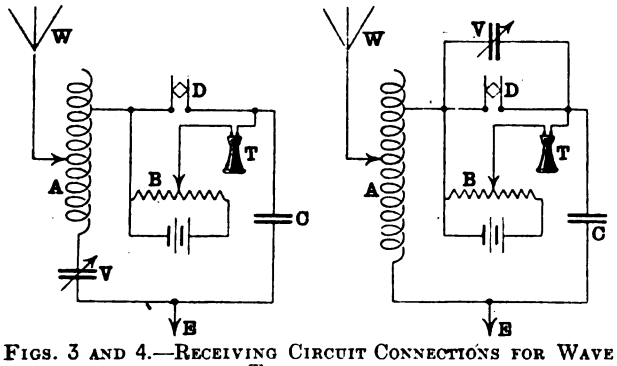


Fig. 2.—Transmitting Circuit Connections for Wave Telegraphy.

comparative silence when working is remarkable. The reason for this is not quite clear, but may be due to the breaking up of the discharge causing interference of the sound waves in the cylinder, or the absence of moisture. This latter is effected by placing a hygroscopic substance in the cylinder, which absorbs not only the moisture, but any nitrogen oxides or other gases produced by the discharge.

A semi-portable apparatus suitable for ships is installed in the Crystal Palace station, and is illustrated in Fig. 1. With this, messages are exchanged with the Bellini-Tosi station at Boulogne, while signals have been picked up even from the Marconi station in Newfoundland. The apparatus has a



Figs. 3 and 4.—Receiving Circuit Connections for Wave Telegraphy.

nominal range of some 300 miles, and consumes less than a quarter of a kilowatt. The receiving and transmitting board is connected to the transmitting apparatus (which is enclosed in a cabinet) by flexible leads with multiple-pin plugs, and a special combined H.T. and L.T. switch is provided. The variable magnetic coupling with the aerial can be seen on the top of the cabinet.

The induction coil used in this apparatus is of the open magnetic circuit type of a new design to give very low losses. The iron wires or strips are built up in several bundles and laid peripherally round a core of insulating material. All the wires are enamelled and eddy currents avoided. Demagnetisation is more rapid, and the efficiency is claimed to be higher. This coil can also be used off an A.C. supply.

The aerial consists of two 7/22 phosphor bronze stranded cables, each strand being enamelled. These are suspended from an insulated hanger attached to the top of the tower, 240 ft. above the ground level. An earth consisting of 150 sq. ft. of 1/16 in. copper plate, arranged as three radiating strips 50 ft. in length, and buried about two feet below the surface, has been put down.

The receiving apparatus employed does not contain any unusual features, except in the construction and arrangement of the tuning devices. On Monday, a carborundum crystal rectifying detector was used, and clear musical signals were obtained from Boulogne. The connections are shown in Figs. 3 and 4, where W represents the aerial, A the variable inductance, V a variable condenser, C another condenser, D the detector, and T the telephone. B is a potentiometer provided for obtaining a suitable P.D. across the detector terminals. Fig. 3 shows the connections usually employed, while Fig. 4 shows a variation.

A disadvantage of the present systems of wireless telegraphy is the fact that no record can be obtained of the signals received, as the filing coherer is the only detector, which permits of this being done, and this is now rarely used, as all signals of the same wave-length affect this detector in the same way, independent of the group frequency. As a means of reducing this disadvantage, it is proposed to use a recorder at the transmitting end, and an instrument of this type was shown us on Monday.

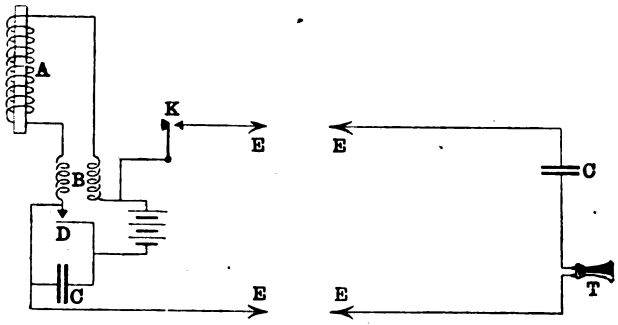


Fig. 5.—Transmitting and Receiving Circuit Connections for Earth Conduction Telegraphy or Telephony.

An extension of the lever of the transmitting key causes a Morse printer to ink the tape every time the key is depressed. The printer is driven by clockwork, and is interlocked with the main transmitting switch of the station and the transmitting key. It is started when the main switch is closed and the key is dead unless the printer is wound up and running. All messages and signals transmitted are therefore recorded.

The method described above, in which valves are used to give a high-potential D.C. current, has proved very suitable for permanent wireless stations, but a system has been devised which secures the same advantages combined with portability and even greater simplicity for small power stations. This system was shown in operation, but cannot be described, owing to patents pending. A combined transmitting and receiving apparatus capable of effecting communication over five miles with a 50-ft. aerial, can be carried by one man, and measures only 8 in. by 8 in. by 15 in. Besides this and the aerial, a 6-volt accumulator is the only apparatus required.

Earth Conduction Telegraphy and Telephony.

The company's system of telegraphy and telephony by earth conduction marks a considerable advance on previous systems of this nature. A powerful momentary current impulse is sent between the extreme points of a base line by means of earth plates or rods buried in the ground, and the stream lines spread out on both sides of the base line. If two further earth plates are sunk within a certain distance so as to form a corresponding base line parallel or nearly parallel to the first, a difference of potential will be produced between them, and if the plates are joined up by a telephone, a current impulse will be received. The effective distance of transmission can be increased by increasing either the length of the base lines or the power employed. The first method is very inconvenient, and can only be employed up to certain limits, while the second method has in the past lead to expensive and heavy apparatus. In the present system, a strong current impulse of very short duration is produced with the aid of an inductance with a very small total expenditure of energy. The connections for both the transmitting and receiving ends for Morse telegraphy are shown in Fig. 5. It will be seen that there is a local circuit comprising a battery, an inductance A, and a high-frequency trembler D with its two exciting coils B.

When signalling, this circuit is permanently closed, and the inductance is continually discharging into the condenser C, which prevents serious sparking across the trembler contact. The core of the inductance A is constructed in a similar manner to that of the induction coil used by the company for wireless

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work, and as the eddy currents are reduced to a minimum, the flux built up by the excitation of the inductance on the closing of the contact at *D* collapses very suddenly at break, inducing a very high momentary back E.M.F. A series of these momentary high-tension impulses is thus produced, the frequency being of the trembler. Now, if the key *K* is depressed, a train of these impulses is sent through the earth from plate to plate, and the lines of flow cutting across the two receiving earth plates cause a similar succession of very feeble current impulses to pass through the telephone *T* and the condenser *C*. The trembler is adjusted so that a musical note is heard in the telephone. With 14-yard base lines and an expenditure of only a few watts, communication has been effected with this apparatus over a distance of nearly four miles.

For wireless telephony on the same principle, the trembler *D* is replaced by a microphone, and the transmitting circuit is closed permanently at *K*. When spoken to, the microphone practically makes and breaks the circuit of the inductance at frequencies corresponding to the sound waves impinging on the diaphragm. The high-tension impulses produced are conveyed to the transmitting earth circuit, and these cause corresponding current impulses in the telephone *T* of the receiving circuit. Thus the sound waves impinging on the microphone diaphragm are reproduced by the receiving telephone. Speech has been transmitted clearly by this method up to distances of one and a half miles with the expenditure of only a few watts, and using base lines of only 14 yards. A portable apparatus with both transmitting and receiving devices was shown to us on Monday, and we were able to carry on a conversation over a distance of 200 yards, with a receiving base only 15 inches long. In this case the "earth-plates" consisted merely of two brass rods driven a few inches into the ground. The apparatus is enclosed in a box measuring 8 in. square, and weighs about nine pounds. The cost of the apparatus is very low.

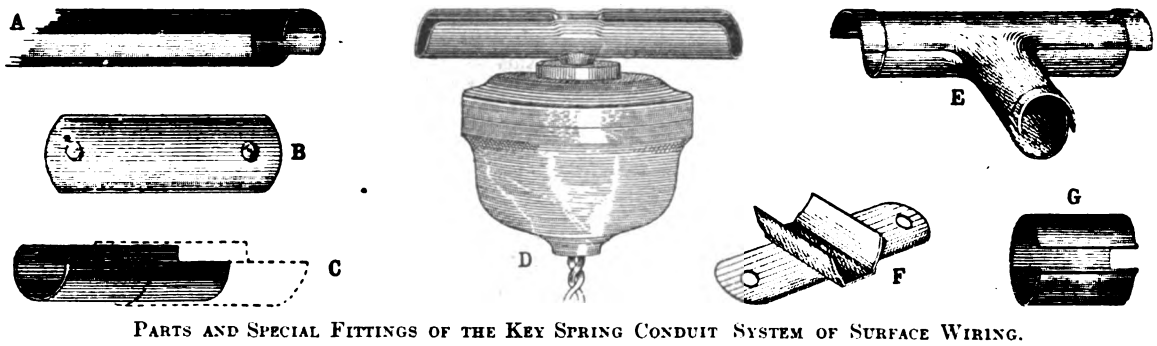
With the aid of a form of telephone relay, it has been found possible to work a bell call. A special telephone, the diaphragm of which works on a microphone diaphragm, is substituted for the receiving telephone, and when the minute impulses are received, the microphone operates a very delicate vibrating relay tuned to the frequency of the impulses, and this closes a bell circuit.

In conclusion, we should like to express our indebtedness to Mr. A. W. Sharman, Mr. H. H. Harrison, and other gentlemen connected with the company, who kindly explained the features of the above systems to our representative on the occasion of our visit to the station.

METAL CONDUIT WIRING SYSTEM

THE metal conduit system of surface wiring which was shown in its initial stages at the Manchester Exhibition by the Key Engineering Co., Ltd., has since then undergone considerable modifications and improvements, and the firm are now prepared to supply this conduit and the necessary fittings in large quantities. The tube which forms the conduit is formed as shown at *A* in the accompanying figure, in two portions, each slightly over a semicircle, so that one half can be sprung over the other. There are two or three different methods of putting up the conduit, but in all cases the cable is laid in and not drawn in. The simplest way is to fix the under portion or a tool, but a special key is provided for this purpose. This key is sprung over the conduit until the free ends engage beneath the edges of the cover when a slight depression of the handle levers one end of the cover off. Bends and tees are constructed on the same principle. A T-joint is illustrated at *E*, and it will be seen that every elbow or joint, or, indeed, any portion of the conduit, can readily be opened up for inspection. These inspection elbows and bends are also applicable to the ordinary screwed barrel system of wiring, and the company expect a considerable demand for them for this purpose.

Where bonding is not thought necessary, the separate lengths of conduit and the various fittings are connected together by means of a spring clip connector as shown at *C*. If a thoroughly bonded system is required, all the joints are electrically connected by means of short steel bonding pieces like that shown at *B*. The two copper rivets are expanded into the bonding piece and into holes punched in the conduit. To punch these holes, a special screw punch is slipped over the end of the conduit, and this cuts a clean hole in the exact position required. To expand the rivets, another special tool is used. Tests have shown that the ohmic resistance of a long run of conduit made up of 12-ft. lengths bonded in this manner is only 4 per cent. greater than if the conduit were continuous. While the overlap of the cover prevents direct access of water, free evaporation of moisture due to condensation is permitted. The system must be inspected and the various special fittings handled to appreciate the many advantages of the system, and a room wired on the system can be seen at the offices of the Key Engineering Co., Ltd. (4 Queen Victoria Street, London, E.C.). In order to encourage the use of the system, the firm offer a special and exceptionally high trade discount.



PARTS AND SPECIAL FITTINGS OF THE KEY SPRING CONDUIT SYSTEM OF SURFACE WIRING.

troughing to the wall or ceiling by screws passing through it, and then to spring on the cover after the cable has been laid in. If it is thought undesirable to pierce the under portion for screws, it is supported on a simple bracket, *F*, screwed or nailed to the support, and is held temporarily in position by special spring clips. The cable is then laid in the troughing and the cover sprung on. Finally, a spring clip, *G*, is sprung over the complete conduit and the edges of the bracket, thus rigidly holding the respective sections together. All the fittings are attached by means of standard nipples to steel clips as shown at *D*, which represents the ceiling rose fitting used in this system. It is practically impossible to pull the cover off without

THE GLASGOW CONVENTION OF THE I.M.E.A.

AS we have already announced, the 1910 Convention of the Incorporated Municipal Electrical Association will be held in Glasgow from June 14th to 17th next, under the Presidency of Mr. W. W. Lackie, Chief Electrical Engineer to the Glasgow Corporation. The full programme is now available.

The Convention will be opened on Tuesday, June 14th, by the Hon. A. Shaw McInnes, Lord Provost of Glasgow, in the Rankine Hall of the Institute of Engineers and Shipbuilders in Scotland, Elmbank Crescent. Mr. W. W. Lackie will then deliver his Presidential Address, which will be followed by a Paper and discussion on "Commercial Progress," by A. C. Cramb (Chief Electrical Engineer, Croydon) and H. Collings Bishop (Chief Electrical Engineer, Newport, Mon.). The Tramways and Electricity Committee will entertain the members and delegates (including ladies) to luncheon at the City Chambers at 1.15 p.m. At 3 p.m. brakes will leave the City Chambers to visit the following works:—(*a*) Springburn sub-station of the Electricity Department; (*b*) Pinkston power house of the Tramways Department; (*c*) Port Dundas electricity works of the Electricity Department. The Lord Provost, Magistrates, and Town Council will give a reception and conversazione at the City Chambers at 7.30 p.m.

On Wednesday, June 15th, the meeting will be in the Free Gardeners' Hall, Picardy Place, Edinburgh, a special train leaving Glasgow (Queen Street) at 8.25 a.m. The following Papers will be read and discussed, after a welcome by the Rt. Hon. the Lord Provost of Edinburgh:—(1) "Exhaust Steam Turbines and Condensing Plant," by F. A. Newington (Chief Electrical Engineer, Edinburgh); (2) "Mixed Pressure Turbines," by Ashton Bremner (Chief Electrical Engineer, Burslem). After the meeting, the Corporation of Edinburgh will entertain the Association to luncheon at the Music Hall, George Street, and at 2.30 p.m. a visit will be paid to the Macdonald Road electricity works of the Corporation.

At the meeting on Thursday, June 16th, in the Rankine Hall of the Institute of Engineers and Shipbuilders, Glasgow, discussions will take place upon the following subjects:—(1) "Advantages of Continuous Records of Costs and of Steam Consumption," to be opened by G. Wilkinson (Chief Electrical

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Engineer, Harrogate) and C. E. C. Shawfield (Chief Electrical Engineer, Wolverhampton); (2) "Cheapening of the Cost of Mains and Services," to be opened by S. E. Fedden (Chief Electrical Engineer, Sheffield) and S. J. Watson (Chief Electrical Engineer, Bury). At 2.30 p.m. visits will be paid to the following works:—(1) St. Andrew's Cross electricity works; (2) Coplawhill Car works; (3) Govan electricity works. An alternative series of visits includes the power stations of the Partick Corporation, and the Clyde Valley Electric Power Co., and Messrs. Beardmore's shipbuilding works. The annual dinner will be held at the Windsor Hotel at 7 p.m.

The Annual General Meeting will be held on Friday, June 17th, at the Institute of Engineers and Shipbuilders.

The headquarters of the Association will be at the Windsor Hotel.

Arrangements have been made by the Association with the railway companies for the issue of railway tickets at fare and a quarter, on presentation at the booking office of a voucher to be obtained from the Association.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

BELLS.—A leaflet from Messrs. Julius Sax and Co., Ltd. (24A High Street, New Oxford Street), describes a redesigned series of trembling bells with patent rubbing contact. A continuous ringing attachment is made, and the bells can, if desired, be arranged for working direct on lighting and power circuits in series with the ordinary incandescent lamp. For this purpose a lamp-holder is provided on the bell base, suitably connected, so that it is only necessary to take the wires to the terminals in the ordinary manner. By a special arrangement breaking at the full circuit voltage on the contacts is avoided.

TELEGRAPH AND TELEPHONE LINE MATERIAL.—Messrs. Siemens Bros. & Co., Ltd. (Caxton House, Westminster, S.W.), have sent us a copy of a new issue of their pamphlet, No. 11, relating to telegraph and telephone lines. This consists of 124 pages, and has been divided into six sections, dealing respectively with iron poles, insulators and stalks, brackets, arms and fittings, stay tighteners, tools, and bolts and screws. All patterns of iron poles, from the simple tubular iron pole with buckled plate down to the very latest types, are represented, and a number of extra long poles are listed, the heights varying from 22 ft. to 80 ft. The insulator section contains, beside examples of telegraph and telephone insulators, designed to meet the requirements of practically every Government and telegraph company, a large selection of porcelain reels and knobs. The pamphlet is coded and provided with a system of cross references, so as to facilitate the drawing up of specifications.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRICITY IN THE HOME.—The South Metropolitan Electric Light and Power Co., Ltd., have sent us an illustrated booklet, which they have issued as a souvenir of the model electric home at Catford. This house, in which all kinds of electrical domestic apparatus can be seen in daily operation, was described in ELECTRICAL ENGINEERING, Vol. V., p. 1028.

FANS.—We have received an advance copy of a new fan list issued by the Edison & Swan United Electric Light Co., Ltd. (Queen Street, London, E.C.). Particulars and prices of the various standard patterns of table, ceiling, and porthole fans are given. An improved type of oscillating desk fan is described, and fans with friction gear of both the table and porthole types are listed. These latter have a high efficiency, the current consumption of a 24-in. D.-C. fan being only 75 watts, and run very quietly as the blades revolve at the most efficient speed without churning the air.

FANS AND VENTILATORS.—A list from the British Department of the Maschinenfabrik Oerlikon gives particulars of a number of patterns of electric fans and ventilators of the desk, wall, bracket, and porthole patterns, both for continuous-current and single-phase circuits, all fitted with provision for speed regulation.

The Dublin Tramways Congress.—The Congress of the Tramways and Light Railways Association in Dublin, which was postponed on account of the death of King Edward, will be held on Thursday and Friday, June 9th and 10th. The arrangements previously announced will hold good. We gave an account of the Papers to be read on page 324 of our last issue.

National Electrical Manufacturers' Association.—At a meeting recently held at Manchester, the formation of a northern section of the Association was decided upon, and Mr. B. Longbottom (Electromotors, Ltd.) was elected Honorary Secretary. Among firms who have joined the Association as a result of the movement are Messrs. E. Brook, Ltd., H. T. Boothroyd, Ltd., Clarke, Chapman & Co., Ltd., Evered & Co., Ltd., Liverpool Cable Co., Ltd., Bertram Thomas, and Wright & Wood. Some changes in the bye-laws to make the Association more national in character have been approved.

PENDING ELECTRICAL LAWSUITS

(Compiled by our own Editorial Staff, and Strictly Copyright.)

SEVERAL legal actions of interest to the electrical industry are down for hearing during the Trinity Sittings, which commenced on Tuesday. The Gravesend & Northfleet Tramways Co., Ltd., had entered an appeal against the judgment of Mr. Justice Hamilton in regard to the reading of the meters in the Gravesend Corporation's power station, which measure the energy supplied for working the tramways (ELECTRICAL ENGINEERING, January 20th, p. 49, and February 3rd, p. 75), but we understand that the parties have come to terms. The only other case in the Appeal Courts is an appeal by the Eccles Corporation against a judgment of Mr. Justice Eve in connection with the working of certain tramways by the South Lancashire Tramways Co. (ELECTRICAL ENGINEERING, February 3rd, p. 75).

In the Chancery Division, the action by the British Thomson-Houston Co., Ltd., against the Midland Railway Co. for alleged infringement of their patents covering the multiple unit control system for electric traction, is early on the list of cases in Mr. Justice Warrington's Court.

Before Mr. Justice Neville there are two actions, viz., the Attorney General *v.* Leicester Corporation, and the Attorney General *v.* West Ham Corporation. In the former, the Electrical Contractors' Association are seeking to restrain the Leicester Corporation from selling fittings or wiring houses, &c., for electric light and power. The action against the West Ham Corporation is at the instance of the India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., and is to restrain the Corporation from enforcing the payment of a rate to meet certain overdrafts for the purposes of the electricity undertaking. The India Rubber Co. are large ratepayers in West Ham, but have their own generating plant, and do not buy their electric power from the Corporation. At the Local Government Board inquiry last year concerning a loan for the electricity works, the company opposed on the ground that the Corporation were selling electricity for power purposes at less than cost. The Local Government Board have deferred granting this loan pending the result of the action above referred to. But for this, we understand, the loan would have been granted with certain unimportant reservations.

Two actions by Messrs. Babcock and Wilcox, Ltd., will also be dealt with by Mr. Justice Warrington. One is against Messrs. E. Danks and Co., Ltd. (Oldham), in relation to an alleged infringement of patent; the other is against the Water Tube Boiler Co., and is a re-hearing of an action *re* an agreement.

In the King's Bench Division is an action, *Electrical Press, Ltd., v.* Mountain, in respect of alleged fraudulent misrepresentation. It will be remembered that the *Electrical Press, Ltd.*, as advertising agents, placed the prospectus of Messrs. Mountain, Gibson and Thornewill, Ltd., and were the largest creditors in the subsequent liquidation of the company.

The action for libel by Mr. W. Griffiths against the proprietors of the *Daily Chronicle* arising out of articles on the G.B. surface-contact system in the Mile End Road is still in the list, and should be reached very shortly.

Among other actions is one by the National Electric Construction Co., Ltd., against the South Metropolitan Electric Light and Power Co., in relation to a contract, and there are, as usual, a few actions brought against tramway and railway undertakings for recovery of damages for injuries in street accidents, &c.

Illuminating Engineering Society.—At the annual general meeting of this society held in London on Monday last, the report of the Council for the past session was presented. Prof. S. P. Thompson, F.R.S., has been re-elected President, and the present Council will also remain in office with one or two additional members.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 19th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

10,588/09. **Commutators for High-speed Machines.** C. A. Parsons, A. H. Law, and J. P. Stockbridge. To avoid taking up useful brush surface by external rings, the segments are held in against centrifugal force internally by providing the hub with dove-tail or T-shaped longitudinal projections which fit into corresponding recesses formed by cutting pieces out of two adjacent segments. The projections are insulated from the segments, and wedges are provided. An alternative method consists in passing radial bolts through the hub. The bolts may either lock or screw into the bars. Another construction is described in which the adjacent bars are locked into one another forming a stiff ring capable of supporting itself. Five claims, twelve figures.

11,285/09. **A.-C. Distribution.** British Thomson-Houston Co., and E. B. Wedmore. In A.-C. stations supplying current at different frequencies, automatic apparatus is provided to prevent the paralleling of a live feeder with bus-bars of a different frequency. Five claims, five figures.

14,674/09. **Arc Lamp Mechanism.** H. D. Weaver. A very simple feeding and striking mechanism for flame arc lamps of the converging carbon type. A twisted rod is mounted vertically in the centre of the lamp so as to be capable of axial rotation and a small longitudinal movement. On this rod is a loosely threaded nut to which the carbons are attached by cords passing over pulleys. The weight of the carbons tends to draw up the nut and rotate the rod, but rotation is normally prevented by a brake block attached to the usual form of rocking lever and bearing on a horizontal disc on the top of the rod. The disc is pressed upward by a spring. When the solenoids cause the disc to be released, the carbons feed, and when they touch the series solenoid causes the disc to be held, and then depresses both disc and rod, thus lifting the carbons and striking the arc. Four claims, six figures.

17,960/09. **Metal Filament Lamps.** Felten & Guilleaume Lahmeyer-Werke A.-G. In order to prevent disintegration of metal filaments, a nitrogen compound free from hydrogen, such as phosphorus nitride, is introduced into the bulb in the form of a paste on some part of the interior. This gradually liberates nitrogen throughout the life of the lamp. It has been found that hydrogen introduced for this purpose became ionised and conducted a comparatively large current, thus short-circuiting the filaments. Nitrogen is said to be free from this objection owing to its smaller molecular velocity. To increase the absorption of oxygen, amorphous phosphorus may be mixed with the phosphorus nitride. Two claims.

21,285/09. **Metal Filament Lamps.** H. Zschocke. The separate filament loops are passed over rigid thick wire supports at the bends, and are attached to resilient strip supports at their extremities, the latter supports being in the circuit. One claim, one figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Jaburg, 15,881/09; Binet and Guenne [Arc-lamp casings] 28,849/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Gray [Electric conductors] 7,791/09; Wildermann [Chlorine-resisting ebonite] 12,424/09.

Dynamos, Motors, and Transformers: Dawson and Pyne [Motor control] 11,445/09.

Electric Ignition: Mowatt [Ignition of gas lamps] 18,243/09; Bellem and Brégéras [Driving of magnetos] 6,962/10.

Electrometallurgy and Electrochemistry: Cowper-Coles [Electro-deposition of iron] 10,655/09; Schauli [Electrolyte for primary or secondary cells and resistances] 10,791/09.

Instruments and Meters: Kallman [Meter testing] 7,754/09.

Storage Batteries: Somers and Crawley, 5,062/09.

Switchgear, Fuses, and Fittings: Sykes and Cooke [Conduit joint boxes] 26,021/09; France [Conduit fittings] 29,811/09.

Telephony and Telegraphy: Peticky, Suchánek and Cizek [Automatic telephone exchange] 11,497/09; Murray [Photographic type-printing telegraph] 22,457/09; Erdmann [Wireless telegraph apparatus] 28,545/09; Thorrowgood [Polarised relays for selective signalling] 30,579/09; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Telephone exchanges] 3,118/10.

Traction: Newton [Brakes] 11,127/09; Blackall and Jacobs [Electric staff signalling] 11,460/09; Morrison [Electric transmission for motor vehicles] 16,331/09; Munro and Railless Electric Traction Co. [Hangers for trolley wires] 17,326/09; Rote and Shee [Brakes] 24,448/09; Hintz and Schmidt [Automatic stopping of trains] 3,918/10.

Miscellaneous: Tierney [Vacuum cleaner] 10,115/09; Greenhill and Goddard [Electric locks] 10,345/09; Nicholas [Ships' compasses] 10,925/09; Tscherkassoff [Electrotherapeutic apparatus] 13,542/09; Verney [Electromagnetic couplings] 26,574/09; Baillie [Vacuum cleaner] 28,775/09; Curtis and Beamand [Lubrication of conductors for mining cages] 3,693/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: Felten & Guilleaume Lahmeyer-Werke A.-G. [Prevention of currents in shafts and bearings] 7,463/10; Balachowsky and Caire [Regulation of machines] 9,375/10; Alexanderson [High-frequency alternator] 9,637/10; Von Kando [Marine propulsion] 10,169/10; Meynier [Machine] 10,208/10; Allgemeine Elektricitäts Ges. [Motors] 10,607/10.

Electric Ignition: Reno and Bois [Distributers] 4,666/10.

Electrochemistry: Schoop [Depositing metals] 5,712/10.

Traction: Haasted [Electrical control of points] 10,375/10.

Miscellaneous: Bellem and Brégéras [Electromagnetic control of petrol supply to engines] 9,496/10; Friese [Selenium cell fire-damp detector] 9,545/10.

Opposition to Grant of Patents

6,936/09. **Metal Filaments.** The Westinghouse Metal Filament Lamp Co., Ltd. (*A. Lederer, Vienna*). The opposition to this patent, covering a process of decarbonising tungsten filaments, has been withdrawn. (*See* Electrical Engineering, March 10th, 1910, page 172.)

12,289/09. **Fan.** J. Keith. This patent has been granted in spite of opposition. It covers an ornamental table-centre fitted with an electric fan and lamps.

12,966/09. **Electric Furnace Reaction.** E. C. Marks (*T. L. Wilson*). Opposition has been entered to the grant of this patent, which covers a process for producing a silicide of an alkaline earth by heating a carbide of the earth with silica and without carbon in an electric arc furnace.

Application for Amendment

12,135/07. **Magneto-Generator.** W. Roos desires to amend this patent in order to limit the scope of the invention, which is for a method of oscillating the armature of a magneto-generator with a minimum return oscillation past the point of equilibrium.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years, unless an extension of their term is granted:—

11,958 of June 2nd, 1896. **Electric Target.** J. L. McCullough. A dummy gun carries a contact arm which moves over a disc. Different circuits are completed according to the direction of the gun, and the point aimed at is indicated on the target.

12,039 of June 2nd, 1896. **Wireless Telegraphy.** G. Marconi. This is Marconi's original patent relating to wireless telegraphy with coherers, the metal filing coherer, the use of mercury in coherers, methods of decohering, the combination of a relay with a filing coherer, spark-gap transmitters of various forms, and various arrangements of transmitting and receiving apparatus. The Marconi Co. has applied to the Courts for an extension of the term of this patent, including the connection of the transmitter and the coherer to earth.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: British Thomson-Houston Co. and E. J. Murphy [Lamps with two arcs in series] 2,715/04.

Dynamos, &c.: M. Latour [Self-exciting, A.-C. machines] 2,471/04; H. Leitner and H. Hill [Brush-rocking gear] 2,341/05.

Electrometallurgy, &c.: F. Fisher and B. J. Round & Sons [Electroplating] 2,684/98; W. C. Wood and B. Oaksford [Electrolytic apparatus] 2,001/05.

Heating and Cooking: Linotype Co., J. Place and M. Barr [Electric heating of melting-pots of linotype machines] 2,904/98.

Switchgear, &c.: R. W. Bill and F. W. Abbott [Circuit-breaker] 2,543/05; W. A. Clatworthy and J. H. Holmes & Co. [Motor starter] 2,190/05; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Fuses] 2,491/05.

Traction: R. Carnegie and A. Beevers [Trolley wheel] 2,397/04; H. Leitner and R. Lucas [Train-lighting system] 2,342/05; E. Peckham [Brakes] 2,488/05.

Miscellaneous: F. McGloin [Fire and burglar alarm] 2,453-4/01; M. A. Codd [Trembler for induction coil] 1,891/05.

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THE ELECTRICAL INDUSTRY AND TARIFF REFORM

A DISCUSSION upon the question as to whether a free trade or protectionist policy would be of the greater benefit to the electrical industry of this country took place at Caxton Hall, Westminster, on Monday. There was an attendance of about 200. Mr. J. E. Kingsbury and Mr. Hugo Hirst opened the debate for free trade and protection respectively, and after a few other speakers had expressed their views the meeting was adjourned until Monday, June 6th, when the discussion will be continued, and Messrs. Kingsbury and Hirst will reply to the arguments put forward. The discussion was promoted by the National Electrical Manufacturers' Association, which, however, does not identify itself with either party. For this reason no resolution will be put to the meeting.

Mr. H. W. Butler (of the Electrical Power Storage Co., Ltd.), who presided, explained that whilst the Association exists for dealing with all commercial questions which are of general interest to the electrical trade, it also forms a common platform where all members of the trade might meet to discuss various questions of policy. Consequently, the Association accepts no responsibility for any of the opinions expressed by the speakers.

Mr. J. E. Kingsbury (late Manager of the London office of the Western Electric Co., Ltd.), in opening the debate, said that, taken as a whole, the electrical industry in Great Britain had a higher efficiency than in any country in the world. Our free trade policy, he contended, permitted us to apply at once any advance made elsewhere, and as soon as the demand became large enough to permit economical manufacture, we abandoned importing and manufactured for ourselves. Protected States, he said, are behind in the development of enterprises originating in other countries. Mr. Kingsbury deprecated the policy of detraction which had been adopted by protectionists, by which Great Britain was held up as exceptionally backward. On this point he quoted figures, which, however, hardly supported his contention that protected States were backward. In 1904, the electrical products in the United States amounted to 6s. 10d. per head of population, whilst ours in 1907, i.e., three years later, were still less, viz., 6s. 2d. He thought he was fairly stating the protectionist argument when he said that it claimed to make a foreign manufacturer sure of his home market, and that he could consequently organise with confidence for the supply of that market; that he could arrange for the production of a surplus to dump in our market, and could secure for his employees continuity of employment. Dealing with the British home electrical market, he said that in 1907 we imported about 17½ or, say, even 20 per cent. of our consumption. This he would divide into two, and assume that 10 per cent. of the imports were wanted to maintain our efficiency, and that 10 per cent. were competing with our own standard manufactures. The value of this second 10 per cent. of electrical goods, however, had a value which amounted only to three-quarters of a million pounds, and the retention of this proportion of our trade might possibly result in the ruin of our export market. The dependence of the electrical industry upon the general trade and commerce of the nation could not be questioned, and it was to be regretted that more attention was not given to this. The argument for the continuity of employment, he said, was negatived by the facts. It was a well recognised fact that the trade of a free trade country was less disturbed, and employment was more regular than that of a protectionist country. The employees of the electrical trade in Great Britain had not been subject in recent years to such sudden and such extensive reductions as had taken place in the United States and Germany. The more moderate policy of retaliation Mr. Kingsbury regarded as useless to the electrical industry, for he did not believe that any of our foreign competitors were so poorly equipped electrically that the operation of a retaliatory tariff would lead to a reduction in their duties on any item which would facilitate our exports to them. He sympathised with the trader who found his sales affected or his profits reduced by imports from a country from which his own products are rigidly excluded, but if we were to legislate for hard cases we should start on the road to ruin. The continual decrying by protectionists of our powers in open competition had resulted in Great Britain's loss in goodwill in the last few years being serious, and it would have been more serious still but for the fact that our customers, our friends, and our competitors had not taken us quite so seriously as we had taken ourselves.

Mr. Hugo Hirst (Managing Director of the General Electric Co., Ltd.) referred at the outset to the indecisive results of the last election on the subject of Tariff Reform, which were largely due to the loud and insistent voice with which the cotton industry clamoured for Free Trade, but it was not generally recognised that the cotton industry enjoyed a special form of protection in the ideal climatic conditions of Lancashire for this particular work. Further, the cotton industry only represented 20 per cent. of the total production of the country. In a final reference to the cotton trade, Mr. Hirst referred to the report recently published by an important section of the cotton industry, that they considered electric driving unsuitable as another instance of a characteristic policy in the cotton trade of *laisser aller* instead of *savoir faire*. Electrical engineers knew that the cost of production could be considerably reduced by the introduction of electricity and modern plant in cotton mills. Mr. Hirst thought a striking example of the process of falling back in the world's industrial race was afforded by the electrical industry. In the early years the electric cable and telegraph industry was exclusively in British hands. The manufacture of dynamos and of incandescent lamps was a flourishing industry in England, whilst on the Continent that branch of technics was still considered only suitable for laboratory research. It was in the early 'eighties that Messrs. Crompton & Co. fitted up the Opera House at Vienna and the Emperor's Palace, whilst a large number of other installations in Germany and elsewhere abroad were being fitted up by British engineers. He himself was connected with the largest accumulator works in this country, and he well remembered Oskar Miller, one of the directors of the Allgemeine Elektricitäts Gesellschaft, visiting this country and raising his hands in astonishment at the great things we were doing here. The arc lamp industry, transformers, &c., were all developed in this country. Instead of a foreign country sending cables to the United Kingdom they had to buy the machinery from us before they could make them. Now, alas, that position was reversed; but if we could keep out the foreign manufactures, and make all we require at home ourselves, we should then be on the high road to economic perfection. He was quite satisfied that it did not require a large percentage of duty to secure our market. With a duty of only 10 per cent. foreign competing firms would well understand that this figure could be varied. Under such conditions they would probably, in organising their works, be more careful to avoid over-production. The net result would be that we could turn out from our existing works continuously larger quantities, securing regular profits, giving regular employment, and at the same time be able to reduce our cost of production. Assuming that last year we imported eight to ten million incandescent lamps, he was bold enough to say that under a tariff of only 10 per cent., the bulk of those lamps would never have been imported, but would have been manufactured in the existing English workshops, many of which last year were running short time. The cost of production would have been reduced by at least the amount of the duty, and nobody would have been a penny the worse. The greater and more regular wages, however, would result in the operatives acquiring an increased power of expenditure in the home market which would benefit every other industry. As a proof that lack of technical education was not the cause of our industrial decline, Mr. Hirst referred to the large works established by certain German and American firms in this country. In spite of unlimited capital and the employment of the best technical and commercial men which these competitors had been able to produce, some of these businesses had not proved financially successful in our free trade country. Mr. Hirst said he was at heart a believer in free trade, not of the spurious type that obtained in England to-day, but free trade amongst all nations, and this might even now be brought about by the erection of a tariff barrier as impregnable as those which protect foreign countries. Probably then the absurdity of running tariff walls against us would become apparent, and trade would become free in the best sense. He claimed that Great Britain had prospered in spite of her free trade policy. At the close of the period of protection which culminated in 1846 she was the chief producer among civilised nations. From 1848 to 1878 nearly all the Continental nations were strenuously fighting for national existence, an opportunity for industrial development of which Great Britain took full advantage. Moreover, the introduction of free trade in this country tallied with the development of steam power.

These were the main points of Mr. Hirst's argument. Incidentally, he referred to the question of rates of wages. He admitted that wages were higher here than abroad—owing to the fact that under free trade the proportion of skilled to unskilled labour tended to decrease—but, although British labour was dearer per head, it was not dearer in proportion to the quantity of the manufactured article.

Mr. J. S. Raworth (British Electric Traction Co., Ltd.) said that in spite of what Mr. Kingsbury had said, the electrical industry had not had free trade. The Electric Lighting Acts and the Tramways Act of 1870 were protective measures in the interests of the municipalities. What we wanted was freedom from legislation, and this was a form of free trade for which he asked. Mr. Raworth also mentioned that 90 per cent. of the tramway machinery in this country came from America.

Mr. E. Cowan (Cowans, Ltd.) said no one could deny that the electrical industry was suffering from disease, but he did not think general protection would be beneficial. A tariff on electrical imports only might have a good effect, but there was no chance of getting this. Whenever any change took place in our fiscal policy, the unemployment of both capital and labour would, he contended, be temporarily increased. He suggested the possibility of a compromise, with the object of avoiding destructive competition, and to bring about economies by regulation and organisation of output. In order to achieve

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the former, the manufacturers would need the assistance of municipal electrical engineers, electricity committees, and consulting engineers.

Mr. J. HARLAND BOWDEN regarded protection as absolutely essential to the future industrial prosperity, both of the electrical industry and of the nation generally, and mentioned the iron and steel trade as an industry which could be revived with attendant advantages to the electrical industry. He disagreed with Mr. Hirst, however, on the question of the relative wages in this country and abroad, and said that he had seen a certificate in London, signed by a British Minister, to the effect that wages were higher in protected countries. He was sorry that no resolution was to be put to the meeting, and asked the Chairman whether it would not be possible to put one. Members of the electrical profession holding free trade views frequently spoke at festive boards, and there was an erroneous impression that these speakers represented the views of the industry as a whole.

Mr. RUSSELL FITCH supported Mr. Hirst's view that Great Britain had prospered in spite of free trade.

Mr. E. GARCKE then proposed that the meeting should be adjourned, and this was carried on a show of hands.

The discussion will be continued at Caxton Hall on Monday, June 6th, at 8 p.m.

LOCAL NOTES

ABERDEEN: *Supply to Consumer in Arrears.*—The Aberdeen Station Hotel Co., which is in liquidation, last week sued the Corporation for cutting off the supply of electrical energy. For the Corporation it was stated that the company were in arrears of payment, and that under the Aberdeen Corporation Act, 1907, they had absolute power to cut off the supply. The Court held that there was no obligation on the Corporation to supply.

ARGENTINE: *Tramway Reconstruction.*—The plans of the National Tramway Co. for the reconstruction of the tramways from horse to electric traction have been approved.

AUSTRALIA: *Purchase of Perth Tramways.*—According to the *Standard*, the Perth City Council is conducting investigations with a view to purchasing the Perth Electric Tramways Co.

BIRMINGHAM: *Electricity Accounts.*—The accounts of the Electricity Department for 1909-10 show a revenue of £186,345, compared with £175,896 in the previous year. After meeting all revenue and capital charges, there is a balance of £19,255, of which £9,000 has been carried to renewals and the balance paid over in relief of rates. In view of the fact that the Local Government Board only allows five years for loans of meters, the Electricity Committee have decided to meet the cost of these out of revenue. The accounts, therefore, bear a charge of £4,000 for meters and £1,520 for service switches installed on consumers' premises, as only a very short period is allowed in this case also. Additional plant will be required to meet the increasing demands (see Tenders Invited). The committee propose to appoint a secretary to the electricity undertaking at a salary of £600 per annum, to take charge of the commercial, secretarial, and accountancy sides of the undertaking, in order to allow the engineer more time to develop the engineering side.

Tramway Accounts.—The net profit from the tramway undertaking for the past year was £56,442, and after placing £23,528 to reserve, the balance goes to the relief of rates. The latter item is £3,500 more than in the previous year. This result is achieved in spite of the fact that the wages' bill has increased by about £8,000 per annum, owing to decreased hours of working on the part of the employees.

Tramways to Harborne.—A deputation waited upon the Tramways Committee last week in opposition to the proposals of the Committee to extend the tramways to the Harborne and Quinton districts.

BRIDLINGTON: *Electricity Profits.*—The electricity undertaking made a profit of £437 last year, against a loss of £188 in 1908-9.

BRIGHTON: *Tramway Accounts.*—After meeting all capital charges, the accounts of the tramways department for 1909-10 show a net profit of £1,190, against a deficiency of £2,420 in the previous year. The receipts increased by £3,549.

BROMLEY: *Electric Lighting Order Revoked.*—The Board of Trade have revoked the Bromley Rural Electric Lighting Order, 1903.

BURY: *Electricity Accounts.*—The profit on the electrical undertaking for last year was £3,569. The number of units sold during the year increased by 700,000.

CLITHEROE: *Electric Lighting Order.*—The Board of Trade have decided to defer revoking the Council's electric lighting Provisional Order for twelve months.

CREWE: *Electricity Profits.*—A profit of £1,219 was made upon the electrical undertaking for the past year. Of this £500 have been handed over in relief of rates, and £305 have been carried to reserve.

DARLINGTON: *Electricity and Tramway Accounts.*—The electricity accounts for last year show a net profit of £2,190, against £1,933 in the previous year. The costs of production are the lowest on record for any undertaking having an output of less than 2,000,000 units per annum.

DEVONPORT: *Electricity Accounts.*—The net profit on the electricity undertaking for 1909-10, after meeting capital charges, was £1,011. The Electricity Committee recommend a reduction in the price of current for lighting purposes from 4d. to 3½d. per unit.

DUNDEE: *Tramway Accounts.*—The revenue from the Corporation tramways for the year to March 31st was £61,235, a decrease of £636 compared with the previous year. The passengers carried, viz., 16,836,571, decreased by 151,760.

EDINBURGH: *Supply to Outside Districts.*—The Electricity Committee are considering the advisability of extending the electric supply mains outside the city boundaries. The permission of the Midlothian County Council, and also that of the Board of Trade, will have to be obtained. A large number of applications for supply have been received.

Charge for Tramway Energy.—The Electric Lighting Committee recommend that the charge for electrical energy supplied to the first electric tramway in Edinburgh shall be 1¼d. per unit for the first year.

FARNWORTH: *Electricity Deficit.*—The accounts of the electricity department for the past year show a deficit of about £1,000. The net loss on the undertaking since the commencement, after allowing for small profits in one or two years, now amounts to £1,701.

HERTFORDSHIRE: *The Trolley Omnibus.*—The construction of tramways in Watford by the Hertfordshire County Council (whose lessees are Metropolitan Electric Tramways, Ltd.) has been deferred for six months in order to gain experience of the working of the trackless trolley system.

HESSLE: *Electric Lighting.*—An offer by the Hull Corporation to acquire the Council's Electric Lighting Order, on payment of £200 by the former, is under consideration. The offer is conditional upon the Council adopting electricity for street lighting.

HULL: *Municipal Telephone Accounts.*—The Corporation telephone accounts for 1909-10 show gross receipts of £11,670, an increase of £1,978 over the previous year, and a gross profit of £4,825, an increase of £380 over the previous year. Capital charges amount to £1,994, and government royalty £1,188. The cost per station now stands at £20·58, compared with £21·42 last year, and it is now regarded as certain that the actual cost of the scheme will be below the estimates. The net profit for the year's working was £1,171.

ILKESTON: *Tramway and Electricity Accounts.*—There was a deficit of £2,086 on the past year's working of the tramways. On electricity account, there was a deficit of £86.

LLANELLY: *Light Railways.*—An application is to be made to the Light Railway Commissioners for certain amendments in the Llanelly and District Light Railways Order, 1907.

LYTHAM: *Electric Supply Company.*—The Lytham Electric Light & Power Co., Ltd., have written a letter to the Council, in which they state that they had anticipated a certain amount of financial support locally, and in this they had been greatly disappointed so far, hence the delay in carrying out the provisions of their Provisional Order. They were, however, hopeful of being able to complete the necessary financial arrangements, and will advise the Council immediately there is progress to report.

NEWCASTLE-ON-TYNE: *Tramway Accounts.*—The accounts of the municipal tramways department for the past year show a net profit of £15,136.

SOUTH AFRICA: *New Power Station.*—According to the *African World*, arrangements have been made for the Victoria Falls & Transvaal Power Co. to construct a power station at Vereeniging for supplying the Western Rand mine with electric power.

TURKEY: *Constantinople: Electric Lighting.*—With reference to the tenders for the electric lighting concession in Constantinople, it is stated that the leading competitors will be the Union Ottomanne (which, together with the A.E.G., the Siemens Schuckert Co., and a French group, put up an installation some years ago) and the Westinghouse Co. So far no information is available as to whether any British firm will tender for the concession.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BARKING.—The Electrical Engineer has prepared a report upon three alternative schemes for the extension of the present generating station or the removal of same to a new site. The matter is to be considered shortly, and in the meantime the report has been circulated amongst the members of the Council.

BARNES.—The Council require low-tension, triple-concentric cable. Particulars from the Engineer and Manager, and tenders by June 14th.

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BIRMINGHAM.—The annual report of the Electricity Committee draws attention to the necessity for installing additional plant in the near future at an estimated cost of £143,000. The plant proposed includes 11,000 kw. of generating plant.

CALCUTTA.—The Calcutta Electric Supply Corporation are proposing to erect a new power station. (See Companies' Meetings.)

FLEETWOOD.—Extensions of the generating plant will be required very shortly.

NEW ZEALAND.—The Waihi Gold Mining Co. have obtained a concession for using the Hora Hora Rapids for the purpose of generating electricity.

ST. ANNE'S-ON-SEA.—The Electricity Committee require a fuel economiser. Particulars from the Engineer.

WIMBLEDON.—An inquiry was held last week concerning a loan of £5,800 for electrical extensions.

WOLVERHAMPTON.—Mains extensions are to be carried out at an estimated cost of £400.

Miscellaneous

ARGENTINE.—The *Diario Oficial* of April 14th contains particulars of a Bill laid before Parliament on April 12th relative to a contract with Mr. Edwin Steer for the construction and working of an electric railway, to be called the "Ferro-carril Expreso Elétrico Montevideo-Buenos Aires." The line will run from Montevideo *via* Libertad, Santa Ecilda, La Paz and Rosario to Colonia, whence there will be a steamship service to Buenos Aires. The concession includes powers for the carrying out of irrigation and water works, and also for hydro-electric works. The concession is for a term of ninety years.

AUSTRALIA.—The Australian Minister for external affairs is, says a Reuter telegram from Melbourne, inviting tenders for the erection of medium power wireless telegraph stations at Port Moresby, on the South Coast of New Guinea and Cape York, the most northerly point of Australia, preliminary to the carrying out of a larger scheme for linking up the Pacific Islands with Australia.

Tenders are invited, by the Deputy Postmaster-General, Adelaide, for the supply of cordless switchboards. Copies of specifications, &c., which have to be in by July 6th, from the High Commissioner, 72 Victoria Street, London. A copy may be seen at 73 Basinghall Street, London.

BELFAST.—Mr. Andrew Nance, the tramway manager, has prepared a report in which he recommends a number of tramway extensions, the estimated cost of which amounts to nearly £300,000. As we have already announced, the Electrical Engineer has been asked to prepare estimates of the cost of the additional generating plant which will be required.

LIVERPOOL OVERHEAD RAILWAY.—Tenders are invited by June 7th, for stores, including electrical fittings, &c. Particulars from 31 James Street, Liverpool.

SWANSEA.—Tenders are to be invited for the annual supply of motors and starters.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

W.—Building, Royal Academy of Music, W. (£30,000). Wallis & Sons, builders, Maidstone.

S.E.—Public meeting hall, Newington Butts. Architect, H. A. Gissing, 1 Finsbury Circus, E.C.

N.E.—Church hall for the Parish of St. Mary (£4,000). The Vicar.

PROVINCES.

BARNSLEY.—School, Grove Street. W. P. Donald, sec., Barnsley Education Committee, Town Hall, Barnsley.

BIRMINGHAM.—Theatre, High Street. Builders, Dallow & Son, Blackheath.

Theatre, Lozells. Builders, Hamson & Smith, Dolman Street, Birmingham.

CANTERBURY.—Extensions, school of art (£2,500). C. Mount, builder, Canterbury.

DARTFORD.—School, Maypole Estate (300 places). Sec., Education Committee, Kent C.C.

DUNDEE.—Extension, lunatic asylum (£3,500). Architect, T. M. Cappon, 32 Bank Street, Dundee.

EDMONTON.—The Guardians require an installation of three-phase motors and accessories, including connection and cable connection, at the Workhouse, Bridport Road, Upper Edmonton. Particulars from Messrs. May & Hawes, Caxton House, Westminster, and tenders by June 2nd.

WEST HAM.—Tenders are to be invited for the electric wiring at the boys' department of the West Silvertown School.

GLASGOW.—Warehouse for John Watson & Son, Black Street (£3,000). C. A. Patterson, Walton Street, Lenzie.

Factory, New City Road, for Steven & Sons (£5,000). A. R. Crawford, architect, 107 West Nile Street, Glasgow.

Store buildings for Johnstons, Ltd. (£4,000). Architects, John Burnet & Sons, 239 St. Vincent Street, Glasgow.

JARROW.—School (£14,930). T. Lumsden, builder, Durham.

LUTON.—School, Beech Hill (£4,488). J. Saunders & Son, builders, Luton.

MERTHYR TYDVIL.—Masonic temple (£2,800). Architect, C. M. Davies, 112 High Street, Merthyr. Builder, J. Jenkins, Merthyr.

NORTH STAFFORDSHIRE.—Alterations to infirmary (£30,000), for the Governors of the North Staffordshire Infirmary.

TENDERS RECEIVED AND ACCEPTED

CHICHESTER.—The tender of the local electric light company has been accepted by the Council for the lighting of the new elementary schools. The voting of the Electricity Committee was equal, and a decision was left to the Council.

The following tenders have been accepted during the past month by the Government Departments named:—Admiralty, Contract, and Purchase Department:—Lampholders, Edison & Swan, &c., Co., Ltd., Evered & Co., Ltd., the General Electric Co., Ltd., W. McGeoch & Co., Ltd. War Office:—Electric cranes, Craven Bros., Ltd.; electric motors, &c., Lancashire Dynamo & Motor Co., Ltd.; installation of electric light, Royal Army Medical College, Millbank-Foote & Milne, Ltd. India Office, Store Department:—Cables and electric light stores, Siemens Bros. & Co. General Post Office:—Electric light fittings, General Electric Co., Ltd.; telephones, Peel-Conner Telephone Works, Ltd.; house telephones, Gent & Co., Ltd.

APPOINTMENTS AND PERSONAL NOTES

Councillor Dudley Stuart has been appointed Chairman of the Electric Lighting Committee of the Wimbledon Corporation in place of Alderman A. Holland, J.P., who has resigned. Mr. Stuart is on the engineering staff of the National Telephone Co., and is a Member of the Institution of Electrical Engineers.

The Finance Committee of Hampstead Borough Council have concurred in a recommendation of the Electricity Committee that the salaries of the following officers be increased:—Mr. George H. Cottam, chief electrical engineer, from £775 to £825 per annum; Mr. Egerton Sayer, chief assistant, from £365 to £390 per annum; and Mr. John Leadbeater, chief indoor assistant, from £325 to £360 per annum.

We regret to record the death of Mr. George Bremer, which took place quite suddenly on May 17th, from heart disease. Mr. Bremer has been in the service of Mr. G. Braulik for over 20 years as country representative.

In consequence of the resignation of Sir George Gibb, managing director of the Metropolitan District Railway Co., the following appointments have been made:—Mr. A. H. Stanley has been elected a director and appointed managing director; Mr. J. Carter, the secretary, has been appointed assistant to the managing director, and Mr. W. E. Mandelick, secretary of the Underground Electric Railways Co. of London, and of the various tube railway companies, has, in addition, been appointed secretary of the District Railway Co.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 to £59 10s. per ton. (Last week, £58 15s. to £59 5s.)

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—A meeting of the Electric Tramways Construction and Maintenance Co., Ltd., will be held at 79, 80 and 81 Queen Street, Cheapside, London, on June 29th, at eleven a.m., to hear the liquidator's account of the winding up.

The last day for receiving proofs of claims in the bankruptcy of R. E. Joy, electrical engineer, 143 Cheltenham Road, Bristol, is June 3rd. The trustee is Mr. F. L. Clark, 26 Baldwin Street, Bristol.

An application for the discharge of Arnold Roberts, electrical engineer, 21 North Parade, Bradford, will be held on June 21st, at ten a.m., at the County Court House, Manor Row, Bradford.

A meeting of the Birmingham Guild of Handicraft will be held at 33 Waterloo Street, Birmingham, on June 21st, at three p.m., to receive the liquidator's account of the winding up.

The Polkey Automobile Electric Lighting Syndicate, Ltd., is to be wound up voluntarily. Mr. A. R. Lancaster, Queen's College, Birmingham, is liquidator.

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J. F. Davie, Electrician, late of 10 Great Castle Street, London (present residence unknown), has been adjudicated bankrupt.

Creditors of the Southport & Lytham Tramroad Co. are requested to send particulars of their claims to Mr. J. T. Wood, 5 Cook Street, Liverpool, before June 30th.

A meeting of creditors of the Lepel Wireless Syndicate, Ltd., will be held on May 28th at the Cecil Chambers, (West) Strand, London, at 11 a.m.

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COMPANIES' MEETINGS AND REPORTS

CALCUTTA ELECTRIC SUPPLY CORPORATION.—At the annual meeting last week, the need for erecting new plant was emphasised. The mill-owners in North Calcutta have been threatening to combine and erect an electricity works, and consequently Messrs. Kennedy & Jenkin were called in to advise. Mr. B. M. Jenkin recommends the erection of a new power station. The Corporation have decided to light six miles of streets by electricity as an experiment.

The profit for 1909 amounted to £70,326. After meeting the preference dividend, the directors recommend placing £17,000 to depreciation, and a dividend of 8 per cent. for the year on the ordinary shares.

ANGLO-ARGENTINE TRAMWAYS CO.—The report for 1909 shows a net profit of £140,973, and a dividend of 6 per cent. per annum is recommended on the ordinary shares, carrying forward £10,348. In view of the concession which the company have secured from the Buenos Ayres municipality for the construction of shallow subways for tramways, the directors propose to issue an additional £6,000,000 5 per cent. debenture stock, £500,000 second preference shares, and £1,500,000 ordinary shares. It is also proposed to increase the dividend on the first and second preference shares from 5 to 5½ per cent. Careful estimates by the manager show that the profits from the subway tramways will be considerably in excess of the amount needed for the interest and sinking fund on the cost of construction.

TYPEWRITING TELEGRAPH CORPORATION.—In their report for 1909, the directors say they cannot hold out any hope of improvement in business, and recommend a voluntary liquidation.

POTTERIES ELECTRIC TRACTION CO.—The profit for 1909, after deducting debenture interest, is £27,291, compared with £21,781 for 1908. The directors recommend the full five per cent. preference dividend, the transfer of £2,000 to reserve, and £7,090 to renewals, and the payment of 2 per cent. on the ordinary shares, carrying forward £1,050. During the year £8.996 has been expended on permanent-way renewal, and additional expenditure will have to be incurred during the present year. The resumption of dividends on the ordinary shares indicates a satisfactory improvement in the position of the company.

LEAMINGTON & WARWICK ELECTRICAL CO.—A dividend of 2 per cent. is recommended on the ordinary shares for 1909, placing £800 to depreciation and reserve, £350 to redemption of debentures, and carrying £119 forward.

CITY OF BIRMINGHAM TRAMWAYS CO.—Mr. E. Garcke presided at the annual meeting on Thursday, and pointed to the fact that, notwithstanding that the lines were being gradually taken over by the local authorities, and that the company was exposed to increasing competition from municipal tramways, the net profits for 1909 showed an improvement over those for the previous year. The position of the company was quite satisfactory, for they had in liquid assets, apart from the remaining tramways and properties, more than the whole of their debenture share capital and the liabilities to creditors. The meeting passed a resolution paying back out of accumulated profits £4 per share to the 6,047 full-paid ordinary shareholders by way of reduction of capital. This step has been taken in order to put all the ordinary shareholders upon the same basis.

SOUTH STAFFORDSHIRE TRAMWAYS (LESSEE) CO.—The accounts for 1909 show that, after providing for debenture and loan interest, there is a loss of £1,493.

CALLENDER'S CABLE & CONSTRUCTION CO.—Mr. Henry Drake, presiding at the annual meeting on Thursday, said that at no time for many years past had the conditions under which the company's operations were carried out been more difficult than in 1909. The quantity of work available was even less than usual, and the struggle for orders was consequently severe. This was especially the case in the home trade, where no new contracts of any magnitude were carried out, and where even the orders for extensions to existing mains were less in number and smaller in value than customary. Whilst this was doubtless due in part to the extended use of metal filament lamps, it was greatly intensified by the universal depression which prevailed, and by the uncertainty in the financial outlook throughout the country generally. It was, therefore, with considerable satisfaction that the directors noticed the improvement in trade which had taken place since the beginning of this year, with the consequent increase in orders which had been placed with the company. In order to increase the company's scope, the Board are extending outside the cable business, and among a number of side lines have taken up a battery which, the chairman said, is largely used for motor-cars.

WAIHI GOLD MINING CO.—At the annual meeting on Thursday, it was stated that the company has obtained a concession for using the Hora Hora Rapids for the purpose of generating electricity.

GRAVESEND & NORTHFLEET ELECTRIC TRAMWAYS CO.—At the annual meeting last week, Mr. W. G. Bond, the chairman, stated that the company had settled its differences with the Gravesend Corporation in regard to the reading of the meters at the power house which register the tramway current. It will be remembered that the company took action in the High Courts to enforce the Corporation to replace the meters by some other type, but Mr. Justice Hamilton decided against the company by reason of a clause in their agreement with the Corporation that all matters of difference should go to arbitration.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED. — Oesterreiche Siemens-Schuckertwerke-Ges., 6 per cent. for 1909. Felten & Guilleaume-Lahmeyerwerke, 6 per cent. for 1909, against 8 per cent. for 1908. Oldham, Ashton & Hyde Tramways Co., 6 per cent. for 1909. Sao Paulo Tramway, Light & Power Co., 10 per cent. for 1909.

Leamington & Warwick Electric Co., 2 per cent. on the ordinary shares for 1909.

MORTGAGES AND CHARGES.—Particulars of the following have been filed:—Ferabin Lamp and Electrical Accessories. £2,500 Debentures, created May 4th, 1910. Property charged—Certain patents relating to galvanised dry cells and any other patents which the company may become entitled to relating thereto under an agreement dated January 28th, 1910. No trustees.—Berry Construction Company. £2,000 Debentures, created April 11th, 1910. Property charged—The company's undertaking and property, present and future, including uncalled capital. No trustees.

ATLANTA HYDRO ELECTRIC POWER CO.—Subscriptions are invited for an issue of $3,000,000 first mortgage 6 per cent. sinking fund gold bonds, and $1,500,000 ordinary stock. The company is erecting a 25,000 h.p. electric power transmission plant, and has a fifty years' concession from the Atlanta City Council for the supply of electricity for all purposes.

NEW COMPANIES

BRITISH ALUMINIUM CO., 109 Queen Victoria Street, London. Capital, £1,000,000 in £1 shares (300,000 preferred). To acquire the Loch Leven Water & Electric Power Co., Ltd., and to adopt an agreement with the British Aluminium Co., Ltd. (in liquidation).

ELECTRICAL ADVERTISING CO.—Registered by C. F. Kennedy & Co., 13 and 14 Abchurch Lane, London, E.C. Capital, £1,500. To carry on the business of engineers, machinists, electricians, advertisers, advertising agents and specialists, advertising machine makers and dealers, &c.

A. WARD.—85 Shaftesbury Avenue, London, W. Capital, £3,000. Electrical and general engineers.

NU-ADS.—Registered by Jordan & Sons, Chancery Lane, London. Capital £2,000. To take over certain patent rights from F. J. Blacksley, C. C. Chapman, A. C. Harris, and F. A. Blacksley, in connection with electric advertising signs.

A. DEAN & CO.—London House, London Road, Norbury, Surrey. Capital, £1,000. Electrical engineers, dealers in electrical fittings, cables, wires and sundries, contractors for electric installations, &c.

FELGATE INSTALLATION CO., Broadway Buildings, Reading. Capital, £1,000 in 100 deferred shares of 1s. each and 995 ordinary shares of £1 each. Electricians, dealers in electricity, motive power and light, &c.

LOVIS PATENT PROPELLER SYNDICATE. Registered by H. E. Warner & Co., 10 Finsbury Circus, London. Capital, £1,400. Marine, electrical and mechanical engineers, &c.

FOSTER & PULLEN, Bradford. Capital, £5,000. Electricians, lighting specialists, &c.

NEW PUBLICATIONS

Science Abstracts, March. Section A, Physics; Section B, Electrical Engineering. (London: E. & F. N. Spon.) 1s. 6d. each.

Engineering Workshop Machines and Processes. By F. Zur Nedden. Translated and revised by J. H. Davenport, with an introduction by Sir Alexander Kennedy. (London: Constable & Co.) 6s.

Foreign and Colonial Patent Laws. By W. C. Fairweather. (London: Constable & Co.) 10s. 6d.

"National Physical Laboratory: Report for 1909." (Teddington: W. F. Parrott.)

"Soldering, Brazing, and the Jointing of Metals." By T. Bolas. Fourth edition. (London: Dawbarn and Ward.) 6d.

Compulsory Working and Revocation of Patents. By E. Lunge. (London: Stevens & Sons.) 3s. 6d.

"The Foundations of Alternate-Current Theory." By C. V. Drysdale. (London: Edward Arnold.) 8s. 6d.

Fortschritte der Elektrotechnik. Part III. 1909. (Berlin: Julius Springer.)

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ELECTRICAL ENGINEERING

No. 179 [VOL. VI., NO. 22] THURSDAY, JUNE 2, 1910. [PRICE ONE PENNY.
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Canada. 8s. 8d. per Annum.
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Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Letters for Insertion, *Tuesday first post.*
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All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, London." Telephone No, : 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

OUR Monthly Supplement on Electrical Engineering in Mines is included in this issue. It opens with an article by a colliery electrician on signals and telephones in mines. Reports are given of meetings at some of the branches of the Institution of Mining Electrical Engineers, including an abstract of a Paper on "Colliery Cables," by Mr. W. J. Richards, discussed at Cardiff. Other Papers read before societies include an account of the electrical equipment of Murton Colliery, and an interesting description of a large exhaust steam turbine plant at a German colliery. Notes are also given on the causes of some recent colliery accidents.

AT the annual meeting of the Institution of Electrical Engineers last Thursday, a resolution containing a message of condolence with the Royal Family was passed, the annual report was adopted, and the following gentlemen were elected to fill vacancies on the Council (a ballot having been necessitated by the proposal of one additional name to those put forward by the Council)—Messrs. McMahon, Pearce, Dickinson, Morcom, and Faraday Proctor. At a special meeting on the same evening some additional expenditure on the new building was authorised. (Page 353.)

SOME notes are given on the electrical equipment of the latest class of French submarines. (Page 354.)

ALUMINIUM has been used successfully in place of copper for commutators. The lower conductivity is of little importance, as brush area and cooling surface are the determining factors as to size. Experiments appear to show that the oxide surface film offers no objections. (Page 354.)

SOME experiments on the use of the Brown telephone relay in a receiving wireless telegraph circuit are described in a short article by Mr. C. C. F. Monckton. (Page 355.)

WE give a brief analysis of the accounts of the North Metropolitan Electric Power Supply Co., which shows average works costs of 0·513d. per unit sold, a figure which is brought up to 0·649d. by the inclusion of management expenses, &c., but not including capital charges. (Page 355.)

SOME experiments made by Mr. E. B. Wedmore, of the B.T.-H. Co., to demonstrate the working of a new system of automatic protective switchgear for colliery and other distribution networks, are described. Cables in branch circuits were mechanically damaged so as to produce short-circuits. The apparatus cut out the faulty circuits only, the main supply remaining unaffected. (Page 356.)

SUBSTANTIAL reductions are announced in the prices of tantalum lamps. (Page 356.)

WE publish a letter calling attention to the fact that a man purporting to represent an exhibition in Brussels, but having no connection with the International Exhibition, is calling upon manufacturers in this country. (Page 356.)

MR. GERRARD'S Paper on electric braking has been further discussed by the Glasgow Local Section of the

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Institution of Electrical Engineers, when the design of the brake magnets was considered in relation to the production of surging. (Page 357.)

A PAPER read by Mr. W. Jamieson before the Glasgow Local Section of the Institution of Electrical Engineers, described a curious effect in the production of electrification of celluloid sheets. (Page 357.)

A COMPANY is to be formed for supplying electricity in Rosario.—There was a net profit of £6,251 upon the Brighton Electricity Undertaking for the past year.—At Dundee, the net profit was £1,260.—The Sunderland Electricity accounts show a loss of £112, and the Tramways accounts a profit of £3,588.—The Board of Trade have refused to renew the licence for the Dolter surface-contact system at Torquay.—Hackney Council have agreed to contribute £15,000 towards the cost of widening Ball's Pond Road.—Bradford Tramway accounts show a record profit of £30,000. (Page 358.)

LARGE extensions of generating plant are contemplated at Belfast and St. Pancras. A water cooling tower is required at Wallasey; motors and motor starters at Swansea; surface condensing plant at Ealing; conduit at Ilford; and tramway stores at South Shields. Loans are required at Wimbledon (£800) and Watford (£7,000). (Page 359.)

MESSRS. Mirrlees, Bickerton & Day show a profit of £5,577 for 1909. Brush Electrical Engineering Co. made a loss of £21,230 last year. Satisfactory results were shown by the first year's working of the Fife Tramway Light & Power Co. A dividend of 4 per cent. is announced by Messrs. Siemens Bros. & Co. (Page 361.)

IN a Paper read recently before the Association of Teachers in Technical Institutions, Dr. R. Pohl (Chief Engineer, Phœnix Dynamo Manufacturing Co.), advocated the reorganisation of technical education on a national basis, and emphasised the importance of a due admixture of theory and practice, and the need for better correlations of the work of technical universities. (Page 363.)

AMONG the Specifications published by the Patent Office on Thursday last was one by A. W. Somers and R. J. Crowley for an accumulator in which the positive plates only are recharged. New charged positive plates are substituted for the old ones when the latter are discharged.—A method of increasing the self-induction of submarine telephone or telegraph cables by covering a solid conductor with a braiding of interlaced copper and iron wires is covered by R. K. Gray.—An electrolyte for batteries for obviating crystallisation and creeping is described by G. Schauli.—The patent by C. A. Parsons and others for a low-pressure system of electrical marine propulsion is opposed.—As a result of opposition Messrs. Dick, Kerr & Co. have surrendered a patent for magnetic track brakes. (Page 364.)

Wireless Telegraphy.—As will be seen from our advertisement columns, Marconi's Wireless Telegraph Co., Ltd., are taking action against the British Radio-Telegraph & Telephone Co., Ltd., for infringement of their Letters Patent Nos. 7777 of 1900, 10245 of 1902, and 4593 of 1907, and against the United Wireless Telegraph Company of New York for infringement of their Letters Patent Nos. 12326 of 1898 and 7777 of 1900.

At a meeting at Newcastle on Friday, under the auspices of the Newcastle and Gateshead Chamber of Commerce, the question of the construction of a wireless station on the north-east coast was discussed. Lieut. Loring, Inspector of Wireless Telegraphy, G.P.O., London, who was present, said he thought there was a demand for such a station, which could be brought into line with the government organisation. If some arrangement could be made between the shipowners whereby the Post Office would be guaranteed against loss, the Postmaster-General would take the matter up. The representatives of the North of England Steamship Owners' Association, the Tyne Shipbuilding Association, and the Tyne Repairers' Association, who were present, resolved to report to their associations and to hold a further meeting, when a report would be drawn up and forwarded to the Postmaster-General.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JUNE 2ND.

Institution of Mining Engineers.

10 a.m. In Geological Society's Rooms, Burlington House, Piccadilly, London. "A Storage Battery Extension to a Three-phase Colliery Power Plant," by W. Maurice.

Rontgen Society.

8.15 p.m. At 20 Hanover Square, London. (1) "Practical Observations on Everyday X-Ray and Electrical Work," by Dr. Howard Pirie; (2) "Recent Improvements in Radiographic Technique," by Dr. R. Knox. A new form of apparatus for producing rhythmical variations in the strength of electrical currents will be shown by Dr. Hampson.

FRIDAY, JUNE 3RD.

Institution of Mining Electrical Engineers.

10.30 a.m. Lancashire Branch. Visit to the Harlton Colliery, Bolton.

SATURDAY, JUNE 4TH.

Institution of Mining Electrical Engineers.

11 a.m. Lancashire Branch. Visits to Manchester Corporation Electricity Works and Municipal School of Technology.

Royal Institution.

3 p.m. Tyndall Lecture I. "Electric Heating and Pyrometry," by Prof. J. A. Fleming, F.R.S.

Institution of Mining Electrical Engineers.

4.30 p.m. Warwickshire and South Staffordshire Branch. At Imperial Hotel, Birmingham. (1) "Earthing of Coal-cutting Machines," by J. R. English; (2) "Resistance of the Human Body to Electrical Currents," by W. Foster.

MONDAY, JUNE 6TH.

National Electrical Manufacturers' Association.

8 p.m. At Caxton Hall, Westminster. Continued discussion on "The Effects of Free Trade or Protection upon the Electrical Industry."

THURSDAY, JUNE 9TH.

Tramways and Light Railways Association.

10.30 a.m. Annual Congress in Dublin. (1) "The Dublin United Tramways," by R. S. Tresilian; (2) "Brake Shoe Standardisation," by J. A. Panton; (3) "Tramway Economics," by J. R. Salter; (4) "Railless Traction," by H. England; (5) "Should the 1870 Act be Revised," by F. Coutts.

FRIDAY, JUNE 10TH.

Tramways and Light Railways Association.

Annual Congress. Visits to works, &c.

SATURDAY, JUNE 11TH.

Royal Institution.

3 p.m. Tyndall Lecture II.: "Electric Heating and Pyrometry," by Prof. J. A. Fleming, F.R.S.

Telegraph Traffic.—The land-line routes *via* Fao and Hanekine were interrupted between Alep and Bagdad and between Mossoul and Bagdad on the 24th ult.—Two days later the cable between Lattagin and Palura failed.—On the 28th ult. telegraphic communication beyond Catumbella in Angola was restored to working order.—On the 30th ult. the cable between Bonny and Duala was once more on the active list, as well as the routes *via* Fao and Hanekine.—Telegraphic communication with Reunion is still interrupted.—The Western Union Telegraph Co. is, it is said, about to lay another Atlantic cable, which will probably be landed in Newfoundland. The *Faraday*, owned by Messrs. Siemens, was recently chartered by the company, but this may be in connection with repairs of the existing cables.—The South American Cable Co. has reduced rates to the South American Republics.

Damages for Electric Shock.—In the King's Bench Division last week, before Mr. Justice Grantham and a special jury, Mr. J. J. Wheeler, a builder and contractor, of Woodford, was awarded £581 damages against the Marylebone Borough Council for injuries caused by an electric shock. Early last year some premises in Devonshire Place, W., were being rebuilt by plaintiff. When the old premises were demolished, only the cellar was left, and the Borough Council, as the electric supply authority, had been given notice to discontinue supply and withdraw the service. The employee of the Council to whom this instruction was handed, finding that the cellar was not to be rebuilt, did not actually withdraw the service, but disconnected at the main fuses, leaving a wire in a lead pipe remaining in the cellar. During the progress of rebuilding, the plaintiff, seeing what appeared to be a lead pipe in the cellar, commenced to cut it away with a chisel, with the result that he received a severe shock, which burned his arms and brought about a temporary withering of the muscles. He was in bed for four months, and was ordered away for another two months. Mr. Justice Grantham, in addressing the jury, said the Borough Council could not justify their action in not withdrawing the service after having been specially instructed to do so, and the jury found as stated above, the damages for loss of business being assessed at £450, for pain and suffering £75, and for special damages £56.

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THE INSTITUTION OF ELECTRICAL ENGINEERS

Annual Meeting and Report

AT the annual general meeting of the Institution of Electrical Engineers last Thursday the following resolution, passed by the Council, was confirmed, before proceeding to the other business of the meeting.

"That the Council of the Institution of Electrical Engineers, in Special Meeting assembled, hereby record their sense of the deep loss which the British Empire has sustained through the lamented death of his Majesty King Edward VII., and their sorrow that one who spent his life for the good of his people, and to whom his subjects were affectionately devoted, has been removed from the scene of his unremitting labours, and that a reign marked by unparalleled social, scientific, and industrial progress is thus brought to a close. The Council humbly beg permission to express to his Majesty King George V., and the Queen-Mother and the members of the Royal Family, their sincere condolence and sympathy, and further to lay before his Majesty an assurance of their unswerving loyalty and devotion, and their earnest wishes that he may, with her Majesty Queen Mary, long be spared to reign in happiness and peace over a loving and united people."

ELECTION OF COUNCIL.

A ballot was held for the election of five members of Council. It will be remembered that, in addition to the five candidates nominated by the Council, Mr. H. Faraday Proctor (City Electrical Engineer, Bristol) was nominated by Messrs. W. A. Chamen and W. W. Lackie. The names of the remaining officers and members of Council were given in ELECTRICAL ENGINEERING, April 28th, page 277. The result of the ballot is given below:—

Mr. P. V. McMahon, 859 votes (elected); Mr. S. L. Pearce, 852 votes (elected); Mr. H. Dickinson, 846 votes (elected); Mr. R. K. Morcom, 842 votes (elected); Mr. H. Faraday Proctor, 696 votes (elected); and Mr. J. E. Kingsbury, 488 votes (not elected).

PREMIUMS.

The following awards were announced:—

Mr. MILES WALKER, the *Institution Premium*, value £25, for his two Papers, "Short Circuiting of Large Electrical Generators and the resulting Forces on Armature Windings," and "The Design of Turbo Field Magnets for Alternate-current Generators, with Special Reference to Large Units at High Speeds."

Professor A. SCHWARTZ, the *Paris Electrical Exhibition Premium*, value £10, for his Paper, "The Testing of Rubber for Electrical Work."

Mr. S. G. BROWN, the *Fahie Premium*, value £10, for his Paper, "A Telephone Relay."

Messrs. W. P. DIGBY and D. B. MELLIS, a *Premium*, value £10, for their Paper, "Some Properties of Switch and Transformer Oils."

Mr. G. W. WORRALL, a *Premium*, value £10, for his Paper, "Commutation Phenomena and Magnetic Oscillations occurring in Direct-Current Machines."

Mr. F. HOPE-JONES, a *Premium*, value £5, for his Paper, "Modern Electric Time Service."

Mr. F. H. R. LAVENDER, a *Premium*, value £5, for his Paper, "Research on Metallic Filament Lamps."

Mr. ALBERT CAMPBELL, a *Premium*, value £5, for his original communication, "On Magnetic Testing of Iron with Alternating Current."

Mr. C. F. SMITH, a *Premium*, value £5, for his original communication, "The Relation between the Stator and Rotor Circuits of the Single-phase Induction Motor."

Mr. L. W. WILD, a *Premium*, value £5, for his original communication, "The Production, Measurement, and Effect of Variable Wave-Form."

In addition to the above, a Willans Premium has been awarded to Mr. J. H. Rider, for his Paper on "The Electrical System of the L.C.C. Tramways."

[This premium, which can be awarded triennially by the Institutions of Electrical and Mechanical Engineers alternately, is of the value of £25.]

STUDENTS' PREMIUMS AND SCHOLARSHIPS.

Scholarships.—Mr. B. C. Clayton, Salomons Scholarship (£50); Mr. G. W. P. Page and Mr. A. D. Peacock, David Hughes Scholarships (£50 each).

Premiums.—Mr. R. C. Plowman (£10), Mr. A. P. Young (£5), Messrs. P. J. Cottle and J. A. Rutherford (£5), Messrs. P. Kemp and W. A. Stevens (£5), Mr. W. H. Young (£5).

MEMBERSHIP.

The report records an increase in the total membership, including students, from 6,097 to 6,222 during the year.

RULES FOR PROFESSIONAL CONDUCT.

The Council have decided to adopt the regulations relating to professional conduct recently incorporated in the bye-laws of the Institution of Civil Engineers. These rules read as follows:—

1. He shall act in all professional matters strictly in a fiduciary manner with regard to any clients whom he may advise, and his charges to such clients shall constitute his only remuneration in connection with such work, except as provided by Clause 4.

2. He shall not accept any trade commissions, discounts, allowances, or any indirect profit in connection with any work which he is engaged to design or to superintend, or with any professional business which may be entrusted to him.

3. He shall not, while acting in a professional capacity, be at the same time, without disclosing the fact in writing to his clients, a director or member of, or a shareholder in, or act as agent for, any contracting or manufacturing company or firm or business with which he may have occasion to deal on behalf of his clients, or have any financial interest in such a business.

4. He shall not receive, directly or indirectly, any royalty, gratuity, or commission on any patented or protected article or process used on work which he is carrying out for his clients, unless and until the receipt of such royalty, gratuity, or commission, has been authorised in writing by those clients.

5. He shall not improperly solicit professional work, either directly or by an agent, nor shall he pay, by commission or otherwise, any person who may introduce clients to him.

6. He shall not be the medium of payments made on his clients' behalf to any contractor or business firm (unless specially so requested by his clients), but shall only issue certificates or recommendations for payment by his clients.

The British Electrotechnical Committee.—The work of this committee has now been transferred to the Institution. An informal meeting of the committee of the various countries is to be held in Brussels this summer.

Wiring Rules.—It is hoped that the further revised edition will be ready before the end of the year.

Electricity in Mines.—A letter embodying the Council's views, after the consideration of several suggestions, has been forwarded to the Home Office Committee, and Mr. W. H. Patchell has attended to give evidence before the committee.

Electric Lighting Act, 1909.—A deputation from the Council, urging certain modifications in this Bill, waited on the Board of Trade. The clause objected to did not receive the sanction of Parliament.

Special Committees.—Committees have been appointed to consider examinations for associate membership, alterations in the Articles of Association, and electrical driving in textile mills.

BENEVOLENT FUND.

The Committee of Management report that the Benevolent Fund of the Institution shows a satisfactory increase for the past year. On December 31st, 1909, the capital account of the fund stood at £3,500, as compared with £3,000 at the end of 1908. The donations to the fund in 1909 include one of £25 from the Committee of the Electrical Engineers' Ball. Grants in aid amounting to £77 were made during 1909.

The Wilde Benevolent Trust Fund stands at £1,744 16s. One grant in aid of £25 was made during 1909.

At a special general meeting on the same evening the following resolution was passed:—

"That, in addition to the sum of £20,000 authorised by special resolution of the 29th of July, 1909, to be expended, a further expenditure of a sum not exceeding £10,000 in connection with the Institution building on (*a*) structural alterations, furniture and fittings, and (*b*) outlays during present or future structural alterations, including ground rent, rates and taxes, less rents received or to be received from tenants in the building, be sanctioned and approved, and that the Council be authorised to make such financial arrangements (including the borrowing of money on the security of the Institution building and on the Institution property in Tothill Street) as the Council may consider necessary for the above purpose."

It was explained by Mr. R. Hammond (Hon. Treasurer), partly in reply to some questions by Mr. W. B. Esson, that there was no intention of raising and spending all this money at once. The estimates for the building alterations had not been really exceeded, but there were certain losses on realisation of securities, &c., which it was considered would be better met out of the building fund than out of the general fund. The Council also wish to have the means of meeting certain eventualities which might occur in event of a change of tenants.

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ELECTRICAL EQUIPMENT OF THE LATEST FRENCH SUBMARINES

IN connection with the regrettable loss of the ill-fated *Pluviôse* outside Calais Harbour last week, some details recently published in the French technical Press of the electrical equipment of the latest type of submersibles will be found of interest. The latest three boats, the *Mariotte*, the *Archimède*, and the *Amiral Bourgeois*, are much larger than the 12 boats of the *Pluviôse* class, and displace about 800 tons, as compared with the 398 tons of the latter class. The equipment is also more powerful. The engines are of about 2,000 h.p., against 700 h.p., and they are capable of travelling 10 knots, using the electric motors only, either on the surface or submerged, while the *Pluviôse* and its sister boats were designed for a submerged speed of 7¾ knots.

Although these boats are often spoken of as submarines, as in radius of action, &c., they correspond to the larger submarines of the British Navy, it is important to remember that the French under-water craft is divided into two classes, "submarines" proper, for home defence, propelled only electrically by accumulators, and "submersibles," equipped with petrol or other engines for use on the surface for long voyages, as well as the electrical equipment for under-water propulsion. The boats we are speaking of should thus strictly be spoken of as submersibles.

Each of the new boats which are now undergoing their trials is provided with two propellers, each driven by a separate shaft upon which is mounted an engine and an electric motor, which during surface cruising acts as a generator to charge the batteries used for under-water propulsion. For manœuvring purposes these shafts are controllable separately. On account of their greater ease of control, the electric motors are often used even when on the surface for such manœuvres as entering harbours, for going astern, &c., and it will be readily understood that a considerable range of speeds must be provided for in the controlling system. The arrangement adopted is somewhat different in the three boats. In the *Mariotte*, which was electrically equipped by the Breguet firm, the battery is divided into sections, placed sometimes in series and sometimes in parallel, and motor field rheostats and series resistances are also used for further speed adjustments. On the *Archimède*, on the other hand, which was equipped by the same firm on a different system, the battery is permanently connected up, and motors with two armature windings but one field system are employed. These windings have separate commutators, which can be coupled in series or in parallel. The arrangement has considerable advantages over the use of two separate motors placed in series or parallel, as it precludes unequal sharing of the load due to inequalities of flux. It has also advantages over the arrangement used on the *Mariotte* in that better conditions of commutation are secured, small and stronger commutators are possible, and less wiring is required for the connections. The arrangement is also preferable as it enables the battery to be charged always with its cells in series, avoiding inequalities of charge liable to be produced with the two halves in parallel. For this purpose both armature windings are put in series, when a sufficient voltage to charge the whole battery can be obtained, even when the boat, and therefore the engines, are running at a comparatively low speed. An article on the subject by M. J. Breguet, in *La Lumière Electrique*, points out some of the special difficulties of this class of work, due to the extreme dampness which affects the insulation, the difficulties of ventilation of the motors, and the confined space. Details of the motors and controlling system are not given, but in some general remarks as to future designs, such as those of the 1,000-ton submersibles now projected, the author states that the directions to which these are tending include the use of voltage up to 480 volts for the main circuits, to reduce the size of conductors and connections, the employment of contactors, breaking under oil and operated by 120-volt control circuits, and the use of enclosed water-cooled motors.

ALUMINIUM FOR COMMUTATORS

IN connection with the increasing use of aluminium for electrical purposes, which has now extended from overhead lines to station 'bus-bars, insulated cables, and even switchgear, it is interesting to note that experiments have already been made with an aluminium commutator, and we are indebted to Mr. Aubrey V. Clayton (the author of the paper read before the Institution of Electrical Engineers on April 21st) for the following particulars of these tests, which were made in 1900. Mr. Clayton, who, after a ten years' residence in Scandinavia, has returned to London to carry on a consulting business, was at that time designer and chief of the continuous-current department of the Magnet Co.'s works, Ludvika, Sweden, and the machine on which the aluminium commutator was used was designed by him. The machine was a 7½ h.p. 220-volt. D.-C. motor running at 1,450 r.p.m., and was placed in service in the works and run continuously day and night for several months, afterwards being used daily in the shops for over a year in order to test whether aluminium commutators could be relied upon under ordinary industrial conditions.

During this time the machine proved quite satisfactory, and the results obtained from the commutator were excellent in every respect. The bars were made from drawn aluminium, and although the metal was very soft, there was practically no wear observable on it, as particles of the carbon brushes seemed to become imbedded in the soft aluminium and prevented its rapid wearing away. It ran quite sparklessly, and without any cleaning of the commutator or attention during the whole of the period under observation.

Mr. Clayton adds that, on account of his severing his connection with the Magnet Company in 1903, he lost sight of the machine, but that in 1907, when the Magnet Company was taken over by some other works to form the Amalgamated Electrical Companies, and he returned to Ludvika as manager, he tried to trace the machine and found that it had been sold as an ordinary commercial machine. No complaints were ever heard about it, so it may be taken for granted that it turned out quite satisfactory.

The chief trouble in using the aluminium bars was, he says, the difficulty in making connections between the copper conductors on the armature and the commutator bars. These were made by wedging the copper conductor into a slot milled in the segment and the fusion of aluminium at the joint by means of a blow-pipe. If the commercial manufacture on a large scale of such machines had been taken up, screwed, or other mechanical connections, would have been necessary. The use of aluminium for commutators and other purposes had, however, to be dropped because of the very large copper commercial interests which were at work against the employment of the new material, and hence this one trial machine having an aluminium commutator was the only one made.

We understand that the British Aluminium Co., Ltd., will supply aluminium commutator segments, drop-forged or drawn as required, from their Milton Works. If the difficulties of connection to the armature conductors can be satisfactorily overcome, it would seem that this should provide a useful field for aluminium. The lower conductivity is of little importance in this case. Brush area and cooling surface are the determining factors as to size, and it does not seem that the oxide surface film offers any objections.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

SIGNALS AND TELEPHONES FOR MINES

By "Durham"

THE installation of a reliable system of signals and telephones is one of the most important factors in regard to the safe and efficient working of a colliery. Quite recently this was exemplified by a fatal accident which happened to a workman in one of our large coal-mines in Durham due to faulty signalling arrangements. At the inquest it was stated that the engineman received the wrong signal, and in consequence the deceased was crushed between two full tubs. It was afterwards found that the lad who at the time had charge of the bell cabin, instead of "rapping" the signal from the cabin to the engineman in the proper manner, did so by crossing the bell-wires on the engine plane, and as a result the engine-man's bell did not ring distinctly.

Any colliery electrician knows that signals are a continuous source of trouble, and the electrician who has charge of this particular department generally holds a most unenviable position. In many colleries this work is undertaken by a "bell-man," who in the majority of cases is nothing more than a jointer or fitter, and who knows but little of the working of bells or telephones. This is probably the principal cause of the trouble with signals, and it would be better to appoint a qualified electrician to look to the proper installation and maintenance of this department of the colliery plant. The following are practical points which are the result of the author's experience :—

All bell-wires on the engine planes should be fixed to porcelain insulators, fastened to the timbers (either props or baulks) by means of coach-screws. The insulators ought not to be more than 6 to 10 yards apart, or the wires will very likely on occasions be made to come in contact with each other. More care in fixing the insulators in this manner would be the means of keeping both the wires and batteries in a much better condition.

All batteries should be of the "Leclanché" type. A good method of getting satisfactory results from a set of batteries is to have them erected in a wooden box, the lid of which is fastened by means of screws, and as an extra precaution it is wise to secure the lid further by means of a small padlock, the key of which is kept by the electrician who has charge of the system. Another important thing is to connect a tumbler switch in circuit with positive of the battery and the battery wire. The electrician should examine every box at least once a week and make sure that there are no faulty zinc rods or broken porous pots. The idea of the tumbler switch mentioned above is to cut the current off the lines whenever the signals are not in use, and then in case the stonemen or shifters happen to cross the wires through fixing timber, &c., the batteries do not become discharged.

The bells themselves, in the writer's opinion, should be of the "single stroke" and not the trembler variety. The single-stroke bell gives a distinct ring, which is most important, whereas trembler bells are liable to give a ring which is not very clear. The bells will be found to work very satisfactorily if they are mounted on the battery box at the out-bye side and on an iron bracket (which has a wood base for the bell to rest on) which can be easily fastened to the props at the in-bye side.

Care should be taken with the insulated wires connecting the bells to the engine plane wires. In a good many cases faults are caused through wires getting broken. In a good many collieries these wires are G.P. insulated. This class of wire may be satisfactory under some conditions, but it sometimes becomes affected in a very dry pit, and the insulation peels off.

Whenever it is necessary to "rap" on the wires, a "push" should be put in circuit with them, and this would do away with such accidents as that mentioned above.

Perhaps the most important part of a signalling or telephone circuit is the "earth" connection, and one which is the cause of a good deal of trouble. It is often possible to make a very good "earth" connection by means of the rails, but sometimes it is not successful, especially in a dry mine. In a case

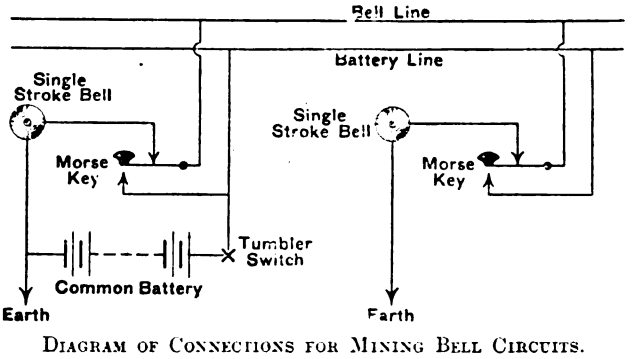


DIAGRAM OF CONNECTIONS FOR MINING BELL CIRCUITS.

of this sort a satisfactory "earth" can be made by filling a hole in the ground, about a yard deep and 2 ft. wide, with coke breeze and fixing an iron rod in the hole.

The writer does not think that there is much fear of any explosion being caused through bells not being "gas-proof," but at the same time it may be the wisest thing to have all signals gas-proof.

A system of wiring bell circuits which can be recommended is shown in the accompanying diagram.

In regard to shaft signalling, all the wires should be in the formed of a cored cable, and an advantage is to have the cable made up so that it contains at least three spare cores, which can be used in case any faults should occur on any of the other cores. Paper-insulated and lead-covered cable is quite satisfactory for signalling work, and may be secured to the brick wall of the shaft by means of wooden clamps about 1 in. to 2 in. off the wall and fastened by means of "rag bolts."

For communicating between different collieries under the same management and between different parts of the same mine the simplest and best method is that of the telephone exchange. I find that the most satisfactory way to arrange a system of this kind is to have built as near to the shaft bottom as possible a "telephone room" to act as an "exchange." Telephones should be installed in all the "haulage houses," pump rooms, &c., the wires from each of these places being brought to the telephone room at the shaft bottom, where they are connected to a central telephone switchboard. From this board connection is also made between the shaft bottom and the manager's office at bank, power-house, engineer's office, &c. It will be seen from this that communication can be made between any of the departments at bank and any of the different places in the mine, and also by means of "double plugs" in the telephone room at the shaft bottom. Any two places in the mine can be connected together.

When running the wires for the telephones it is always ad-

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visable to fix the wires whenever possible in travelling ways, so that in case of accident on the engine planes, such as are so often caused by falls of stone, &c., the wires do not get broken. An important point is never to allow telephones to be connected to the bell wires.

Both the battery and magneto types of telephones will be found to work very well in mines, but in the author's opinion the magneto instruments are the most suitable. They have the advantage that it is only necessary to have at the most two cells for speaking purposes at each point. The apparatus should be of a make which will stand rough usage, and the loud-speaking pattern is preferable, although the ordinary office type of telephone has worked very well in mines. The majority of "inter-communication" systems are quite unsuitable for mining conditions.

INSTITUTION OF MINING ELECTRICAL ENGINEERS

NOTTINGHAMSHIRE AND DERBYSHIRE BRANCH

AT a meeting held at University College, Nottingham, on May 28th, the discussion on Mr. L. Routledge's Paper on "Earthing," referred to in ELECTRICAL ENGINEERING IN MINES, May 5th, was resumed. The chairman, Mr. J. C. Thomson (Mansfield), described a method of testing earth connections at the working pressure. The use of a small accumulator battery for this purpose was discussed. Mr. L. de Grave (Derby) and Mr. Lee (Mansfield) also described methods of earthing. Mr. F. Cusworth suggested that, for mechanical reasons, nothing less than 7/18 stranded cable should be used for earth connections. He also suggested that manufacturers should provide earthing screws on motor frames.

A short Paper on the subject of flame-proof apparatus was then read by Mr. L. W. de Grave, who described several forms of flame tight motors, including those with baffle plates so arranged that any hot gases produced by combustion within the motor case are cooled by passing between the plates before reaching the atmosphere. He considered it advisable to provide the covers of switchboxes with lips to prevent the entrance of dust. A wide lip also made them flame-proof if a gap of about 1/64 in. was employed. Some device should, he thought, be provided to indicate when gas had been ignited inside a switch-box or motor case. Referring to ignition of gas or coal-dust, he mentioned that the knives of a coal-cutter had been known to cause this, presumably by causing sparks by friction. In the discussion Mr. F. Cusworth expressed the opinion that of the various types of flame-proof motors, the plate protected type was the best.

The next meeting will be held on June 25th, when Mr. Williams-Ellis will read a Paper on the cascade motor as applied to mining work.

Colliery Plant destroyed by Fire.—On Saturday, May 21st, the generating plant of the Wernos and Rhos collieries at Wernos, Pantyffynon, Carmarthen, was destroyed by an outbreak of fire. Power is supplied from this station to drive the washing and crushing plant of the collieries. Arrangements have been made for a temporary supply.

The Institution of Mining Electrical Engineers.—A meeting of the Warwickshire and South Staffordshire Branch of this Institution was held on Saturday, April 30th, at Birmingham. The local president, Mr. A. Hall (Nuneaton), read a short Paper on mining switchgear, and Mr. J. R. English described some experiments he had made respecting the earthing of coal-cutting machines, which were most instructive. The discussion was adjourned.

South Wales Branch of the I.M.E.E.—The first annual dinner of this branch of the Institution of Mining Electrical Engineers was held on Saturday, April 30th, Mr. S. F. Walker occupying the chair. The toast of "The Industries of South Wales" was acknowledged by Mr. L. Watkins, manager of Bargoed Colliery. Mr. T. Schonthiel proposed the toast of the Institution, and Mr. G. Humphrey that of the Press, acknowledging the assistance and encouragement which had been given by the technical papers to the new Institution.

Mining Patent.—Among the specifications published by the Patent Office last month was one by J. Gillies and C. D. McPhee, of Ontario, describing an electrically ignited fuse for blasting purposes. The wires pass into a short tube through a plug of wax mixed with chlorate of potash, and terminate in a short length of fine wire enclosed in a button of highly inflammable composition. The fuse enters the tube from the opposite end, and can be readily inserted or removed. There is a space between the fuse end and the igniting button, and a slit is made in the wall of the tube for the escape of the gas during ignition of the fuse.

CABLES FOR COLLIERIES

AT a recent meeting of the South Wales branch of the Institution of Mining Electrical Engineers in Cardiff, Mr. W. J. Richards read a Paper on cables for colliery purposes. After referring to the fact that the majority of electrical accidents in mines are traceable to cables, the author states that overhead cables are most usual for surface work, although, perhaps, not always the most economical, and calls attention to the suitability of aluminium for this purpose. The constant alterations at the pit-head render buried cables unsuitable.

Shaft cables should be double-wire armoured and covered with a non-hygroscopic material. They should be placed in the down-cast shaft as the gases rising in up-cast shafts have an injurious effect on them. It is often advisable to divide the cables up into two or more sets in parallel as heavy cables are difficult to handle, especially in deep shafts, and the risk of complete cessation of supply is lessened. A preservative coating should be applied annually. Vulcanised bitumen cables are gaining in favour for shafts, but with these there is a risk of decentralisation with high temperatures, though they withstand the action of water well. In armouring cables, compounded jute should be applied between the layers of armouring, and a final covering of jute serving or Hessian tape over the whole. Jute packing round the cores increases the resilience, but is liable to absorb moisture and increase the risk of break-down. Lead-covered cables are not to be recommended for shafts, as the weight of the lead produces a creep. Junction-boxes often give trouble in shafts, and joints should therefore be avoided whenever possible.

For cables in-bye, continued the author, the ideal method is to use conduit, but the heavy capital cost and the occasional movements of the strata render this method only rarely practicable. The usual methods are suspension from the timbering or merely laying along the surface of the roadway. Cables should, as far as possible, be fixed in in-take air-ways so as to be in a pure atmosphere. If laid on the ground, they are liable to get covered up, and then damaged by picks when sought for. Other causes of damage are derailed trams, and sawing by haulage ropes. Suspended cables should be strung high up by leather or tarred rope slings, fixed by oak cleats impregnated with tar, or attached to heavy porcelain insulators. They should be loosely strung to avoid damage by falls of roof. Joint-boxes should be placed in man-holes and supported on pillars. In wall-arched in-take roadways, armouring is not necessary; but along ordinary roadways, where there are occasional falls of roof, armoured cables, well bonded and earthed, are best. Armouring adapts itself to automatic leakage protection, and in general unarmoured cables are more dangerous when damaged.

Trailing cables, continued Mr. Richards, are subjected to particularly severe conditions. They should be tested for insulation every day before use, and should be taken out of the pit and thoroughly examined every month. A standard covering comprises (1) mattress twine braided and waterproof compounded, (2) hard cord braid specially manufactured to prevent unravelling when cut, (3) compounded hard cord braid interwoven with galvanised steel wire, (4) raw-hide or leather strip braiding or a wrapping of stout marline.

DISCUSSION.

The President, Mr. S. F. WALKER, suggested that the evening's discussion should be confined to shaft cables.

Mr. L. THOMAS (Bargoed Colliery) did not think paper or bitumen insulation could be much improved upon. He had tried "dialite," and after a few months the cable was found to be stripped bare for about two yards by the action of falling water. He suspended his cables by cleats, but had found that tightening them up caused the armouring to become embedded in the lead sheathing.

Mr. S. FOKES (Treharris) agreed with the author in the matter of shaft cables. He had had difficulty in properly filling the joint-boxes, but now obtained good results by first thoroughly drying the box, and then pouring in Diatrine compound in a very liquid state, so as to expel all the air and moisture. He had had no troubles due to decentralisation of the cores.

Mr. G. HUMPHREY (Cardiff) advocated impregnated paper cables, lead-covered and armoured, for H.-T. work, having used such successfully for over sixteen years. Care had to be taken to avoid the absorption of moisture, and the occurrence of resonance effects.

After a few remarks from Mr. S. F. WALKER, Mr. T. SCHONTHIEL showed a novel method of jointing cables, and an interesting form of joint-box, and the discussion was then adjourned.

The Whitehaven Disaster.—We are glad to be able to state in contradiction to certain rumours which have been circulated that the explosion at Whitehaven was in no way due to electrical causes. A certain amount of cable has been laid in the mine for the supply of power for ventilation, but at the time of the accident the electrical plant was not running, and, indeed, the cable in question has not yet been used. There was a telephone system in the mine using the iron wire haulage signal wires, but these appear to have been broken by the explosion.

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ELECTRICAL EQUIPMENT OF MURTON COLLIERY, DURHAM

A PAPER, by Mr. E. Seymour Wood, read on April 9th, before the North of England Institute of Mining and Mechanical Engineers, described the electrical equipment of the South Hetton Coal Co.'s Murton Colliery, which consists of three pits, two used for coal drawing and the third for ventilation only. Ventilation was formerly carried out by means of an underground furnace, assisted by the heat from 20 underground boilers, which supplied steam for working the underground pumping and haulage plant.

After the establishment of the Durham Collieries Power Co., with their generating station at Philadelphia, a distance of eight miles from Murton Colliery, it was decided to dispense with the whole of the boilers underground, substitute electric power, convert the haulages to electric drive, put down ram pumps driven by motors, and do away with the underground furnace. A three-phase alternating supply at 5,500 volts 40 cycles is given through duplicate cables to a sub-station on the surface. This sub-station is equipped with three switchboards. The main high-tension switchboard distributes the fan-circuit, four 2,000-volt transformers for underground work, and a 500-volt transformer for the surface screening machinery. The medium-tension (2,000 volts) switchboard, which distributes to the three shaft cables, connected to a distribution board underground, and the low-tension (500-volt) switchboard supplies the motors for driving the screening machinery at the surface.

The 5,500- and 2,000-volt switchboards are built of granite-concrete, and are of the cellular type, with enclosed bus-bars, each panel being equipped with an oil-break switch, overload relay, time-limit fuse, and isolating switches to separate the switchgear of any panel from the bus-bars. The fan installation consists of two duplicate single-inlet Capell fans, each capable of passing 300,000 cu. ft. of air, with a 4-in. water gauge, at a speed of 200 r.p.m., rope-driven, by two 12-pole 400-h.p. slip-ring induction motors, with a synchronous speed of 400 r.p.m.

The weight of each motor with pulley and slide irons is 11¾ tons, and the efficiency given is 92·8, and the power factor as 89·5 on full load. Liquid starters are used. Current is taken to the 2,000-volt underground board through three 37/14 double-armoured dialite cables, which are carried in the shaft by wooden cleats resting on wrought-iron clamps attached to steel-wire ropes suspended in the shafts of the mine. Six three-phase induction haulage motors have been installed, representing a total rating of 1,550 b.h.p.

One of these is among the largest underground haulages known. The distance to the farthest landing is 13,464 ft., the average gradient being 1 in 33·5, and the maximum 1 in 9 against the load. The load consists of 60 tubs, the total weight of the set being 45 tons, and the maximum speed is at the rate of 16½ miles per hour. In addition to the coals, sets of empty tubs are run for the purpose of conveying the men and boys in- and out-bye at a speed of six miles per hour, an auxiliary motor being used operating the same drums. The main motor is of the protected ventilated type, with a capacity of 400 b.h.p., working at a speed of 285 r.p.m. The auxiliary motor is of 200 h.p., and is connected to the shaft of the main motor with a clutch, the gear operating the clutch also working a change-over switch, which cuts off the current from the stator of the 400-h.p. motor, and switches it on the auxiliary motor when required. The controller is of the liquid type, having a high-tension reversing switch, and three movable electrodes operated with a wheel gear by the attendant. The cooling is done by water from the shaft tubbing passing through a coil above the electrodes. The switch panel is fitted with an overload relay and a wattmeter.

The second haulage is a converted one, driven by a 300-h.p. motor, and has a similar controller, but a metal type controller is used in the case of two other haulages, with 150 h.p. and 200 h.p. respectively. This pattern of controller is combined with a high-tension reversing switch. The secondary switch is connected to the rotor circuit, which is two-phase wound, and consists of six fixed and two movable contacts, each fitted with four fingers, the tips of which are fitted with sparking-pieces. The whole of the contacts operate in oil. The resistance frames are enclosed in well-ventilated cases, placed as near to the controller as possible. The first movement of the wheel closes the primary switch, and allows the current to enter the stator; in this position the fingers are all clear of the contacts, with all the resistances in series. The second movement is on to the first contact with the first fingers, and this cuts out the wire resistance. The third movement cuts out the multiplying resistance, and leaves the main resistance in series. The fourth movement brings the second fingers on to the first contact, and puts the first step of the main resistance in parallel with the multiplying resistance, whilst the fifth and sixth steps of the main resistance are in series with the multiplying resistance. The movements over the six contacts result in cutting out or putting in sections of resistance, working the section in parallel or series according to the speed required, and this arrangement gives a range of 25 speeds to the motor.

The remaining haulage has a 300-h.p. motor, and a liquid controller.

The pumping equipment is arranged to pump the water from the lowest seam to the large standage in the main seam, where the water from that seam is collected, the whole then being forced 1,224 ft. to the surface.

The pump in the lowest seam is a three-throw ram pump driven by through-gearing by a 30 b.h.p. enclosed induction motor with slip-rings in a gas-tight case.

The main pumps consist of two three-throw ram pumps, each with a capacity of 200 gallons per minute, running at 45 r.p.m. The driving is done from each end of the crank-shaft with machine-cut cast-iron spur-wheels from an intermediate shaft, this being driven from the motor by eight cotton driving ropes, 1¼ in. in diameter. The pumps are driven, partly by gearing and partly by ropes, by two induction motors of the slip-ring protected type, each of 120 b.h.p. at 385 r.p.m. The starting arrangements consist of two rheostats, with resistance and contacts immersed in oil. Thorough tests have been made with these pumps, and careful measurements of current and water show an overall efficiency of 73 per cent.

There is also a drift pump driven by a 60-h.p. motor, eight motors varying in size from 10 to 50 h.p., and aggregating about 175 h.p., are used on the surface for driving screening machinery, &c. The whole of these motors are of the slip-ring type, totally enclosed, and dust-proof. Each motor is equipped with a switch-panel, fitted with an oil-break switch, a wattmeter, and a starting switch with cast-iron grid resistances.

The whole installation was put in under the supervision of Messrs. D. Selby Bigge & Co., consulting engineers, Newcastle, and has been at work with good results since August, 1908.

RECENT COLLIERY ACCIDENTS AND THEIR CAUSES

ON May 5th, a boy of 16, R. Walker, engaged as a putter at the Bardykes colliery of the Summerlee Iron & Coal Co., was killed by electric shock. The system is three-phase 500 volts, with insulated neutral. The boy was found dead near a triple-pole oil switch, and there is no positive evidence as to how he received the shock. It is believed that he inserted a piece of wire under the cover protecting the terminals of the switch, as one of the terminals showed signs of arcing, and a piece of wire partly fused was found hooked on to the switch box. The switch was found to be in order. As a precaution against similar accidents, the openings between the terminal covers and the switch case in these switches have been filled up. The terminal box of one has been filled up with compound, and this also protects the terminals from corrosion and dirt.

Two accidents occurred on May 12th. At the Blantyreferme colliery, near Uddingston, a roadsman, J. Bellingham, was engaged on the main haulage way in repairing the damage caused by a runaway hutch, and received a fatal shock from a steel girder which the hutch had caused to fall by displacing its props. It appears that the girder had fallen on to an unarmoured 400-volt three-phase bitumen-insulated cable, the flange cutting through the insulation into the core. The neutral of the system was earthed, but the other end of the girder had fallen on to a wooden sleeper. It was thus practically insulated, and so the man received a 230-volt shock. The electrician and one of the owners of the mine have agreed that it is desirable to use armoured cable in this and similar steep roadways with girder supported roofs.

The other accident on May 12th was at the Auchengeich colliery, near Lenzie, Lanarkshire, where a man, J. Martin, received a fatal shock by touching a transformer case. The system is 440 volts three-phase, and armoured cables are employed. Examination of the transformer showed that the cable inside the case had become bared, and had come in contact with the case, but that the latter was not connected to the armouring. The armoured cable was led into the case through a gland, and it appears that the man had placed his hand on the cable and caused the bare part to touch the case and the armouring to come out of the gland at the same time. The gland was not designed for use as an earth connection to the armouring.

Wire Ropes.—We have received from Messrs. W. N. Brunton & Son (Musselburgh, Scotland) a new catalogue of wire ropes for mining, containing full particulars of a variety of types of rope for use under different conditions, with various fittings, &c., and some useful notes on the handling and care of wire ropes, fixing of attachments, sockets, &c.

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ELECTRICAL EQUIPMENT OF A GERMAN COLLIERY

A Large Exhaust Steam Installation.

AMONG the Papers read at the meeting of the North of England Institute of Mining and Mechanical Engineers on April 9th was one by Mr. H. M. Hudspeth, describing the electrical equipment at the Shamrock I. and II. Colliery at Herne, Westphalia, Germany. The plant generating station is driven partly by live steam and partly by exhaust steam, and consists of the following sets:—One 1,000-kilowatt live-steam Curtiss turbine, with Allgemeine-Elektricitäts-Gesellschaft generator, running at 3,000 r.p.m.; one 1,800-kilowatt live-steam Parsons turbine, with Brown-Boveri generator, running at 1,500 r.p.m.; one 1,500-kilowatt exhaust-steam Parsons turbine, with Brown-Boveri generator, running at 1,500 r.p.m. One of the live-steam turbo-generators usually stands as a reserve. The turbines exhaust into a main receiver, which is connected to the three condensers, of the surface-cooling type, through valves. Usually, two only of the condensing plants work at one time, the third standing as a reserve. The exhaust steam turbines work with the steam from two main winding engines, two auxiliary winding engines, two steam-driven ventilating fans, and five air compressor engines.

The winders exhaust immediately into a receiver (an old cylindrical boiler), which serves as a feed-water heater and to steady up the intermittent flow of steam due to the winders. From this receiver is carried the main exhaust-steam range, which is joined by the exhausts from the ventilators and compressors before reaching the accumulators. Before entering the accumulators, the whole of the exhaust-steam is passed through an oil-extractor.

There are two regenerative accumulators, each having a diameter of 157 inches and a height of 236 inches, and consisting of a wrought-iron shell, the interior of which is so arranged that the exhaust-steam entering nearly at the top of the vessel descends down one side to the bottom, and then ascends through the downcoming water. The latter is kept in circulation by means of two small centrifugal pumps. Delivering in at the top of the accumulators, the water falls down to the bottom, being baffled on its way so as to allow it to come into contact with the ascending steam as much as possible; a self-regulating apparatus keeps the level of the water at the bottom of the accumulators at a depth of about 18 inches.

From the accumulators the steam passes through water-separators before entering the turbine. The latter develops 1,500 kilowatts, which is probably the largest load developed by such a plant. The steam is supplied at a pressure varying from 1 to 1·2 atmospheres absolute, equal to from 14·7 to 17·6 lbs. per square inch. The turbine is coupled to a three-phase Brown-Boveri 5,000-volt 50-cycle generator. The steam consumption with a 90 per cent. vacuum and a load of 1,100 kilowatts equals 37·4 lbs. per unit. Under ordinary working conditions, all the engines above-mentioned are supplying steam, with the exception of the reserve ventilator. The turbo-generator is always running when the pit is working. During the night-shifts it runs on a very light load, there being only three to four compressors and the ventilator supplying exhaust-steam. An automatic live-steam inlet-valve is in process of being fitted to the plant for the purpose of keeping the turbine loaded up to 1,500 kilowatts. The capital cost of the whole exhaust-steam plant was £17,500.

This power station is one of five situated at the other collieries of the same company, all inter-connected by 5,000-volt trunk mains, so that they can work in parallel or supply each other in case of breakdown. The larger motors about the mines are run direct off the 5,000-volt three-phase circuit, but 1,000-volt motors are used for the screening and washing plant, &c., on the surface.

Practically all the underground haulage is done by electric locomotives worked on the overhead-trolley system at 220 volts continuous current, from a circuit supplied by underground motor-generators. Each locomotive is equipped with two compound-wound motors of about 12 h.p. each, and is capable of exerting a normal tractive force of 970 lbs. They travel at 8 miles per hour and weigh about 5 tons each. The cost of haulage by this method is worked out as 1·46d. per ton mile, with power at 0·3d. per unit.

The pumping arrangements are at present undergoing alterations, the old steam-driven forcing pumps being taken out to be replaced by electrically-driven high-speed centrifugal pumps and an electrically-driven forcing set. For lighting, three-phase current at 110 volts is mostly used, from transformers from the 1,000 volts circuit. Underground on the electric haulage-roads 220-volt lamps are simply put between the trolley-wire and the rail. Osram metallic-filament lamps are largely used both above and below ground.

We understand that the Louis Schwarz & Co. A.G., of Dortmund, Germany (whose London representatives are Messrs. Michael Pal & Co.), were the main contractors for the exhaust-steam installation at the Shamrock I. and II. Collieries, and erected the plant.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during May.

May 5th.—Supplement on "Electrical Engineering in Mines," opening with a letter on the desirability of employing competent men as colliery electricians, and containing reports of a number of discussions in various parts of the country of the Institution of Mining Electrical Engineers. The Papers discussed include one on the relative merits of continuous and alternating currents for colliery work by Mr. C. R. M. Young, read at Newcastle. Mr. J. Glynn Williams handled some aspects of the same subject in a Paper on storage batteries for colliery work at Whitehaven, and the question of earthing was introduced for discussion by Mr. Routledge at Nottingham. A report of a discussion before the Mining Institute of Scotland on Mr. Nelson's Paper on electricity in mines; an abstract of a further contribution on the subject of electricity and coal-dust explosions by Prof. W. M. Thornton and Mr. E. Bowden are also given. Reports of the discussions at the Newcastle and London meetings of the Institution of Electrical Engineers on Mr. W. W. Wood's Paper on earthing of the neutral of three-phase colliery installations are also included. A summary of electrical mining patents which have been published in April is given, and notes explaining the circumstances of one or two colliery accidents are included.

May 12th.—Descriptions of some new switches, wall plugs, &c. Report of Paper discussed by the Iron and Steel Institute dealing with the production of electric power from waste heat.

May 19th.—Illustrated description of a large electric power station in the Argentine.—A new testing set.—Description of a large new steam turbine driven generating station in London.

May 26th.—Details of a metal conduit wiring system.

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A NOTE ON THE BROWN TELEPHONE RELAY

By C. C. F. Monckton

A TELEPHONE relay lent to the writer by Mr. S. G. Brown was placed in a receiving radiotelegraphic circuit as shown in Fig. 1. By means of switches S_1 S_2 an eight thousand ohm Sullivan hand telephone combination T_1 or the three thousand ohm primary coil of the relay A could be switched into the detector circuit. The detector D_1 was of the silicon type, and generally a potentiometer was also connected with a battery of either one or two accumulators C_1 and resistances of R_1 100 ohms and R_2 6,000 ohms. The secondary winding of the relay B was taken through a resistance box R_3, which was generally short-circuited, a dry cell C_2, a microammeter M suitably shunted, and a pair of Sullivan telephone receivers T_2 (40 ohms).

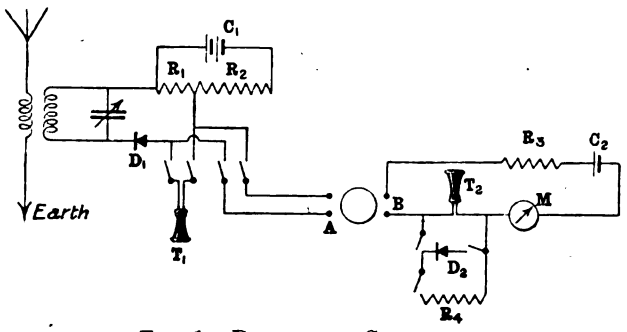


FIG. 1.—DIAGRAM OF CONNECTIONS.

The novel conditions consisted in placing switches so that this telephone combination T_2 could be shunted either by a crystal detector D_2 or a resistance R_4. The adjustment of the relay was purposely altered fairly frequently. It was found quite easy to obtain an adjustment with the relay, such that signals could be heard in T_2 which could not be heard in T_1 with S_2 open. Closing S_1 made no apparent difference to the loudness of the signals heard in T_2.

Under most conditions of working, shunting T_2 with the detector made no difference to the sounds. Shunting with a resistance R_4 diminished the sensitiveness. If, however, the relay were in a more than usual sensitive state, shunting the telephone T_2 with the detector still further increased the sensitiveness of the combination.

Under the same condition, shunting the telephone with a resistance increased the sensitiveness, but on account of singing noises the relay current had to be increased by turning the milled head W (Fig. 2). The best results with shunted resistances were obtained with R=70 ohms, but better results were obtained by shunting the telephone with a detector. The best combination tested for this detector was a metal point against iron pyrites. With this as a shunt, signals were lost when R_3 was 13-14 ohms; the same signals were lost without the shunt with R_3=7-8 ohms.

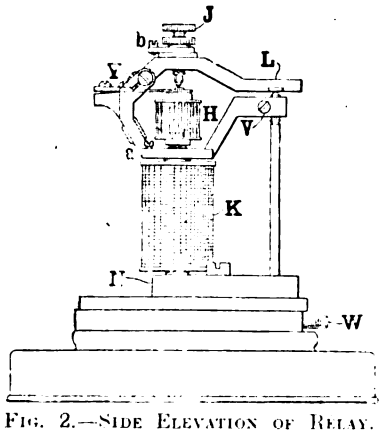


FIG. 2.—SIDE ELEVATION OF RELAY.

A method of testing the sensitiveness was placing the telephone T_1 on a separate table, closing the switch S, and placing a watch on the table about two feet away from the telephone. Under the best conditions the tick could be heard in T_2 when shunted by the detector, but could not be heard without the shunt.

With a little practice it might be possible to tell from the sounds in T_2 whether shunting the telephone would be of advantage. It was found only possible to obtain this extreme sensibility by trial. J (Fig. 2) was first altered; then the adjustments Y and W could be made in five minutes. If the relay were not sufficiently sensitive it was found best to readjust J, so as to bring the point against another part of the flat contact piece.

ACCOUNTS OF THE NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.

THE report and accounts of the North Metropolitan Electric Power Supply Co. for the year ended December 31st, 1909, show a considerable increase in the connections and output over that of the previous year, and some remarkably low generating costs. The total number of units sold during the year was 16,402,447, which, compared with the previous year's figure is an increase of 16·5 per cent. Particulars of the maximum demand are not included in the report, so that it is impossible to work out the load-factor. It is also impossible to give the generating costs of the Brimsdown and Willesden stations independently, as they are not separated in the accounts, nor are particulars of the units generated at each station and used in conversion given. The following table gives an analysis of the revenue account showing the costs per unit sold for the whole undertaking:—

	£	Pence per unit sold.	
Generating Costs—			
Coal	21,292	0·312	
Oil, waste, water, stores, &c. ...	950	0·013	
Salaries and wages...	5,335	0·078	
Repairs and maintenance	3,446	0·050	
	31,023		0·453
Distributing Costs—			
Salaries and wages...	2,524	0·037	
Repairs and maintenance—Mains.	270	0·004	
,, ,, Substations, &c.	693	0·010	
,, ,, various	652	0·009	
	4,139		0·060
Total works cost	**35,162**		**0·513**
Management Expenses, &c.—			
Rent, rates and taxes ...	4,067	0·059	
Salaries, fees and establishment charges	4,617	0·067	
Law and other charges (including insurance	657	0·010	
	9,341		0·136
Total, excluding capital charges	**44,503**		**0·649**

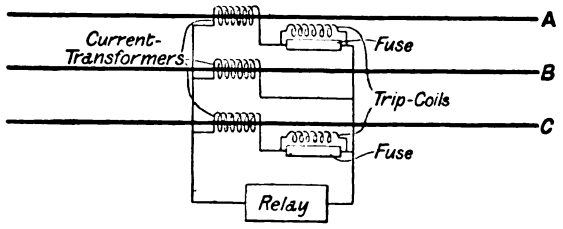
The total receipts (including £87,834 for the supply of current) amounted to £88,925. Of the balance, interest on debentures, loans, &c., absorbed £10,725, and £2,000 was carried to reserve, so that with the addition of £603 remaining from last year's account, after payment of dividends and allowing for depreciation, and with the addition of £2,016 interest received, the net balance is £34,315. Of this the directors recommend the transfer of £7,000 to depreciation, the writing off of £3,500 against preliminary expenses, and the payment of dividends on preference stock amounting to £1,977. This would leave £21,838, out of which a six per cent. dividend is recommended, with £837 carried forward.

The capital expenditure amounts to £535,968, of which £510,380 has been spent on works, £22,610 on special Acts and Orders, and the remainder on special items.

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AUTOMATIC PROTECTIVE SWITCHGEAR

SOME interesting experiments made with a special arrangement of leakage protective devices were described in a Paper read recently by Mr. E. B. Wedmore, of the B.T.-H. Co., before the Institution of Mining Engineers. In the author's arrangement, there are current transformers in each phase, but one trip-coil is transferred from the usual position into a return circuit common to the three transformers. This coil operates only on faults to earth, as there is then a resultant current in the common circuit, and the other two operate with overloads or faults between phases. Independent adjustment for operation on faults and overload is obtained. With a sensitive relay, similarity of the three transformers is necessary, as if their ratios were to differ, say, on a momentary overload, a current would flow in the relay, representing a spurious leak. This current is kept within limits by the use of a trip-coil shunted by a low-resistance fuse, as indicated in the accompanying figure. This



ARRANGEMENT OF TRIP-COILS FOR DISCRIMINATING BETWEEN OVERLOADS AND LEAKAGE.

prevents the trip-coil from operating until an overload of sufficient magnitude has lasted sufficient time to melt the fuse, when the coil instantly takes the current and trips the switch. When relays are employed, the oil switches are operated by trip-coils excited preferably independently of the A.-C. supply. Where individual motor circuits are furnished with a low-voltage release, this may be utilised for the purpose, the relay short-circuiting the winding. A resistance is used in series.

The author proposes to use such leakage devices in series, on the main feeder, on every branch feeder, and again on each motor or group of motors. In this case, some discriminating arrangement is necessary, or a leak on any one motor will affect all the devices. This may be obtained by grading the settings of the devices; thus, on a 3,000-volt circuit, a 100-ampere feeder may be equipped with a relay operating at 10 amperes; the switch controlling a branch circuit carrying 25 amperes may be set to open on a leak of 1½ amperes, and an individual motor of, say, 30 h.p., may have an automatic switch operating at ¼ ampere. The tests show that even in the rare event of sudden and extensive damage to a cable, discriminating action can be obtained in some measure. The cables employed were supplied by Messrs. Callender & Co., and were paper-insulated three-core, with vulcanised-bitumen shield, and double-wire armoured, 2·5 in. diameter. The apparatus employed corresponded to the equipment of a main feeder of 100-amperes capacity, and a local circuit of 25 amperes, and leakage relays were employed as described above. The following are some of the results :—A 2,000-volt cable had a 15-cwt. pug dropped on to it from a height of 5 ft. This resulted in the immediate disconnection of the branch circuit, but the main-feeder switch was unaffected, and the overload devices did not operate. On restoring supply without removing the faulty portion, the branch-circuit switch was again opened by the leakage relay, and the branch-circuit time-limit fuses also blew, indicating a short-circuit between the phases. Another sample was damaged in a similar manner, and on restoring supply the relay cleared the fault four times. On the fifth test, however, the fuses blew. A 500-volt cable, with bitumen sheath, was damaged by repeated hammer blows. Only the branch-circuit relay operated. Neither flame nor smoke appeared outside the cable. Another 500-volt cable, with bitumen sheath, was cut through with a blunt tool to a depth of ⅛ in. On the insulation breaking down, both relays operated without disturbing the overload devices. In order that fire and smoke might issue, it was found necessary to damage the cable very severely, and the most effective means proved to be successive blows of a heavy hammer. When the relays were not in use, smoke and flame issued in several instances; but in no case was it possible to produce any sign of flame, or even of smoke, when the relays were in service. Where the relays are employed, the problem of the proper time-limit for a given service can be solved without regard to the conditions accompanying a fault. It is necessary on some occasions to supply overload devices, which delay the opening of the switches for several minutes on moderate overloads. The author designed such a device for haulage work to act when one of a number of trucks became derailed, and the man in charge did not notice the fact at once. With such a device in use, every leak would develop into a severe short if no leakage relays were employed.

The author concludes that leakage is the principal source of danger in mines, and that this danger may be reduced to a minimum if a thoroughly armoured and well-earthed system be employed. In this case leakage currents will be confined to the metallic covering, thus removing all risks except those arising from actual rupture of, or severe arcing in, the cable. With the author's system, even when an earthed neutral is employed, the supply should not be disturbed except at and beyond the point where the fault exists. The majority of faults develop, in the first instance, as faults to earth, whether arising from moisture, electrolysis, abrasion, or from any other external cause. In the past where the neutral has been earthed, it has been necessary to employ a connection capable of passing sufficient current to operate the overload device with the heaviest setting on the largest feeder. Where leakage relays are employed, however, it is possible to employ a resistance in the earth-connection, which limits the leakage current under the severest conditions to a fraction of normal load.

REDUCTIONS IN THE PRICES OF TANTALUM LAMPS

SOME important reductions in the prices of Tantalum lamps are announced to take effect from the beginning of this month. The discounts, terms for contracts, &c., will remain exactly as hitherto, but the new list price of the popular 16-c.p., from 100 to 120 volts, is now reduced to 2s., to which price the 50-130 volt 25-c.p., the 60-130-volt 32-c.p., and the 100 to 130-volt 50-c.p. lamps have also come down. Still cheaper is the 50-80-volt 10-c.p. lamp at 1s. 6d., to which price all the 20-40-volt lamps have also been reduced. The 200-250-volt 50-c.p. lamp has been reduced to 3s. The above prices are for standard bulbs. Spherical bulbs are, as a rule, 3d. higher. All other sizes remain as heretofore.

CORRESPONDENCE

THE BRUSSELS EXHIBITION.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—A Mr. Max Kaiser, describing himself as "Commissioner for England and Great Britain," is soliciting manufacturers and traders in respect of an exhibition at Brussels which may be mistaken for the Exposition Internationale et Universelle now in being. The forms of application for space are headed "International Exhibition, Brussels, 1910."

It is therefore necessary to say that Mr. Max Kaiser has no connection with the International Exhibition in which the British Government and the Governments of other nations participate, and to appeal to your esteemed courtesy for publicity in the matter.

I am, Sir, your obedient servant,

Bruxelles, May 26th, 1910. F. MANDER BURCH.

Municipal Telephones.—The annual report of the National Chamber of Trade, presented at the annual meeting last week at Bradford, dealt with the question of telephones. It pointed out that the average cost per station throughout the National Telephone Co.'s system is £30, in the local areas served by the Post Office £52, and in the municipal exchange area at Hull £21. This illustrated in the most striking manner possible what might be expected as between municipal and State administration of local telephone areas. Mr. J. W. Clark, of Halifax, urged that municipalities should be given an opportunity of purchasing the local telephone areas at the price paid by the Government in 1912 to the National Telephone Co. What could be done in Hull could be done in all the other large cities, where at present the charges were higher. The report was adopted.

Tramway Running Powers in Lancashire.—Before the Master of the Rolls and Lords Justices Farwell and Kennedy in the Appeal Court on Thursday, an appeal against a judgment of Mr. Justice Eve in regard to tramway running powers was heard. The Eccles Corporation wish to restrain the South Lancashire Tramways Co. from using a section of the Corporation lines in the Worsley Road, Eccles, of a length of about 500 yards. The company were running their cars over this section of the Eccles lines under a licence from the Salford Corporation, with whom there was an agreement, and there was also an agreement between the two Corporations. The company contended that under the agreement the power to grant such a licence was vested in the Salford Corporation, but this the Eccles Corporation denied. Mr. Justice Eve held that the grant of the licence to the company by the Salford Corporation was not a breach of the agreement between the two Corporations, and was not, therefore, *ultra vires*. The Appeal Court, however, took an opposite view, and allowed the appeal, and issued an injunction restraining the company from running their cars over the line in question until authorised by Parliament to do so. The main reason for this view by the Appeal Court was that the Board of Trade consent was necessary after Parliamentary sanction, and this had not been obtained.

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ELECTRIC BRAKING

GLASGOW DISCUSSION.

MR. A. GERRARD'S Paper on electric braking on the Glasgow Corporation tramway system, on which we have already reported the discussion at the London meeting of the Institution of Electrical Engineers on April 7th (see ELECTRICAL ENGINEERING, April 14th, p. 249), was further discussed by the Glasgow Local Section of the Institution on Tuesday, April 12th. In the Paper Mr. Gerrard described some experiments made on the Glasgow tramway system with magnetic track brakes. It was found that on braking at high speeds, the motor pressure rose to twice the normal, and various methods of reducing this pressure and the heavy braking currents were tried. The method finally adopted consists in shunting the motor fields in two successive steps by means of solenoid switches, and is found to prevent abnormal pressure rise and intermittent skidding, and further to reduce the braking current very considerably.

The discussion was opened by Mr. J. FERGUSON (Mechanical Engineer, Glasgow Corporation Tramways), who testified to the diminution of damage to the cars by the use of electromagnetic brakes brought about by the introduction of the solenoid control, and to the increased confidence of the motorman in handling cars equipped with the new brakes, owing to the fact that he knows he need not fear skidding. On the Glasgow system the electromagnetic brakes are only supposed to be used for emergency stops, and on that basis Mr. Ferguson estimated that the number of applications per annum would be about 18,000,000. The defects reported for last year totalled to 17 or less than one per million applications.

Mr. W. MCWHIRTER (Messrs. McWhirter & Son, Glasgow) commended the action of the Corporation in allowing the result of their experiments to be made public. He also criticised the magnetic design of several of the magnets, the older type of which he thought contained too little iron and too much copper, and emphasised some of the conclusions given by the author of the Paper as to the causes of surging.

Mr. SCOTT MAXWELL (Electric Control, Ltd., Glasgow) advocated the regular use of the electric brake for low as well as high speeds in place of the hand-brake. This would enable higher values of both acceleration and deceleration to be adopted with safety even in crowded thoroughfares, with a consequent increase in schedule speed. There was now no justification for the view that double-truck cars could not be safely used in Glasgow owing to the difficulty of securing proper braking effort. In American practice—the cars were, as a rule, very long and of the double-truck type—the brake system was usually compressed air. This system had one advantage in that the brakes could be tested while the car was standing, and it was possible to see that everything was in order by merely examining the pressure gauge.

Prof. F. G. BAILY (Heriot Watt College, Edinburgh) thought that surging was possibly due to the sluggishness of the magnets, due to the appreciable amount of time required for complete saturation or demagnetisation. He agreed with Mr. McWhirter's conclusions as to the design of the magnet, and said that very heavy iron cores were needed to give high retardation at low speeds.

Mr. SAM MAVOR (Messrs. Mavor & Coulson, Glasgow) said he would be interested to have further information as to the different effect produced by variation in the magnet's design, as it appeared to him that both the length of the magnetic path and the area of contact of the magnets were vital factors in deciding the efficiency of the brake.

Councillor HOY (Member of Works and Stores Committee, Glasgow Corporation) did not think that the last word had yet been said in brakes. He thought that a good many papers given at the various Institutions of late had been too descriptive of what had been done, and not sufficient illustrative of what might be done.

Mr. J. ROBERTSON (Glasgow Corporation Electricity Department) drew attention to the tendency for the 1908 25B brake rigging described to lift the car wheels from the rail, thereby making them cease to drive the motors as generators, and so depriving the brakes of their operating energy.

Mr. CAMPBELL MCMILLAN (Electrical Control, Ltd., Glasgow) referred to the criticisms of some of the previous speakers on the design of the magnets; he suggested that some of the differences in surging effects obtained might be more due to variations in the magnetic properties of the iron than to differences in the mass of iron used in the core as had been suggested.

Mr. GEORGE STEVENSON (British Thomson-Houston Co., Glasgow) inquired if Mr. Gerrard could give him the cost of the brake equipments and the cost of working, including wear and tear, &c.

Mr. GERRARD, in his reply, gave the dimensions of magnets and shoe area asked for by some of the speakers. The old magnet core was 3 in. in diameter, and the core of the new 26C magnet was, he thought, either 5 in. or 6 in. square. The shoe area with the old type of brake was 23 sq. in., and that of the small new brake was also 23 sq. in. The area of the new large brake was 27 sq. in. The criticisms of Mr. McWhirter and Prof. Baily as to the magnet being too large and producing sluggishness were quite correct. It had been suggested that a better effect might be obtained by designing the motors with a view to the braking duties which they would be called upon to perform, but Mr. Gerrard pointed out that the problem in his case was to apply satisfactory braking methods to all cars irrespective of the type of motor employed. It was quite possible to get high retardation with either the old or new type of brake at speeds as low as two miles per hour. His objection to air brakes was that they entailed entirely separate equipments to do work which could quite easily be done by the adaptation of the plant already in use on the car. In negotiating heavy gradients, he was of opinion that nothing surpassed the method now commonly adopted, *i.e.*, the screwing down of the track brake before starting the descent of the hill and doing the rest of the control by means of the electric brake. Mr. Robertson was quite right in assuming that the 1908 25B brake tended to lift the car and to set up surging by putting a portion of the weight of the car on to the track shoes, so robbing the generators of their propelling power. Mr. Gerrard regretted that he could not give details of cost, but he was quite satisfied that the use of the solenoid would very materially reduce the upkeep costs.

ELECTRIFICATION OF INSULATING MATERIALS

A SHORT Paper by Mr. W. Jamieson, read on Thursday, May 12th, before the Glasgow Local Section of the Institution of Electrical Engineers, describes some investigations as to the best kind of materials to use for producing electrification in a humid atmosphere. Of all the substances tried, by far the best was rolled celluloid sheet, particularly if the surface were well burnished. It was found that if two pieces of this celluloid sheet be drawn smartly between the finger and thumb, not only are the outsides electrified, but the inside surfaces as well, one being positively, the other negatively electrified. The explanation of this phenomenon appears to be that when the two strips are drawn through the fingers they are not only compressed, but bent to one side or the other. Of the two inner surfaces in contact, one is concave, the other convex—that is, the particles of the one surface are in compression and those of the other in tension. The molecular difference due to this tension and compression combined with the direct pressure evidently produces the electrification. The surface in tension becomes positively electrified, and *vice versa*. This was borne out by further experiments, which suggest the possibility of static charges being produced in electrical machines simply by vibration and rotation; it is possible, therefore, that cases of insulation breakdown may occur through these causes alone. A further practical illustration of the phenomenon is to be seen in printing machines. The author considers that much of the electrification of the paper produced in these machines is due to the combined bending and pressure exerted on the paper by rollers. The author has constructed an electrical machine in which bands of celluloid running over pulleys produce + and − charges in this way. Though the differential charges are small, they are cumulative, and may become large in a long run. This would seem to indicate that more care should be taken to consolidate insulating material used in layers, and to prevent it coming adrift, and so setting up the kind of electrification mentioned.

DISCUSSION.

Mr. W. W. LACKIE (City Electrical Engineer, Glasgow) said that it had occurred to him that the small sparks one sometimes sees between commutator segments might be due to electrostatic discharge across the edges of the mica.

Mr. J. C. MCMILLAN (Electric Control, Ltd.) referred to the well-known phenomena of electrostatic discharge from belting, which is commonly observed in very dry localities, such as the north-eastern States of America. He had seen belts running with a continuous stream of sparks 14 in. to 20 in. long. He pointed out that the very features of vibration which led to electrostatic electrification were those which called for careful mechanical design in order that distortion and breakage might be avoided.

Mr. WILLIAM MCWHIRTER (Messrs. McWhirter & Son, Glasgow) mentioned that in the early days of the paper milling industry it used to be quite common to have to fit large combs across the paper in order to discharge the electrification accumulated.

Mr. W. SUTCLIFFE (Siemens Bros.' Dynamo Works) remarked that he had on one occasion some experience with a Ferranti open coil armature, the bars of which were insulated with paper. In the dark it was quite possible to see sparks playing across the armature bars, and they found that small punctures were very rapidly formed in the paper insulation. He thought that this was very probably accounted for by electrostatic effects.

Mr. J. ROBERTSON (Burgh Electrical Engineer, Greenock) commented on an experience he had had with a machine to which

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equalising coils had been fitted at one end of the armature. Frequent breakdowns on the armature coil rendered it necessary to take the equalising coils off. It was thought that the trouble was due to mechanical causes, such as friction between equalising coils and the end coils of the armature, but on examination it was found that all the coils showed signs of small punctures.

Mr. JAMIESON, in his reply, mentioned that if two layers of a band of either celluloid or paper were run over a single pulley for eight or ten times electrification was produced. If, however, the bands were stretched tightly over two pulleys, electrification was not produced. It therefore looked as though some neutralising effect was thus obtained.

LOCAL NOTES

BARROW-IN-FURNESS: *Electricity Accounts.*—The accounts for March last show a net profit of £249, after meeting interest and sinking fund charges. The total costs, exclusive of capital charges, were 1·249d. per unit compared with 1·426d. per unit in the previous year. The number of units sold were 1,130,092, and the maximum load was 925 kw. The financial result is £383 worse than in the previous year.

BRADFORD: *Tramway Profits.*—The net profit from the tramways for the past year was £30,000, which is about £10,000 in excess of the record hitherto established.

BRIGHTON: *Electricity Profits.*—The accounts of the Municipal Electricity Department for the year to March 31st show a net profit of £6,251, compared with £565 last year. The total revenue, £88,856, increased by £5,575. Works costs per unit sold are 0·70d., a decrease of 0·09d. per unit. The units sold increased by over 1,000,000, being 9,041,844. The increase was mainly noticeable in supply for power purposes due to the electrical working of the railway workshops and the charging of the batteries for the electric 'buses. There were 247 new consumers added during the year. Mr. J. Christie, the Borough Electrical Engineer, recommends that the surplus be transferred to the reserve fund, which has been sorely depleted in recent years to meet the unavoidable deficits made during the stage of transition from North Road to Southwick. The reserve, excluding the profit for last year, stands at £6,559.

COATBRIDGE: *Electricity Company's Accounts.*—A report upon the accounts of the Coatbridge & Airdrie Electric Supply Co. has been placed before the Council. It is pointed out that the net revenue account for 1909 shows a loss of £4,599, and that no provision has been made for reserve or depreciation.

DUNDEE: *Electricity Accounts.*—The profit from the electricity accounts for last year was £18,429, and after meeting capital charges and setting aside £2,750 for depreciation in addition to £1,250 to claim account, a balance of £1,260 is carried forward. The number of units sold was 6,144,956. The balance carried forward is a few pounds in excess of the previous year, but the revenue was about £3,000 in excess.

ECCLES: *Excess Expenditure.*—The Borough Treasurer has been instructed to transfer the amount of profit on the electricity undertaking for the year ended March 31st last, viz., £1,206, to the credit of the capital account, towards the excess expenditure, for which the Local Government Board refused to grant borrowing powers.

EDINBURGH: *New Electric Tramway.*—Trial runs have been made on the first electric tramway in Edinburgh. The line runs between Ardmillan Terrace and Gorgie Markets.

EXETER: *Electricity Profits.*—The net profit on the electrical undertaking for 1909-10 was £2,927, after meeting capital charges.

GLASGOW: *New Power Station.*—The Electricity Committee have authorised the Town Clerk to accept an offer to purchase the land for the proposed new power station of the Corporation at 8s. per square yard. We gave some information with regard to this power house in our issue for April 14th, p. 253.

New Tramcar.—A new type of an electric tramcar has been placed in service at Glasgow. It is of the vestibule type intended to afford protection for drivers in bad weather. In addition to this protection, the difficulty caused by the draught down the front stairs has been overcome by placing a permanent cover over two-thirds of the stairway, and enclosing the top of the staircase with a sliding door on the prinicple of the roll top desk.

GRIMSBY: *Electricity Accounts.*—There was a net profit of £3,860 on the electricity undertaking for 1909-10, the largest yet made by the Department. The gross revenue increased by £2,345. Power supply increased by 36 per cent., and the number of new consumers connected during the year, viz., 106, is a record. Costs, excluding capital charges, reached 0·921d. per unit, an increase of 0·046d. per unit. But for the fact that the Great Central Railway Co. have given notice to cease taking current from the Corporation, additional plant would have been required. Mr. W. A. Vignoles, the Borough Electrical Engineer, recommends his Committee to pay for services out of revenue, in view of the short life, viz., fifteen years, which the Local Government Board allow.

HEYWOOD: *Electricity Accounts.*—There was a small profit of £124 on the electricity undertaking for 1909-10.

Tramway Accounts.—There was a loss of £1,188 on the tramways for the past year. The number of passengers carried was less by 109,376 than in the previous year.

HUDDERSFIELD: *Linthwaite Tramways Dispute.*—The Linthwaite Council have agreed to sell the tramway track in their district to the Huddersfield Corporation for £4,000. The track, which is single, was originally laid by the Corporation, who run their cars over it. There have been continual complaints as to the maintenance of the track, but the Corporation will now relay it with double track, and maintain it.

LONDON: *Hackney: Tramways.*—The Borough Council has agreed to contribute £15,000 towards the widening by the London County Council of Dalston Lane, Ball's Pond Road and Graham Road, in connection with the conversion to electric traction of the tramways in that district, thus enabling the linking up of Hackney, Leyton, and Epping Forest with the West End.

PLYMOUTH: *Motors on Hire.*—The Borough Electrical Engineer has been instructed to consider and report upon the advisability of hiring out electric motors.

PORTSMOUTH: *Light Railways.*—The Portsmouth-Hayling Light Railway (Extension of Time) Order has been submitted to the Board of Trade for confirmation.

SHIPLEY: *Electricity Accounts.*—The electricity accounts for the year to March 31st show a net profit of £585 compared with £151 in the previous year. This reduces the deficiency on the working of the undertaking to £147.

SUNDERLAND: *Tramway Accounts.*—After meeting interest and sinking fund charges, the tramway accounts for 1909-10 show a net profit of £3,588. The total revenue was £58,546. The financial result has been improved by the reduction of the charge for electrical energy from 1 11-16d. to 1½d. per unit. The average working costs were 6·11d. per car mile. There was a falling off in traffic receipts of £1,896 compared with the previous year, and this is attributed to the continuation of the bad state of trade in the town, and to the troubles in the adjacent colliery districts.

Electricity Accounts.—The electricity accounts for the year to March show a loss of £112. The number of units sold was 7,848,815, compared with 6,584,825 in the previous year. The Borough Electrical Engineer (Mr. A. S. Blackman) states that the outstanding features of the year were a partial recovery from the depression in the shipbuilding and engineering trades, the commencement of supply to consumers at extra high tension; the introduction by the Home Office of new regulations, which are necessitating alterations to portions of the works and sub-stations; the rapid introduction of the metal filament lamp, and the reduction in the sale of electricity for lighting purposes consequent thereon; and the continued drop in the costs of production.

TORQUAY: *Surface Contact Traction.*—The Board of Trade have now definitely intimated to the local tramway company that they are not prepared to renew the licence for the running of the surface-contact system in Torquay. The present licence expires in October. The Council has therefore to decide whether it will agree to the adoption of the overhead system, for the company has stated that if this is not done they will have to abandon the undertaking. A curious feature of the position is that the inhabitants have not complained of the Dolter system, but the Board of Trade regard the defects and deficiencies as sufficiently important to withhold a licence, and the company would prefer the overhead system by reason of the expense of maintenance. When the Bill for the original tramways was passed, it contained a provision that the overhead system must not be used except with the consent of the Corporation. It is estimated that the cost of the change over to the overhead system would be £8,000, and already one local paper has evinced a desire for "squeezing" the tramway company by suggesting that the Council should require certain concessions before granting the privilege, an attitude which has been the greatest drawback to the tramway industry in Great Britain. The cost of running with the Dolter system is said to be 9d. per car-mile, against an average of 7d. per car-mile for the overhead system. The Council was informed at its last meeting that the number of live studs varied from 40 to 60 per month, or 1¼ per month per mile, having in mind that there are eleven miles of track, and between 6,000 and 7,000 studs. The view of the Tramways Committee is that the action of the Board of Trade is hardly warranted. The whole matter has been referred back to the Tramways Committee, there being a feeling among some members of the Council that the undertaking should be purchased from the company.

TOTTENHAM: *Street Lighting.*—The electric light and gas companies are to be asked to tender for public lighting.

WALTHAMSTOW: *Electricity Accounts.*—In addition to wiping off a deficit of £1,040 for 1908, the electricity accounts for 1909 show a net profit of £1,350.

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TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BELFAST.—Mr. T. W. Bloxam, the City Electrical Engineer, has reported upon the cost of additional generating plant in connection with the proposed tramway extensions. A sub-committee has been formed, and further consideration of the extensions has been postponed until this has reported.

BRISTOL.—Generating plant is required for the new refuse destructor at Eastville. Particulars from City Engineer, and tenders by June 13th.

DEVONPORT.—The Electricity Committee require d.c. meters, cables, wires, cut-outs, and oils. Particulars from Borough Electrical Engineer, and tenders by June 15th.

LONDON: *St. Pancras.*—A committee has been appointed to deal with a report by the Chief Electrical Engineer concerning a rearrangement of the generating plant. He proposes so arranging the generating plant at Regent's Park works that it will deal with the peak load only, and during the remaining nine months of the year will be operated at a sub-station. For this purpose it will be necessary to instal the following machinery at Regent's Park works:—Two motor converters of 1,000 kw. each, with switchboards, &c., £5,900; three-phase trunk mains connecting King's Road with Regent's Park, £9,000; at King's Road, one spare turbo set, £9,400. Total £24,300. The economies to be obtained by the foregoing arrangement would be considerable, but these economies could only be brought about by the extension of the boiler plant at the main generating station, King's Road. He submits two schemes for the latter, involving capital expenditure of £51,000 and £84,549 respectively.

SWEDEN.—The British Acting Consul at Stockholm reports that a proposal is shortly to be laid before the Swedish Diet for the electrification of the State frontier railway in the north of Sweden.

WALLASEY.—The Electricity Committee require a water-cooling tower (see an advertisement on another page).

SWANSEA.—Motors and motor-starting switches are required by the Swansea Electricity Committee (see an advertisement on another page).

WATFORD.—An inquiry was held on Thursday concerning a loan of £7,000 for electrical extensions.

Miscellaneous

AUSTRALIA.—The Melbourne City Council require 941,000 arc lamp carbons. Particulars from Messrs. McIlwraith, McEacharn & Co., Ltd., Billiter Square Buildings, London, and tenders by June 17th.

The High Commissioner for Australia in London has received tender forms, specifications, &c., for 4,200 telephone sets (Victoria), and insulators, insulated wire, copper wire, &c. (Queensland).

BIRMINGHAM.—The Tramways Committee invite tenders for 2,100 tons of grooved steel girder tramway rails, with fish plates, bolts, nuts, and tie bars. Particulars from the Tramway Manager and tenders by June 20th.

EALING.—A surface condensing plant is required at the Electricity Works. Tenders by June 4th.

ILFORD.—The Electricity Committee require 1,600 yards of conduit. Particulars from the Borough Electrical Engineer, and tenders by June 14th.

RAWTENSTALL.—The Electricity Committee have approved plans for electric tramways along Whitewell Valley. Tenders will shortly be invited.

SOUTH SHIELDS.—The Tramways Department require stores during the ensuing twelve months. Particulars from the Manager, and tenders by June 13th.

SUNDERLAND.—A recommendation of the Electricity Committee that 266 existing gas lamps upon the route of the present electricity mains be converted to electric lighting, at a cost of £465 10s. The annual cost of lighting by electricity and maintenance will be the same amount as at present.

TURKEY.—The Turkish Ministry of Commerce and Public Works invite offers for an electric tramway concession in Constantinople. Particulars from the Public Works Ministry, Constantinople, and tenders by Nov. 10th.

A concession is also offered for electric tramways at Salonica. Particulars as above.

Local representation is essential in the case of Turkish Government contracts. A list of British commission agents in Constantinople and a copy of the Constantinople specification (in French) may be seen at 73 Basinghall Street, London.

WALTHAMSTOW.—A Sub-Committee is considering the the question of providing additional tramcars.

WIMBLEDON.—The Local Government Board is to be asked to sanction the borrowing of £800 for meters.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

ABERDEEN.—Offices for the Royal Insurance Co., 28 Lombard Street, E.C.

ALTRINCHAM.—School (£8,295). Secretary, Education Committee, Altrincham Council.

AYR.—Club for S. Ayrshire Liberal Association, Blasnell Park (£10,000). Architect, J. Johnson, Troon, Ayrshire.

BELFAST.—The Committee of Management of the Belfast District Asylum invite tenders for electric lighting installations in new asylum buildings on the Purdysburn Estate. Particulars from Messrs. Watt, Tulloch & Fitzsimons, 77A Victoria Street, Belfast, and tenders by June 13th.

BIRMINGHAM.—Theatre, High Street. Builders, J. Dallow & Sons, Blackheath, near Birmingham.

BRISTOL.—Factory, Staple Hill. Architects, Fred Gardiner & Son, Barton Street, Bath.

DERBY.—Theatre. Architect, A. Eaton, 6 St. James Street, Derby. Builder, J, Dickenson, Derby.

DUBLIN.—The Trustees of the Stewart Institution, Chapelizod, invite tenders by June 6th for the electric lighting of the Institution. Particulars from Mr. T. Tomlinson, 16 Beresford Place, Dublin.

DURHAM.—Additions, Eldon Lane School (£2,000). Architect, F. E. Coates, Shire Hall, Durham.

EDINBURGH.—Teachers' training college (£60,000). Architect, A. K. Robertson, 29 Hanover Street, Edinburgh.

Hall, George Street (£30,000), for the Grand Lodge of Freemasons of Scotland.

ERITH.—Extensions of Sanatorium (£1,298). Builders, G. T. Gunning & Sons, Erith.

FOLKESTONE.—Theatre. G. S. Valentine, 19 Charing Cross Road, W.C.

GATESHEAD.—School (£6,000). Architect, F. W. Purser, West Gate, Gateshead. Builders, Raven and Hitcham, Gateshead.

GLASGOW.—School offices, Bath Street (£20,000). Architect, H. E. Clifford, 225 St. Vincent Street, Glasgow.

HEREFORD.—School (£9,950), Widemarsh Street. T. Lewis, Secretary, Education Committee, Hereford C.C.

ILFORD.—Electric theatre, High Road. Architects, Emden, Egan & Co., 2 Lancaster Place, W.C.

MANCHESTER.—The West Didsbury Guardians propose to light the G and L blocks of the workhouse by electricity. Particulars from Messrs. C. Clegg & Sons, 21 Spring Gardens, Manchester, and tenders by June 7th.

MOSLEY (Birmingham).—Fire station (£10,000). Builders, J. Dallow & Sons, Blackheath, near Birmingham.

SALISBURY.—Isolation hospital (£15,750). Surveyor, Wiltshire C.C.

WEST HAM.—The Education Committee require tenders for the electric wiring of three schools. Particulars from the Architect, Mr. W. Jacques, 2 Fen Court, Fenchurch Street, E.C., and tenders by June 20th.

TENDERS RECEIVED AND ACCEPTED

BRISTOL.—The Corporation have accepted the following tenders: Joint and junction boxes, Messrs. Sykes & Sugden, Ltd. (£214); meters, The General Electric Co., Ltd. (£546); 500-kw. converter for Underfall Yard substation, Bruce Peebles & Co., Ltd. (£1,230). Contracts amounting to £655 have also been entered into with the Union Electric Co., Ltd., Ship Carbons, Ltd., and the Oliver Arc Lamp, Ltd., for arc lamp carbons during the year 1910-11.

DERBY.—The order for replating the lighting battery, consisting of 240 cells, has been placed with the Chloride Electrical Storage Co., Ltd.

DUBLIN.—The Board of Works has given Messrs. R. Waygood, through their Dublin agents, Messrs. W. Coates & Sons, an order for the supply and erection of one of their latest pattern push-button automatic electric passenger lifts for the Viceregal Lodge.

ECCLES.—The Council has accepted the tenders of the British Insulated & Helsby Cables, Ltd., for high-tension concentric paper insulated cable at £459 11s.

GRIMSBY.—The Council have accepted the following tenders in connection with the lighting of additional streets with electricity: J. H. Tucker & Co., fuse boxes, £37 10s.; Phœnix Dynamo Manufacturing Co., Ltd., 3-wire balancer, £38; Chamberlain & Hookham, and Ferranti, Ltd., meters; W. Lucy & Co., 300 cast-iron lamp posts, £326 5s., and incandescent lamp fittings, £248 3s. 9d.

HESTON & ISLEWORTH.—The Council has accepted the following tenders in connection with the proposed extension of the electric light works: Browett, Lindley & Co., 250-kw. generating plant (Westinghouse dynamo and B.T.-H. switch panel), £1,514; 68 tenders were received; Babcock & Wilcox, steam piping and pumps, £210; Korting Bros., condensing plant, £300; Selson Engineering Co., machine tools, £102 4s. 6d.

KINGSTON-ON-THAMES.—The Council have accepted the

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tender of W. T. Henley's Telegraph Works Co., Ltd., for ½-mile of 5-ampere cable at £44 10s., and ½-mile of 35-ampere cable at £87 10s. They have further accepted the tender of Siemens Bros. & Co. for ½-mile of 12-ampere cable at £58, and ½-mile of 22-ampere cable at £71.

LONDON.—Messrs. Rashleigh Phipps & Co., 147 Oxford Street, London, W., inform us that they have obtained the contract for the electrical work at Messrs. Swears & Wells' premises in Regent Street, which are about to be re-built. The new building will be equipped with electric lifts, electric heating, electric irons, besides electric lighting and automatic intercommunication telephones, and will be one of the most up-to-date buildings in London.

Southwark.—The Electric Light Committee report they have had under consideration the question of the supply of carbons for the ensuing twelve months, the market price of which has considerably increased during the past few months. The Committee have received the option of continuing the arrangement entered into in March, 1909, with the Union Electric Co. and the Sloan Electric Co., for the supply of carbons at the then existing price, viz., £2 18s. per 100 pairs, less special discount, and have accepted same.

METROPOLITAN ASYLUMS BOARD.—The tender of W. J. Fryer & Co., at £51 17s. 6d., has been accepted for installing the electric light at the assistant medical officer's quarters, North-Eastern Hospital.

MIDDLESEX.—The County Council has accepted the tender of Dick, Kerr & Co., at £429, for the laying of a double instead of an interlacing line in a portion of High Road, Willesden, to widen the road here, and set back forecourts.

SALFORD.—The Council have accepted the following tenders for annual supplies:—W. Lucy & Co., Ltd., house service cut-outs; Liverpool Electric Cable Co., rubber-covered cable; W. T. Glover & Co., Ltd., paper-insulated cable; C. Macintosh & Co., Ltd., twin workshop flexible. They have also accepted the tender of the British Westinghouse Co. for installation of electric light at the Wellington Street School, at £146 8s.

WALTHAMSTOW.—Subject to the sanction of the Local Government Board, the Electricity Committee have accepted the following tenders:—Booster set, General Electric Co., Ltd.; switchboard, Bertram Thomas, Ltd.; constructional iron-work, General Iron Foundry Co. The total cost of the extensions amounts to £950.

Siemens-Schuckert Meter.—The Board of Trade have approved of the Siemens-Schuckert alternating-current meter, type W10, and of the means for fixing same.

MISCELLANEOUS CITY NOTES

CALGARY POWER CO.—An issue of 5 per cent. first mortgage 30 year gold bonds of this company is being made at £92 per cent.

HARPER ELECTRIC PIANO CO.—An issue is being made of 22,052 participating ordinary £1 shares at par.

COMPANIES STRUCK OFF REGISTER.—The following have been struck off the register of joint stock companies: Aberavon District Tramways Syndicate, Automatic Telephone Co. (1903), British Electric Separating Co. (1904), Everyday Electricity Publishing Co., Garcin Renault Electric Cars & Accumulators, Northern Electrical Supply Stores, Reliance Electric Co.

APPOINTMENTS AND PERSONAL NOTES

The National Telephone Co. require young ladies, between the ages of 16 and 25 years, as telephone operators. (See an advertisement on another page.)

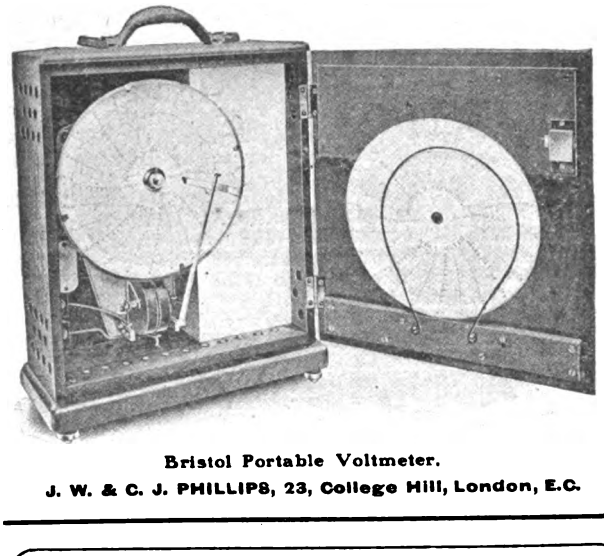
An electrician is wanted at Dudley. (See an advertisement on another page.)

Mr. J. A. Crowther, shift engineer at the Sunderland Corporation electricity works, has been appointed an assistant electrical engineer at a salary of £150 in place of Mr. Humphrys, resigned.

The late Mr. Arthur Greenwood, J.P., chairman of Messrs. Greenwood & Batley, Ltd., Albion Works, Leeds, left estate valued at £20,555 gross, with net personality £8,138.

A recommendation has been made by the Brighton Electricity Committee that the salary of Mr. G. Cloughton, power-house superintendent at the Southwick power-house, should be increased from £260 to £300 per annum, with two further annual increments of £25, making a maximum of £350 per annum.

Obituary.—We regret to hear of the death of Mr. Alfred Colson, Electrical and Gas Engineer to the Leicester Corporation. A few months ago Mr. Colson underwent an operation in London, which, although not in itself a severe one, revealed the existence of a malignant growth, the nature of which precluded any hope of a successful cure. At the same time, the suddenness of Mr. Colson's death was unexpected. Mr. Colson's first appointment under the Leicester Corporation was as gas engineer in 1882. It was in 1894 that the Corporation decided to erect an electricity works, and Mr. Colson was appointed engineer to this undertaking as well, and the deceased gentleman held this dual position until the end.



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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 5s. to £59 15s. per ton (last week, £59 to £59 10s.).

FOR SALE.—The Torquay Corporation have a number of maximum demand indicators for sale (see an advertisement).

A patent for an improved telephone dictating machine is for sale (see an advertisement).

An electrical engineering contracting business is for sale (see an advertisement).

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—A meeting of the Automobile Electric Lighting Syndicate, Ltd., will be held at Queen's College, Birmingham, on June 28th, at 11.45 a.m., to hear the liquidator's account of the winding-up.

A meeting of the Polkey Automobile Electric Lighting Syndicate, Ltd., will be held at Queen's College, Birmingham, on June 28th, at 12 noon, to hear the liquidator's account of the winding-up.

Mr. W. H. Trentham, consulting electrical engineer, 39 Victoria Street, Westminster, S.W., has been adjudicated bankrupt.

Mr. F. W. Pixley and Mr. F. S. Salaman, 1 Oxford Court, Cannon Street, London, have been appointed trustees of the estate of the late Mr. F. H. Medhurst, electrical engineer, 13 Victoria Street, London, S.W.

The liquidator of the British Power, Traction & Lighting Co., Ltd., has been released.

An application for the discharge of Albert Clapham, electrical engineer, 101 Kirkstall Road, Leeds, will be heard at 10.30 a.m. on July 18th at the County Court House, Albion Place, Leeds.

DISSOLUTION OF PARTNERSHIP.—F. W. Richardson & J. D. Carlmark, electrical engineers, High Street, West Bromwich, have dissolved partnership.

CANADIAN AGENCIES.—A Birmingham firm manufacturing portable electric hand lanterns, electric dry cells of various kinds, electric pocket lamps, torches, accumulators, weatherproof bells, wood-cased bells, electrical accessories, dynamos, motors, switches, fittings, &c., wish to enter the Canadian market. Further particulars from the High Commissioner for Canada, 17 Victoria Street, London, S.W.

A London firm representing manufacturers of pressure turbine pumps, electric haulage engines, lifts, cages, &c., would like to get into communication with Canadian engineering firms prepared to act as their representatives. Further particulars from the Board of Trade City Trade Branch, 73 Basinghall Street, London, E.C.

THE DUSSEK BITUMEN CO.—The name of the British Electrical Trade Supply and Bitumen Co. has been changed to The Dussek Bitumen Co. The address will remain as hitherto: Canal Bank, Trundley Road, Deptford, London, and there will be no change in the management.

NEW LONDON SHOWROOMS.—Messrs. Jesson, Birkett & Co., Ltd., designers and workers in metals, have removed their London offices and showrooms from 27 Ely Place to 9 Newman Street, Oxford Street, W., and extend a cordial invitation to the trade to visit these new premises.

The London showrooms of the British Prometheus Co., Ltd., are now at 9 Newman Street, Oxford Street, W.

APOLOGY.

To Messrs. Galsworthy, Ltd., of Roberts Works, Hampstead Road, N.W., and of Nos. 15 & 16 Newman Street, Oxford Street, W.

I BEG to express my sincere regret at the infringement by W. Sitch and Co., Ltd., of your registered design No. 493,943 for an electric or gas fitting, and to assure you that this infringement was the result of inadvertence, and will not be repeated; and, to remedy as far as possible the injury caused you by my company's action, I authorise you to make this apology public in any way you think proper.

(Signed) ALFRED SITCH.
Managing Director of
W. Sitch & Co., Ltd.

48 *Berwick Street, London, W.*
May 23rd, 1910.

National Physical Laboratory Accounts.—The balance-sheet of the National Physical Laboratory of 1909 shows a profit of ordinary income over expenditure of £183 16s. 9d. The income includes a Treasury grant of £7,000, and £13,006 fees for tests, and donations and subscriptions £1,000.

P. & O. Batti-Wallahs' Society.—A general meeting will be held at the Golden Cross Hotel, Charing Cross, London, on Monday next, June 6th, at 6.30 p.m., to consider a proposal to delete "P. & O." from the title. The object is to increase the support to, and scope of, the society.

Poplar School of Engineering.—At a meeting on May 25th of the "Association of Electrical Engineering Students," formed by the students of this school, Mr. W. S. Ibbetson read a Paper on "Hydro-electric Power Plants." On June 22nd a debate on "Gas *versus* Electricity" will take place.

COMPANIES' MEETINGS AND REPORTS

MIRRLEES, BICKERTON & DAY.—The second annual meeting of this company was held last week. There was a profit of £5,577 for the year 1909, and after placing £1,000 to reserve and paying a dividend of 5 per cent. on the ordinary shares, the sum of £577 is carried forward. Mr. A. H. Baird, who presided, said that important agencies had been established in foreign countries, and the company had supplied engines to China, Japan, India, Java, Bulgaria, West Indies, and other parts of the world. The discoveries of oil and the starting up of new oil companies in so many parts of the world would doubtless have a very beneficial effect upon their business.

FIFE TRAMWAY LIGHT & POWER CO.—The first ordinary general meeting of this company was held in Edinburgh last week. The Chairman stated that with a little over one-half of the tramways running for less than two months out of the year, they were able to pay a dividend to the Dunfermline Tramways Co. of £1,111. The company have made an agreement to acquire all the shares of the Fife Electric Power Co., but as they were debarred from any interest in the Power Co. until after December 31st, no revenue from this source could be included in the accounts. New substations are being built at Cowdenbeath and Lochgelly. The company are satisfied with the position of the Power Co.'s business.

POTTERIES ELECTRIC TRACTION CO.—At the annual meeting on Thursday, satisfaction was expressed at the resumption of dividends upon the ordinary shares. The chairman, Mr. C. F. Cornwallis-West, read extracts from reports by the Board of Trade inspecting officer, which testified to the thorough repair of the company's lines, and to the satisfaction of the borough authorities, compared with two years ago. It was impossible for him to say to what extent, if any, the federation of Burslem, Hanley, Longton, Stoke, and Tunstall have upon the company's business. The fair fare system had not been in use a sufficiently long time to gauge its earning capabilities.

SIEMENS BROS. & CO.—A dividend of 4 per cent. is announced for 1909, allocating £23,600 for repairs to the c.s. *Faraday*, and carrying forward £3,689.

BRUSH ELECTRICAL ENGINEERING CO.—The report for 1909 shows net profit of £1,811. Debenture and other interest charges, and bad and doubtful debts written off, absorb £23,042, leaving a loss of £21,230. Orders secured during the latter portion of 1909 showed a considerable improvement over the previous twelve months, but was not possible to make up for the shortage of invoicing during the earlier months. The year 1910 will benefit by the larger volume of unfinished work in hand at December 31st last. The auditors point out that no provision has been made for depreciation during the three years ended December 31st, 1909.

The Committee for the Protection of Electrical Interests.—At a meeting held at Faraday House last Wednesday, Mr. Robert Hammond in the chair, Mr. Arthur Preece was elected hon. treasurer, and Mr. R. Borlase Matthews, who has acted as hon. secretary *pro tem.*, was elected hon. secretary of the committee.

The Brennan Gyroscopic Mono-rail System.—A full-size vehicle on this system can be seen running on a long track at the Japan-British Exhibition. The vehicle and its mode of working were fully described with illustrations and diagrams in ELECTRICAL ENGINEERING, Vol. V., page 977. At a press demonstration on Wednesday of last week Mr. Brennan informed our representative that he had sold the rights for the use of the system in Alaska to Major J. E. Bellaine, of Seward, who is now arranging for the construction of a line 100 miles long in Alaska. The total cost of the line, including two mono-rail cars, is estimated at £1,000 per mile. As the rates in Alaska are very high, a very substantial return for the first year of working is expected. Both goods and passengers will be carried.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the annual meeting on Thursday:—*Members:* A. A. Bion and A. Hands. *Associate Members:* S. H. Busch, P. J. Childs, H. V. Flinn, F. J. Howe, J. W. Miles, J. C. Morby, A. J. Newman, G. W. Shearer, D. H. Slack, L. W. Swainson, J. T. Tattersall, H. W. Tyler, A. L. Veitch, A. G. Watson, J. H. Wright, J. G. Bell, J. S. Brown, W. F. Duncan, J. W. Fraser, S. C. Hackney, N. Pensabene-Perez, A. J. Rayner, A. M. Robertson. *Associate:* W. H. Hunter. *Students:* R. M. Clark, J. H. Enion, José Gomes, H. E. Gough, S. M. Hill, N. G. Kapp, R. O. Kapp, G. W. McCall, D. J. Martino, A. Plowman, B. B. Pradhan, H. Rider, H. Shannon, J. Slevin, W. M. Slevin, R. Stafford, H. A. Steytler, H. Tetlow, G. H. Tilly, P. N. Varman.

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50—80	16	2/-	2/-
100—120		2/-	2/3
130—160		2/-	2/-
50—130	25	2/-	2/3
140—160		2/6	2/9
200—250		3/6	3/9
60—130	32	2/-	2/3
140—160		2/6	2/9
200—250		3/6	3/9
100—130	50	2/-	2/3
140—160		2/6	2/9
200—250		3/-	3/3

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TECHNICAL EDUCATION

IN a Paper entitled "The Movement towards a National System of Education" read on Saturday, April 2nd, before the West Yorkshire branch of the Association of Teachers in Technical Institutions, Dr. R. Pohl (Chief Engineer, Phœnix Dynamo Manufacturing Co., Ltd., Bradford) said that the fundamental principles for future work in technical education were as follows: There should be a thoroughly organised system of technical education, leading up from the primary and secondary schools to the technical school, and having, as its crown, the technical university, every stage of the system being in intimate contact with the next, so far as possible without overlapping, and the educational work must be carried out in the closest possible co-operation with the employer. This system should be a national one; that is to say, the Board of Education should not only inspect and supervise the individual institutions, but should ensure proper co-ordination; extend by law the leaving age for children, when and where necessary; enlist by all available means the co-operation of employers, and introduce a uniform system of examinations and degrees; and it should, from its exalted position, watch the working of the system, comparing it with that of other nations, and generally employing and developing the powerful weapon of technical education in the interests of the industries and the progress of the nation as a whole.

He did not advocate a copying of the German system, as it had several disadvantages, and tended to a centralisation which caused lack of intimate contact with local industries and insufficient amalgamation of theory and practice. There was also in Germany insufficient co-operation between the schools and the technical universities. He had great admiration for the work of evening classes in England, though in principle he was in the fullest agreement with those who object to all evening work and wish it transferred to the day. He regarded some sort of "sandwich" system as the best for training the industrial rank and file, and suggested that the present evening courses should be made more efficient by establishing co-operation with the employers, and by reducing the hours of labour to shift the centre of gravity gradually from the evening to the day.

Turning to the question of technical universities, Dr. Pohl expressed the view that better organisation and efficiency was found in Germany owing to there being national institutions, just sufficient in number for the needs of the whole nation, so as to allow of intense specialisation in all branches, instead of results of the haphazard efforts of private persons, guilds, societies, municipalities, and whosoever liked to distinguish himself in this direction. There should be full inquiry by a Royal Commission into the means of correlating the work of universities with that at other institutions. A further increase in the already excessive number of competitive institutions was not wanted, but, instead, a thorough amalgamation of the same and the replacement of mutually destructive competition by effective co-operation.

It appears not unlikely, continues Dr. Pohl, that as a result of the inquiry of the special Royal Commission appointed last year, such amalgamation may soon be brought about so far as London is concerned, and an early extension of the principle to the provinces would then be within the range of probability. The leading institutions at present existing, in each university area decided upon, would form the constituent colleges; they might have the first and second year's courses in common, which, of necessity, would be generally scientific and educational in character, including such subjects as national economy, industrial history, industrial legislation, patent laws, &c., but the higher branches would be distributed according to the nature of the institutions and the industrial activities of the districts. Higher technical education in England, if developed on such lines, would have adopted only one important point from the Prussian system, that is, organisation on a national basis, a point which, in his opinion, is indispensable to success. Other and less important points of similarity, such as the uniform system of examinations and of legally protected degrees, would come as a natural consequence.

The fees, Dr. Pohl thinks, should not be kept low, except for scholarship students, but should be, at any rate, in proportion to the cost of such institutions. Scholarship students would thus predominate more and more, which would make it possible to adjust the number of highly-trained men to the needs of the industries, and to avoid the excessive supply found in connection with the German system.

Electrical Contractors' Association.—The annual general meeting of this Association will be held at the Caledonian Station Hotel, Princes Street, Edinburgh, on Monday, June 13th, at 3 p.m., and will be followed by the annual dinner at 7 p.m. The price of the tickets for the latter is 8s. 6d., and these can be obtained from Mr. Walter Finlay (18 Frederick Street, Edinburgh), or from the Hon. Secretary, Mr. L. Tate, at the offices of the Association. Special reduced charges for members have been arranged for with the proprietors of the hotel.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

DRAWING APPARATUS.—We have received from Messrs. W. J. Brooks & Co. (Letchworth, Herts) particulars of several new appliances for the use of draughtsmen. One of these is a locking device by which the T-square can be locked in any position to the board, and released by pressure on a knob at any time. Another useful device is a metal strip with small spikes at intervals, which serves instead of a row of drawing pins. Other leaflets describe several patterns of fixed and flexible curves.

FANS.—A new illustrated folder of a size convenient for enclosing in letters, and describing various patterns of electric fans, is being issued by the General Electric Co. (67 Queen Victoria Street, London). The fans illustrated include the little "Liteweight" desk fan, which weighs only 10 lb., a universal-type fan which can be used as a bracket fan, and a ceiling fan. The company is willing to supply these in quantities to contractors and central station engineers with their name and address printed on free of charge. Applicants should refer to this notice.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRIC POWER ON THE RAND.—We have received a reprint in book form of a series of articles on the question of the working costs on the Rand, which appeared recently in the "Investors' Guardian." The various causes of the large reduction within the last few years are reviewed, and a brief reference is made to the application of electric drive to ore crushing and other machinery.

DRIVING OF PLANING MACHINES.—A booklet from Messrs. C. E. Lugard & Co. (Chester) gives a description of a simple arrangement of electromagnetic clutches for the working of planing machines without having recourse to the shifting of belts over fast and loose pulleys. The clutch can be applied to any existing belt-driven machine. The old striking gear is removed, and one of the levers is utilised to actuate a sliding switch controlling the supply of current to the clutches. The form of double clutch used can be applied to various cases of reversing machine tool drive.

FANS.—An attractive folder from the British Thomson-House Co. calls attention to desk and other fans for continuous and for alternating current.

OSRAM LAMPS AT THE JAPAN-BRITISH EXHIBITION

The accompanying illustration shows the attractive stand erected by the General Electric Co., Ltd., in the Machinery Hall of the Exhibition. It is devoted entirely to Osram lamps and fittings. Demonstrations of fancy bulb blowing, mounting Osram filaments, and fitting the completed carriers in the bulbs, are given daily. Various patterns of indoor and outdoor fittings,



THE OSRAM LAMP STAND AT THE JAPAN-BRITISH EXHIBITION.

including several types of the new Osramlite shades and reflectors, are exhibited. A number of attractive illuminated signs and Osram lamps of all sizes and patterns are also shown. Very effective literature is distributed from the stand, including a card with a concise and striking comparison between the costs of lighting with carbon filament and Osram lamps at different charges per unit.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 26th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

5,062/09. **Storage Battery.** A. W. SOMERS and R. J. CROWLEY. This is a storage cell of the type in which the positive plates only are recharged, and are taken out of the cell to be charged. The positive plates consist of the usual active material in a lead grid, and are immersed, before forming, in a solution of silicate of sodium to harden them. They are enclosed in perforated celluloid cases and placed between negative plates of zinc or zinc amalgam. The latter are formed by treating zinc plates with a solution of mercury, soda, and dilute sulphuric acid. An alternative negative plate consists of zinc granules similarly treated, and supported in an amalgamated copper grid and enclosed in a perforated celluloid case. The electrolyte is a solution of sulphuric acid and soda. A high discharge rate, absence of sulphating, and a high efficiency are claimed. The cell can be recharged by replacing the discharged positive plates by charged ones. Four claims, four figures.

7,791/09. **Submarine Cables.** R. K. GRAY. For the purpose of increasing the self-induction and reducing the capacity of submarine telegraph or telephone cables, the conductor is formed of wires of two different metals, one of which is magnetic. Thus a solid central copper core is braided with two sets of strands of copper and iron respectively, the two sets being interlaced and insulated from one another. Six claims, one figure.

10,791/09. **Battery Electrolyte.** G. SCHAULI. An electrolyte for primary and secondary cells consists of a pulp of flaked rice, dextrin, or cellulose mixed with zinc chloride, and either ammonium chloride or some metal chloride salt. The mixture is heated for pouring into the cells, and practically solidifies on cooling. It is claimed to prevent crystallisation or creeping in almost any climate. One claim.

12,424/09. **Insulating Material.** M. WILDERMANN. An ebonite capable of resisting the action of chlorine and alkalis is manufactured by mixing the rubber and sulphur with from 5 to 15 per cent of graphite or finely-divided mica or carbon. The mixture is finally over-vulcanised, as described in a previous patent, No. 18,269/08. Two claims.

15.881/09. **Arc Lamp.** H. J. JABURG. A flame arc lamp in which the arc is struck between two downwardly converging touching electrodes, and a third electrode movable in a plane perpendicular to the plane of the axes of the other two, was described in Patent No. 7,471/09 (see ELECTRICAL ENGINEERING, March 31st, 1910, p. 222). According to this patent, the electrodes are of large section to facilitate the changing over of the arc and to increase the burning hours. The third electrode is of plain carbon. To ensure uniform burning, the cores of the other two are displaced towards each other. Six claims, four figures.

26,021/09 **Cable Conduit Joints.** W. R. SYKES and C. J. COOKE. The abutting ends of two lengths of bitumen conduit are enclosed in a sleeve, and an iron bridge-piece spans across this sleeve and grips the two sections by means of split collars clamped on with bolts. A joint box constructed on the same principle consists of a wooden box encased in metal, the metal cover having split collars to grip the incoming bitumen conduit. Five claims, eight figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: DAVY, 11,482/09; SIEMENS-SCHUCKERTWERKE GES., 16,904/09; SZUBERT, 22,926/09; GRAVIUS, 29,239/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MARTYN [Junction boxes] 10,860/09; LUCAS and WALMSLEY [Distribution] 11,201/09; TANNER and CLAREMONT [Distribution] 7,019/10.

Dynamos, Motors, & Transformers: TURNER [Machines] 2,959/09; DURTNALL [Power transmission and speed regulation for hauling and winding gear] 6,758/09; KILROY and EVERSHED & VIGNOLES, LTD. [Starting of motors] 10,680/09.

Electric Ignition: BELLEM and BRÉGÉRAS [Electromagnetic control of petrol admission] 9,496/10.

Electrometallurgy & Electrochemistry: JOHNSON (*Badische Anilin & Soda Fabrik*) [Production of nitrates] 11,274/09; LUCKOW [Electrolytic manufacture of salts of metals insoluble in the electrolyte] 408/10.

Heating & Cooking: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Heating apparatus] 11,172/09.

Instruments & Meters: GODDARD [Prepayment meters] 11,402/09; BRITISH THOMSON-HOUSTON CO. and HOLDEN [Meters] 12,689/09; SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Frequency meters for speed measurement] 2,726/10.

Switchgear, Fuses, and Fittings: ELIESON [Switches] 10,757/09; VON ZWEIGBERGK [Traction controllers] 11,302-3/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Rectifying apparatus] 11,539/09; LYNESS [Contact-fingers for controllers] 15,151/09; LUNDBERG [Switch and fuse boxes] 3,926/10.

Telephony and Telegraphy: LEAKE [Signalling] 11,295/09; PEDERSEN [Signalling apparatus] 25,190/09; SIEMENS BROS. & CO., and RIBER [Telephone receiver] 466/10.

Traction: LUKE & SPENCER, LTD., and WATERHOUSE [Brake-shoes] 16,404/09; DURTNALL [Power transmission and speed regulation for electric vehicles] 6,758/09; HARRISON (*Electric Railway Improvement Co.*) [Welded rail-joints] 28,617/09; SIEMENS & HALSKE A.-G. [Recording intervals and speed of trains] 376/10.

Miscellaneous: MAYOR & COULSON, LTD., and MAYOR [Coal-cutter] 11,206/09; LICHTENFELD [Burglar alarms] 28,942/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution Systems, &c.: TORCHIO [Cable insulation] 10,160/10.

Dynamos, &c.: ALLGEMEINE ELEKTRICITÄTS-GES. [A.-C. commutator machines] 10,692/10; A.-G. BROWN, BOVERI ET CIE. [Driving of dynamos] 11,024/10.

Electric Ignition: JUSTON [Magneto generator] 9,772/10; DELAGE and WOOD [Ignition of gas burners] 11,362/10.

Electrometallurgy, &c.: SOC. ANON. ELECTRO-METALLURGIQUE (Procédés Paul Girod) [Refining of steel] 26,588/09; SOC. D'ELECTRO-CHIMIE and HULIN [Electrolytic production of sodium] 6,063/10; FRANTZEN [Furnaces] 10,917/10.

Incandescent Lamps: KRAUSE [Metal filament lamps] 11,107/10.

Traction: COTA [Air brakes] 10,776/10; SOC. IN ACCOMANDITA PER L'UTILIZZAZIONE DELLE INVENZIONI ING. BEER [Signalling] 11,358/10.

Miscellaneous: REGINA-BOGENLAMPENFABRIK GES. [Alloy for electric soldering tools] 6,523/10.

The following amended Specifications can now be obtained.

J. C. DOBBIE [Mariners' compass] 8,305/01; C. F. SCOTT [Control of A.C. motors] 19,520/05; E. FREUND [Track brake] 28,546/07; J. KEITH [Ventilation of ships] 5,638/09.

Opposition to Grant of Patents

6,177/09. **Electrical Marine Propulsion.** C. A. PARSONS, G. C. STONEY, and A. H. LAW. Opposition has been entered to the grant of this patent. It covers a method of winding motors and generators in sections, so as to work at low pressures. (See ELECTRICAL ENGINEERING, April 14th, 1910, p. 258.)

12,289/09. **Table Fan.** J KEITH. An appeal has been lodged against the decision of the Comptroller to grant this patent. The specification was abstracted in ELECTRICAL ENGINEERING, March 10th, 1910, p. 172.

19,098/09. **Magnetic Track Brakes.** Dick, Kerr & Co., Ltd. (*R. Braun*). As the result of opposition, the right to a grant of a patent on this application has been surrendered. The specification was abstracted in ELECTRICAL ENGINEERING, January 20th, 1910, page 50.

Revocation of Patent

9,289/08. **Meter.** H. ARON. The application for the revocation of this patent has been dismissed. It covers a two-rate or multiple-rate meter, the counting mechanisms of which operate separate maximum demand indicators.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: C. A. VANDERVELL and W. H. PROCTOR [Constant-pressure variable-speed dynamo] 2,918/05.

Electric Ignition: A. DE DION and G. BOUTON [Condenser across contact breaker] 8,919/05.

Electrometallurgy, &c.: J. C. JOBLING and H. C. HARRISON [Electro deposition] 2,632/05.

Instruments, &c.: W. M. MORDEY and G. C. FRICKER [Meter] 2,710/00.

Storage Batteries: J. T. NIBLETT [Plates] 3,819/02.

Switchgear, &c.: H. LEITNER and R. N. LUCAS [Automatic voltage regulator] 3,425/03 and 3,603/04; F. TESTOR [Time switches] 3,453/03; L. ANDREWS [A.-C. reverse-current cut-outs] 3,460/04; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Ironclad switch-fuse box] 2,586/05; A. HEPKE and K. DIENER [Multiple fuse plugs] 2,858/05; H. HIRST and H. BEVIS [Lamp-holder with lock] 2,894/05.

Traction: F. B. BEHR [Electric mono-rail locomotives] 3,610/02; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Air brakes] 3,261/04.

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ELECTRICAL ENGINEERING

No. 180 [Vol. VI., No. 23] THURSDAY, JUNE 9, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Small Advertisements and Official Announcements, *Wednesday first post.*
Displayed Advertisements, *Tuesday first post.*
Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

The fifteenth annual convention of the incorporated Municipal Electrical Association will be held in Glasgow next week, under the presidency of Mr. W. W. Lackie, City Electrical Engineer, Glasgow. In accordance with our usual custom, we give portraits and short biographies of members who are down to read Papers and open discussions. For the convenience of those attending the convention we also publish some general notes on the works to be visited, including an account of the electricity supply and tramway systems of the Glasgow Corporation, and short descriptions of the municipal electricity works at Edinburgh, Govan, and Partick, the Yoker power station of the Clyde Valley Electric Power Co., and Messrs. W. Beardmore's works. A list of members and visitors who, up to the time of going to press, have intimated their intention of being present is also given. (Pages 367 to 371, and 378.)

At the last meeting of the Newcastle Local Section of the Institution of Electrical Engineers, Mr. H. W. Clothier gave an interesting lecture on the historical development of switchgear from the very earliest open-type low-tension board to the modern sub-divided iron-clad system. Several interesting experiences were described, both in the lecture and in the discussion. (Page 371.)

A new line of portable A.-C. and D.-C. instruments of the dynamometer type, including a wattmeter specially designed for lamp testing, is referred to on page 373.

Our monthly article on new electrical supplies and accessories includes illustrated descriptions of a new edgewise tumbler switch for flush work, an insulating lamp-holder shield, a new pattern of tubular metal filament lamp, and several novelties in the way of heating and cooking apparatus, including a toaster and a water-heater with heating elements enclosed in quartz, and a cheap complete cooking outfit. Another interesting appliance described is an electrolytic bleaching apparatus for removing stains. (Page 373.)

Among the specifications published by the Patent Office on Thursday last was one by W. P. Durtnall for a system of electro-mechanical power transmission for vehicles or winding gears.—An automatic motor starter, in which the starter-arm is prevented from advancing on each step by a differentially wound electromagnet until the current has fallen to a predetermined value, is covered by Eversheds & Vignoles, Ltd.—J. Howden describes a method of preventing the rotor discs of impulse turbines from seizing on the rotor shaft by electroplating the interior surface of the nave with copper.—Patents by J. and E. Conradi for a wall-plug, and by K. Maxaner for a centrifugal fan with self-contained motor, are opposed. (Page 374.)

The discussion promoted by the National Electrical Manufacturers' Association as to whether a Free Trade or a Protectionist policy would most benefit the elec-

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trical industry was continued on Monday. Messrs. E. Garcke, G. Byng, H. H. Berry, A. Bruce Anderson, and H. Hirst spoke in favour of Tariff Reform, and Messrs. H. Oppenheimer, R. Hammond, W. G. Bond, and J. E. Kingsbury in favour of Free Trade. (Page 376.)

THE boundaries of the city of Birmingham have been extended to include Aston Manor and a number of other places. The electricity works in these will be transferred.—The Acton Council is still undecided as to disposing of its electricity undertaking.—The Blackburn Corporation Tramway Accounts for last year show a profit of £453 against a loss of £4,804 in the previous year.—There was a net profit on the Bolton electricity accounts for last year of £7,119.—A sum of £4,000 has been transferred to relief of rates by the Croydon Electricity Committee.—The Folkestone Corporation have decided not to purchase the Folkestone Supply Co.'s undertaking.—Bethnal Green Council have decided to take a supply of electricity in bulk from Shoreditch.—A system of tube railways in Toronto is being reported upon.—Mr. C. W. Mallins, General Manager of the Liverpool tramways, is to report upon the Wigan tramways. (Page 379.)

A BOILER and generating set is required at Erith, and an electric power plant at the Knowle Asylum (Fareham).—An expenditure of £78,207 is contemplated upon extensions to the Neepsend (Sheffield) power station.—A loan of £3,234 is being taken up at Eccles, and one for £5,500 at Grimsby.—Tramway extensions are contemplated at Northampton.—The London County Council require tramcar bodies and electric equipments. (Page 380.)

AT the Brush Co.'s meeting on Monday, Mr. E. Garcke said there was nothing to do but reduce working expenses and hang on until better times came. The absence of any dividend for 1909 on the preference shares of the Imperial Tramways Co. is due to the loss on the company's holding in the London United Tramways.—The capital of the Anglo-Argentine Tramways Co. is to be increased by £8,000,000. (Page 381.)

Electrical Contractors' Association.—Mr. G. R. Ratcliff, of Messrs. Ratcliff & Co., has been elected chairman of the London Section of the Electrical Contractors' Association, in succession to Mr. Harland Bowden, who is president-elect of the Association. Mr. E. H. Freeman, of Messrs. Tyler & Freeman, has been elected vice-chairman of the London Section.

Light Railways in 1909.—The report of the Light Railway Commissioners for 1909 states that 13 orders were submitted to the Board of Trade for confirmation during the year, eight of which have been confirmed. The remainder are still under consideration. A total of 599 applications have been made to the Commissioners since the commencement of the Act, of which 199 have been rejected or were withdrawn. In previous reports attention has been drawn to the need for the construction of light railways in many parts of the country, and the opinion has been expressed that such needs are unlikely to be met unless the Act is amended. The lists show that a large number of light railways, the need for which has been established at public inquiries, and for which orders have been granted, have not been proceeded with. Whereas 46 light railways with a length of 375 miles (mostly steam), and 54 light railways with a length of 326 miles (mostly electric), have been constructed, orders have not been carried into effect in the case of 61 schemes with a length of 765 miles (steam), and of 35 schemes with a length of 210 miles (electric); in addition, powers have finally lapsed for 421 miles (steam), and 138 miles (electric). The chief difficulty in proceeding with schemes already authorised has been in finance, while the failures enumerated above have had the effect of deterring other proposals. In relation to electric light railways, experience has shown that the absence of any provision under the Act of 1896, for "submitting to Parliament" proposals which are required to be so submitted in accordance with the Act, renders the procedure unavailing, and practically unavailable, in many cases. To what exent, and in what way, the policy of the Act should be revised, the Commissioners admit, presents a difficult problem; but they draw attention to the marked success of the system adopted in Belgium, under which a total length of more than 2,000 miles of light railways, constructed with moneys raised on national credit, is already being worked without loss to the State, while a further length of some 2,000 miles has been projected.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JUNE 9TH.

Tramways and Light Railways Association.

10.30 a.m. Annual Congress in Dublin. (1) "The Dublin United Tramways," by R. S. Tresilian; (2) "Brake Shoe Standardisation," by J. A. Panton; (3) "Tramway Economics," by J. R. Salter; (4) "Railless Traction," by H. England; (5) "Should the 1870 Act be Revised," by F. Coutts.

FRIDAY, JUNE 10TH.

Tramways and Light Railways Association.

Annual Congress. Visits to works, &c.

Physical Society.

8 p.m. At Imperial College of Science, South Kensington. (1) "A Galvanometer for Alternate-current Circuits," by Dr. W. E. Sumpner and W. C. S. Phillips. (2) "The Positive Electrification due to Heating Aluminium Phosphate," by A. E. Garrett.

SATURDAY, JUNE 11TH.

Royal Institution.

3 p.m. Tyndall Lecture II.: "Electric Heating and Pyrometry," by Prof. J. A. Fleming, F.R.S.

MONDAY, JUNE 13TH.

Electrical Contractors' Association.

3.30 p.m. Annual Meeting at Caledonian Station Hotel, Princes Street, Edinburgh.

7 p.m. Annual Dinner at Caledonian Station Hotel.

TUESDAY, JUNE 14TH.

Incorporated Municipal Electrical Association.

10 a.m. Fifteenth Annual Convention in Glasgow. Reception by Lord Provost at Institute of Engineers and Shipbuilders in Scotland. (1) Presidential Address by W. W. Lackie. (2) "Commercial Progress," by A. C. Cramb (Croydon) and H. Collings Bishop (Newport, Mon.).

3 p.m. Visits to Glasgow Electricity Works and Substations.

7.30 p.m. Reception and Conversazione at City Chambers by Lord Provost.

Institution of Gas Engineers.

10.30 a.m. Annual General Meeting. "Public Lighting from a Municipal Point of View," by Jacques Abady.

WEDNESDAY, JUNE 15TH.

Incorporated Municipal Electrical Association.

10 a.m. Fifteenth Annual Convention. At Free Gardeners' Hall, Picardy Place, Edinburgh. (1) "Exhaust Steam Turbines and Condensing Plant," by F. A. Newington (Edinburgh). (2) "Mixed Pressure Turbines," by Ashton Bremner (Burslem).

2.30 p.m. Visit to Macdonald Road Electricity Works.

THURSDAY, JUNE 16TH.

Incorporated Municipal Electrical Association.

10 a.m. At Institute of Engineers and Shipbuilders, Glasgow. Discussions on (1) "Advantages of Continuous Records of Costs and of Steam Consumption," to be opened by G. Wilkinson (Harrogate) and C. E. C. Shawfield (Wolverhampton); (2) "Cheapening of the Cost of Mains and Services," by S. J. Watson (Bury) and F. Ayton (Ipswich).

2 p.m. Visits to Electricity Works, &c.

7 p.m. Annual Dinner at Windsor Hotel.

FRIDAY, JUNE 17TH.

Incorporated Municipal Electrical Association.

10 a.m. Annual General Meeting at Institute of Engineers and Shipbuilders, Glasgow.

Wireless Telegraphy.—It is stated that Mr. Marconi intends to make a series of tests shortly with a view to ascertaining the practicability of sending wireless messages across Canada.

Telegraph Traffic.—The Western Telegraph Co. on the 1st inst. put the cable between Para and Pernambuco into working order. Telegrams for Novo Redondo and Bailundo, in Angola, are no longer subject to delay. The land line between Bogota, the capital of the Republic of Colombia, and Barranquilla, in the same country, has been repaired after being down several years. On the 5th inst. cable communication between Mozambique and Majunga was restored.

Wireless Telegraph Patent Litigation.—With reference to the announcement last week of an action by the Marconi Wireless Telegraph Co., Ltd., against the British Radio-Telegraph and Telephone Co., Ltd., for alleged infringement of their patents, the latter company state that they are defending the above action and are fully prepared to indemnify all purchasers and users of their apparatus against any claim in respect of the Marconi patents.

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THE I.M.E.A. CONVENTION

THE Incorporated Municipal Electrical Association will hold its fifteenth annual convention in Glasgow and Edinburgh from Monday to Friday next week, under the Presidency of Mr. W. W. Lackie, chief electrical engineer to the Glasgow Corporation.



MR. A. C. CRAMB, Chief Electrical Engineer, Croydon, who will read a Paper on "Commercial Advancement of Electric Supply."



THE PRESIDENT.

MR. W. W. LACKIE,
City Electrical Engineer, Glasgow.



MR. H. COLLINGS BISHOP, Chief Electrical Engineer, Newport (Mon.), who will read a Paper on "Notes on Commercial Progress of Electricity Undertakings."



MR. ASHTON BREMNER, Chief Electrical Engineer at Burslem, who will read a Paper on Wednesday on "Extensions to Existing Electricity Supply Stations by means of Mixed Pressure Turbines."



MR. G. WILKINSON, Chief Electrical Engineer, Harrogate, who will open a discussion on Thursday on "Advantages of Continuous Records of Costs and of Steam Consumption."

Mr. W. W. LACKIE, the President, was born at Montrose in July, 1869. He was educated at Montrose Academy, Aberdeen Grammar School, and was two years at the engineering classes in University College, Dundee, under Professor Ewing. He afterwards attended Glasgow University, studying under Lord Kelvin. After leaving college, Mr. Lackie entered the services of Messrs. Mavor & Coulson, who then owned the concern which was later to develop into the Glasgow Corporation Electricity Department. When the Corporation took over the undertaking, Mr. Lackie transferred his services, and was appointed mains superintendent of the new Department. Having been promoted to be Chief Assistant Engineer, it was natural that Mr. Lackie should be appointed to the post of chief, when Mr. W. A. Chamen left Glasgow in 1905. Mr. Lackie has been for two sessions Chairman of the Local Section of the Institution of Electrical Engineers, President of the Scientific Society of the Glasgow Technical College, Vice-President of the Institute of Engineers and Shipbuilders, and President of the Angus and Mearns Benevolent Society. Mr. Lackie's Presidency of the I.M.E.A. commenced immediately after the annual general meeting held at Manchester in June last year, and his term of office concludes with the close of the present Convention.

AUTHORS OF THE PAPERS.

In accordance with our usual custom, we publish portraits and short biographies of the members who are down to read papers and open discussions.

ALEX. C. CRAMB, who, jointly with Mr. H. Collings Bishop, will read a Paper on "Commercial Progress," was educated at the Devon County School, and received his technical training at the Northampton Institute, London, where he gained honours in electrical engineering. He served his articles with Walker & Co., Cardiff, and Easton, Anderson & Goolden, of Erith. Before his appointment as Borough Electrical Engineer at Croydon, Mr. Cramb was successively Assistant Engineer at Holloway, Islington, Huddersfield, Hampstead, and Croydon. He entered the employ of the Croydon Corporation in 1902 as



MR. C. E. C. SHAWFIELD, Chief Electrical Engineer, Wolverhampton, who will follow Mr. Wilkinson.



MR. J. S. WATSON, Chief Electrical Engineer, Bury, who will open a discussion on Thursday on "Cheapening of the Cost of Mains and Services."

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Chief Assistant Engineer, and in 1904 succeeded to the position of Borough Electrical Engineer. In addition to acting as consulting engineer to the electrical undertaking, Mr. Cramb has carried out a considerable amount of extension work for the tramways committee.

Mr. H. COLLINGS BISHOP was educated at Clifton College, Bristol, and in 1888 went to America, and among other work completed two high-tension installations in the State of Oregon. Returning to England in 1894, he accepted the post of charge engineer at the Bristol Electricity Works, and two years later was appointed chief electrical engineer and manager of the Leyton Electricity Works, where he remained until 1899. He resigned this post in order to take up the position of chief engineer and tramways manager to the Wigan Corporation, and designed and erected the municipal electricity works and tramways there. Having completed this work, he proceeded, in 1902, to his present town of Newport (Mon.), in a similar capacity.

Mr. F. A. NEWINGTON, chief electrical engineer to the Edinburgh Corporation, will read a Paper on "Exhaust Steam Turbines and Condensing Plants at the MacDonald Road Station, Edinburgh." Mr. Newington was President of the Association in 1905, and is a familiar figure at all the I.M.E.A. Conventions, where he frequently takes part in the discussions. The MacDonald Road Station is described in a later portion of this article, and the method of utilising water from the main sewer for circulating purposes will doubtless form the chief matter of interest in Mr. Newington's Paper. In conjunction with Sir Alexander Kennedy, he is now engaged in working out an extension scheme, which involves the addition of cooling towers, and there is some opposition to these on æsthetic grounds. An ornamental design of cooling tower, has, however, been prepared by the City Architect, and will doubtless ultimately be adopted as a welcome addition to the other beauties of the city which the members of the Association will have an opportunity of inspecting on Wednesday.

Mr. ASHTON BREMNER, who will read a Paper on "Mixed Pressure Turbines," is chief electrical engineer at Burslem. He was educated at the Oswestry Grammar School, and was first engaged on the staff of the late J. E. H. Gordon. Mr. Bremner has since acted as consulting engineer to the Oswestry Electric Lighting & Power Co., and to the Sleaford District Council. In addition to being consulting and resident electrical engineer to the Burslem Corporation, which now forms part of the new County Borough of Stoke-on-Trent, Mr. Bremner acts in a similar capacity to the Tunstall and Wolstanton Councils, whose areas are supplied from the Burslem works.

Mr. GEORGE WILKINSON, chief electrical engineer to the Harrogate Corporation, and a Vice-President of the Association, will open a discussion on "Advantages of Continuous Records of Costs and of Steam Consumption." Mr. Wilkinson, who regularly attends the annual conventions of the Association, read a Paper on "The Distribution of Electricity in Scattered Areas," in 1900, and one on "Live Steam-Heated Feed Water: its Effect on the Output and Efficiency of Steam Boilers," in 1906. Mr. Wilkinson has recently been concentrating his attention upon a comprehensive street lighting scheme, a proposal which has caused grave concern to the gas interests in Harrogate.

Mr. C. E. C. SHAWFIELD, who will follow Mr. Wilkinson in this discussion, is chief electrical engineer and manager to the Wolverhampton Corporation. After a course at the Durham College of Science, Newcastle-on-Tyne, Mr. Shawfield was articled as a pupil for three years with the Newcastle-on-Tyne Electric Supply Co., and subsequently passed through the works of Messrs. Robey & Co., of Lincoln. In 1896 he was appointed Chief Assistant Electrical Engineer to the Wolverhampton Corporation, and in June, 1898, succeeded Mr. Harman-Lewis (who resigned through ill-health), as Chief Engineer. The addition of the tramway load, and a considerable increase in the power demand, since Mr. Shawfield became chief engineer, has necessitated very large additions to the plant, all of which he has designed and carried out. A further scheme of extension is now under consideration.

Mr. S. J. WATSON, Chief Electrical Engineer to the Bury Corporation, will open a discussion on "Cheapening of the Cost of Mains and Services." Mr. Watson was Chairman of the Manchester Section of the Institution of Electrical Engineers for the session that has just closed. In 1906 he read a Paper before the I.M.E.A., on "The Supply of Power to Tramways from Small Towns." Mr. Watson acts as consulting engineer at Bury, and on his advice a new power station has been decided upon, and is now under construction. The scheme was carried through in spite of great local opposition at the time.

Mr. F. AYTON, Chief Electrical Engineer and Tramway Manager at Ipswich, will follow Mr. Watson on the question of cost of mains and services. He supervised the erection of the Ipswich electricity works for the consulting engineers, Messrs. Kennedy & Jenkin, and was appointed chief engineer and tramway manager when the works were opened in 1903.

WORKS TO BE VISITED

ELECTRICITY SUPPLY IN GLASGOW

THE state of electrical supply in Glasgow at the present time is remarkable testimony to the rapid growth in the use of electricity by communities. Starting with the efforts of a small private company (Messrs. Muir & Mavor, now Mavor & Coulson, Ltd.), in 1879-80, electricity supply in this city grew until in 1890 the company owned plant of 300 kw. capacity, and had an annual output of somewhat over 400,000 units. These works were at this date bought over by the Glasgow Corporation, who had just obtained their first provisional order. A generating station was laid down at 75 Waterloo Street (now the site of the main offices of the department and a large substation) to the plans of Sir A. B. W. Kennedy. This plant was extended, until in 1897 the whole available space was occupied, and the plant installed aggregated to 3,300 h.p. The Electricity Department was taken out of the control of the Gas Committee about this time, and it was decided to purchase two new sites on the north and south sides of the river respectively—these are the present Port Dundas and St. Andrew's Cross stations. The system of supply, which was D.C. 3-wire 2×100 volts, was altered to D.C. 3-wire 2×250 volts. In addition, the Kelvinside Electricity Supply Co. was bought out, and their system absorbed. In 1904 it was found that the supply, especially to outlying districts, was growing so rapidly that it was necessary to lay down E.H.T. plant giving 3-phase current at 6,500 volts, to be used in conjunction with transforming and converting sub-stations.

The records of the department since its inception are a good gauge of the progress made in electricity supply generally, as may be seen from the appended table:—

Year.	Units generated.	Cost per unit.	Lb. of coal per unit
1893	854,766	2·01d.	13·04
1898	3,401,731	1·11d.	9·27
1903	17,770,488	0·51d.	5·23
1908	41,493,035	0·41d.	4·26

This cost per unit covers coal, oil, wages and repairs, but not management charges.

Another interesting table culled from the records of the department shows the relative growth of the supply for lighting and power purposes in Glasgow since 1898:—

Year.	Lighting H.P.	Motors H.P.	Total H.P.
1898	7,899	301	8,200
1902	22,407	4,597	27,000
1905	36,695	19,805	56,500
1908	36,495	29,505	66,000

In the analysis of records made by Mr. Lackie last year, it was shown that there were some 3,600 consumers using electricity for power purposes, these consumers representing 112 different trades.

Generating Stations.

The Port Dundas station was originally designed to be built in three sections, each to contain 10,000 h.p. When the second section of the engine room was built in 1904-5, it was found that owing to the introduction of large turbine-driven generating sets it would be possible to install 30,000 h.p. in this section, giving a total of 40,000 h.p. in the two sections. The capacity of the plant now installed is 29,000 h.p. All the boiler house space available is required, however, and the result is that the space destined for the third section of the engine room is being converted into a large departmental stores. As explained in ELECTRICAL ENGINEERING, 14th April (page 253) owing to difficulties with water and coal supply it has been decided to lay down a new generating station on a fresh site. The St. Andrew's Cross station is almost full of plant, and again owing to use of turbine generators it has been found possible to install much more than the 15,000 h.p. it was originally intended to accommodate.

Port Dundas.

The feature that will probably take the attention of the visitor first in the Port Dundas station, which is to be visited on the afternoon of Tuesday, June 14th, is the somewhat heterogeneous nature of the low tension continuous current generating plant. This is accounted for by the fact that in the period from 1898 to 1900 the demand has grown so rapidly that quick delivery was a primary consideration. This plant, though still used and kept in working order, is not used very frequently, as it has been supplemented by a 1,000 kw. motor generator and two 500 kw rotary converters, which tend to equalise the load and the power factor on the turbo-generators, as well as to ensure sufficient results. The range of five turbo-alternators present a very fine effect when looked at from the centre of the engine-room, but the principle points of interest

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to the visitors will be the installation of recording instruments of various types for measuring the economy of the plant. On each of the five sets is fitted a "Kenotometer," supplied by Messrs. Brady & Martin, of Newcastle-on-Tyne. This instrument is designed to show the value of the absolute back pressure on the exhaust side of the turbine. It is also calibrated to a basis of a 30 in. barometer, in terms of the vacuum efficiency; this allows for barometric variations, and considerably simplifies all testing processes. One Lea V-notch recorder is already in use for measuring the hot well water from one of the turbines, and it is hoped that by the time of the Convention a Glenfield & Kennedy recorder will also be in use. Another instrument of interest in the engine room is the Tirril regulator, used for controlling the voltage on the main generators. In the boiler room the principal points of interest are the "Sarco" CO_2 recorder, which is so arranged that tests on sections of the boiler plant can be taken in detail, and the induced draught fans. The majority of the boilers are of the usual Babcock & Wilcox land type, but several of the marine type have been installed, and there are also four Stirling boilers.

St. Andrew's Cross.

In the St. Andrew's Cross generating station, which is to be visited on June 16th, the Ferranti remote-control E.H.T. switchboard is worthy of inspection, and is much more modern in every way than that of Port Dundas. Visitors will be interested in the Ferranti-Field oil switch, which is mounted on the lower floor of the engine-room, in such a way that the working can be clearly seen. Of the turbo-generators installed at St. Andrew's Cross three are A.C. machines similar to those at Port Dundas, but the remaining two machines are a Siemens' 1,400 kw. D.C. generator and a Brown-Boveri 1,700 kw. D.C. generator respectively. An interesting feature of the Siemens machine is the ventilated commutator with tunnels in the segments through which air is forced by a fan. As in the case of Port Dundas a Tirril regulator is installed, and "Kenotometers" are in use on the turbine exhaust.

Distributing Systems.

The 3-phase current is generated at 6,500 volts pressure and 25 periods, and is transformed at sub-stations throughout the city to D.C. at 250 or 500 volts for distribution in the surrounding areas. Practically the whole of the direct current networks are inter-connected with each other, and directly with the two main generating stations at Port Dundas and St. Andrew's Cross respectively, where a certain proportion of D.C. generating plant is still in use. The standard D.C. feeder is triple concentric of one sq. in. section, paper insulated, lead-covered, and armoured. The distribution cables generally are also triple concentric. For branch joints and services a special form of shell fitting is used. In two core services concentric cable is again employed. The feeder pillars were made by the department to their own designs, and are in every way worthy of examination.

Sub-stations.

Altogether there are some nine sub-stations, with a total installed plant of 24,500 kw. capacity. Four of the sub-stations are on consumers' premises, and the plant in these sub-stations aggregates about 2,000 kw., and generally consists of D.C. motor generators, transforming from 500 volts to a voltage suitable for the consumers' own plant, or rotary converters with transformers or induction motor generators transforming from 6,500 volts 3-phase to 500 or 250 volts D.C. The remaining five sub-stations each supply a district of the city, and are similar in essentials, differing only in size and detail. In general the sub-stations are arranged with the machines down the centre, the A.C., E.H.T. board, and cable tunnel being on one side, and the D.C. board and tunnel on the other, and the Springburn sub-station, which is to be visited on Tuesday, June 14th, may be taken as being typical.

Two types of induction motor generators are in use, the motors being of the slip-ring and squirrel cage patterns respectively, the latter being started up from the D.C. side. In the case of the rotary converters the use of a starting motor and the necessity for synchronisation have been avoided by employing transformers with multiple tappings. The generator ends of the motor generator sets do not call for special attention, being simply multipolar machines of substantial design. Many of these are fitted with "compensators" or static balancers, which are capable of dealing with an out of balance current of 25 per cent. of the output with a voltage drop of only 2 per cent. on the heavily loaded side.

The D.C. bus-bars are in duplicate, and the feeders are so arranged with selector switches on each pole that it is possible to run heavily loaded and lightly loaded feeders from different bus-bars at different voltages, so compensating for the extra drop when supplying to feeder points at some distance from the sub-station.

Our thanks are due to Mr. W. W. Lackie, Chief Electrical Engineer to the Glasgow Corporation, and Mr. A. Page for their courtesy in allowing our representative every facility for the preparation of this article.

THE GLASGOW TRAMWAY SYSTEM

THE Glasgow tramways have always been owned by the Corporation, who in 1871-2 laid down a tramway system and leased it to a company for a period of 23 years. In 1891 the Corporation passed a resolution in favour of the tramways being worked as a department of the Corporation, and negotiations were commenced with the lessees for the acquisition of the system and plant, but, as no terms could be arranged, the Corporation were faced with the task of providing an entirely new equipment, with premises, &c., in the space of two years, that being the length of time remaining of the company's lease. In 1896 it was decided to equip a short length of line in the centre of the city for electric traction. A small temporary power-house was constructed, and line to a total of five miles of track equipped. In 1899 the Corporation decided to proceed with the electrical equipment of the whole system. Mr. H. F. Parshall was appointed consulting engineer, and the plant was in operation in April, 1901, *i.e.*, the month before the commencement of the International Exhibition.

The Pinkston Power House.

The main generating station at Pinkston, which is to be visited on the afternoon of June 14th, is situated on the north bank of the Forth and Clyde Canal, from which circulating water for condensing purposes is obtained.

Coal is brought in wagons, which are tipped directly into bunkers by electric locomotives fitted with swivelling cranes. Two mechanical bucket conveyors, built by The Mirrlees Watson Co., take the coal to the overhead bunkers, and also handle the ashes. The water from the condensers is passed through a Harris-Anderson water purifier before going into the hot well. There are in all 22 boilers, all of Messrs. Babcock & Wilcox's make. One section of these give a superheat up to 450° F. for the new turbine plant. All are fitted with chain grates.

The original engine-room plant consists of 2,500-kw. sets driven by three cylinder vertical compound engines, made by the Allis Co. of Milwaukee, and Messrs. Musgrave & Sons, Bolton, with Corliss valve gear. Their three-phase generators are by the British Thomson-Houston Co., Ltd. These sets, which weigh about 800 tons, and have flywheels about 24 ft. in diameter, with correspondingly massive generators, each with 40 poles, look an enormous size compared with the 3,000-kw. Richardson-Westgarth turbine and Brown Boveri generator recently laid down (see ELECTRICAL ENGINEERING, Vol. V., p. 625). In addition to the three-phase generators there are two 500-kw. D.C. generators coupled direct to cross-compound Stewart engines for supplying current to the system during the times when the general car service is not in operation. They are also used in conjunction with two rotary converters to relieve the main engines at times when the load on the power station is slightly more than the full load for the main generators in use. Six 50-k.w. steam-driven exciter sets are also installed.

Three-phase current at 6,500 volts and 25 periods, which forms the main supply, is generated and transmitted to five sub-stations. The original E.H.T. switchgear with air-break switches, was replaced in 1904 by a modern electrically controlled system, with oil break switches. The feeder switches are of the Westinghouse Co.'s solenoid type, and the generator switches are of the B.T.-H. Co.'s motor control type (see ELECTRICAL ENGINEERING, Vol. V., page 628). There are two 'bus-bars, which can be put in parallel by the use of oil switches. The generator switches are non-automatic, but the feeders are controlled by automatic overload relays of the Brown Boveri inverse time element type.

Sub-stations.

The equipment of the sub-stations generally consists of single-phase static transformers and 500-k.w. rotary converters. The sub-stations are divided into three distinct parts, viz., the E.H.T. 'bus-bar and oil switch room, the transformer house, and the rotary converter house. In the rotary converter house the A.C. board is on the side nearest the transformer house, the rotary converters in the centre, and the direct-current board on the side opposite to the A.C. board. A feature of the control is that four E.H.T. feeders are laid into each sub-station, and the switching arrangements are such that it is possible to run any four of the converter units installed, one off each of the incoming feeders, without being connected anywhere on the high-tension side. Each of the rotaries is started by an induction motor fixed at the end of the rotary shaft and on the A.C. side. On the D.C. end of the machines there is fixed a negative booster for dealing with a part of the return current so as to minimise and control the drop in the rails. A shunt is placed directly across the field of the booster so as to prevent damage to the field coils should a short occur on the feeder, and also to act as a field discharge when the field is broken. The booster field panels provide means whereby it is possible to pass any feeder current round any booster field. On these panels is also mounted a rheostat which can be connected in parallel across the field so as to shunt a portion of the feeder current which is exciting it.

The whole of the feeders and telephone cables are paper insulated and lead covered. Most of the cables are in ducts,

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but a certain amount of cable on the later extensions has been laid in asphalt troughing.

The Coplawhill Works.

The works and general stores at Coplawhill are used for the execution of all maintenance and repair work for rolling stock, permanent way, overhead line, and even the power and sub-stations. These works will be visited on Thursday afternoon, June 16th.

On the right as one enters is the Coplawhill sub-station and school for motormen. Passing into the works, one comes to a large space into which the shops all open. On the left are the works offices, comprising manager's rooms, drawing offices, general stores, &c. The smithy has both steam-driven and pneumatic hammers, and there is also a brass foundry well equipped with white metal pots, case-hardening furnaces, &c. Next comes the saw-mill, a feature of which is the suction plant for removing sawdust and chips. In the same bay as the saw-mill will be found the machine shops, tool room, and fitting shops. The paint shop covers an area of 2,000 sq. yds., and accommodates about 30 cars, in addition to other vehicles, such as tower wagons, &c. The light work, such as polishing and lettering, is handled in a gallery. Beyond the paint shop and in the same bay, is the shop in which the steel plate and handrail work is done. The car overhauling and repair shops cover three bays. Two of the bays are traversed by 15-ton cranes with sufficient headroom to clear the top-deck cars. The third bay is used for the motor equipment overhaul, and is provided with a remarkably complete stock of portable tools of all kinds. Above the overhaul shop is the electrical repair shop, which is also well equipped with machine tools of various kinds. It should be mentioned that all the cars in use, with the exception of about eighty, have been built and equipped in the car-works. In conclusion, we would like to thank Mr. Jas. Dalrymple (General Manager, Glasgow Corporation Tramways), and Mr. E. T. Goslin for their kindness in allowing our representative to visit the various parts of the works and for other kind assistance.

ELECTRICITY SUPPLY IN EDINBURGH

THOSE attending the meeting at Edinburgh on Wednesday, June 15th, will be able to visit the MacDonald Road Station, which is equipped with ten 750-kw. sets driven by high-speed reciprocating engines, and, what will perhaps prove of more interest, two exhaust steam turbines of the Rateau type, driving Brown Boveri 1,200-kw. generators. The main plant supplies direct current to a 460 volt three wire system. Two reciprocating sets at full load supply sufficient steam to produce the full load output of one exhaust steam turbine. A small amount of single-phase alternating current is generated and distributed to the outlying portions of the town through street transformers. A small motor alternator in the MacDonald Road Power Station deals with this supply at times of light load, in order to avoid running the A.C. steam plant at Dewar Place Station.

The condensing plant is particularly interesting, as sewage is used as a cooling medium. A large shaft is sunk into the main sewer some 200 yards away from the generating station, and from this shaft four suction pipes are laid to four centrifugal pumps placed in a basement recess adjoining the boiler house. The shaft mentioned above is about 26 ft. in diameter, and is provided with two floors at different levels. On the first of these is placed the motor and shafting which is employed to drive the automatic scraper gear which travels up and down the face of the bar screens in order to prevent them from becoming choked. The lower floor is used for access to the bar screens when they are raised, and for the operation of the artificial weir, which can be raised during times of flood. The circulating pumps are placed some 15 ft. above the level of the sewer inlet, and the total head on the discharge side of the pumps to the highest point of the return pipe from the condensers is some 40 ft. Exhausters are installed in order to assist the main circulating pumps when starting, as it can be readily understood that fluid sewage is much more difficult to lift by suction than pure water, and that gas is liable to be given off and to so fill the suction pipes. In addition, exhausters are installed to serve the return pipes from the condensers in order to extract any gas or air which may be found, the result being that the pressure on the discharge side of the pumps is only equivalent to that of about one-third of that corresponding to the actual head of water. The sewage is passed through the pumps on to the inlet side of a Bailey & Jackson strainer. This apparatus consists of a large circular drum about 10 ft. in diameter and several inches in thickness, which is revolved slowly inside a cylindrical casing which forms, as it were, two end bells, which are divided into halves internally by dividing fillets. In the drum just described there are holes which are fitted with gauze strainers. The sewage entering the top half of the casing nearest the pumps passes through the holes into the side of the casing on the condenser side of the apparatus, and thence along the pipes to the condenser. The solid matter is deposited on these gauze screens, and, by the revolving motion of the drum, is carried around until it has passed the dividing fillet already mentioned. The sewage returning from the condenser enters on this side of the chamber and passes through the holes in the drum, carrying back with it the solid matter which has been deposited on the gauze screens.

The condensers used are Messrs. Richardson & Westgarth's "Contra-flo" type. With all the precautions described it is impossible to prevent a certain amount of matter(such as hair, wool, &c.) from getting through to the condensers, and it is consequently necessary to open the end doors and remove such matter from the ends of the tubes about once in every twenty-four hours.

Another interesting portion of the plant is the Davis-Perrett electrolytic oil filtering apparatus. In brief, the system consists in passing the condensed water from the hot wells through a tank in which are placed iron plates, arranged somewhat similarly to the plates in a secondary battery, the adjacent plates being of opposite polarity. Electrolytic action takes place between the plates, and, in consequence, oxide of iron is formed. In their passage through the water the particles of iron oxide attract minute particles of oil to them, and the result is that the oxide of iron rises to the surface of the water, carrying with it the aforesaid particles of oil, in the form of scum. The whole of the hot well water is passed from these tanks through a filter, which is practically an enclosed sand bed. The sand bed tends to get choked in time by the amount of scum deposited, and a valuable feature of the method is the means whereby, when this occurs, a valve is automatically opened, admitting water under pressure to the under side of the sand bed, so flushing through it and clearing away the scum.

We would like to acknowledge our thanks to Mr. F. A. Newington, City Electrical Engineer, for his kindness in showing our representative over the works, and furnishing him with the necessary information.

THE GOVAN ELECTRICITY WORKS

THE latest extension to the plant in the generating station of the Govan Electricity Department, which, however, is not at work yet, is a three-phase, 6,000-volt, 25-period Westinghouse alternator, driven by a Howden-Zoelly turbine with the necessary E.H.T. switchgear. The present plant in the station is all D.C., and all driven by reciprocating engines, but the constant growth of the supply and radius of distribution has led to the adoption of E.H.T. plant It is intended to instal two rotary converters in the power station, and one in a sub-station to be erected at the far end of the system. Two of the three converters are to be of 250 kw. capacity each, and the third is to be of 500 kw. capacity. The two smaller converters will be started on the A.C. side only, but the larger set will be arranged to start on either A.C. or D.C. side. The larger set is to be capable of being run inverted in order to provide the necessary standby to the turbo set.

A British Thomson-Houston E.H.T. switchboard of the mechanical control type, and with concrete cell construction, is in process of erection, and on the new gallery which has been erected there will also be a D.C. board, consisting of two rotary and five feeder panels, by the same maker. Unfortunately it is possible that very little of this new plant except the switchboard will be installed by the date of the Convention.

Of the older plant there is nothing that can be described as novel, and the arrangement of the station generally does not call for any special comment. The present switchboard is of the now obsolete Ferranti cellular type.

The boiler plant is all Babcock & Wilcox, with the usual coal- and ash-conveyor gear. The arrangement of the haulage and tipping gear for the handling of the coal trucks is distinctly neat and workmanlike. A Harris-Anderson water filter is installed, and a Klein cooling tower deals with the circulating water for the Mirrlees Watson condensing plant. A Simmance-Abady CO_2 recorder is in use in the boiler room. One point of interest lies in the fact that there are three electrically-driven feed pumps to one steam-driven, the latter of Weir's make.

The works will be visited on Thursday afternoon, June 16th.

ALTERNATIVE VISITS

The following is an alternative series of visits which has been arranged for Thursday afternoon, June 16th:—

Partick Corporation Electricity Works contain about 2,500 kw. of generating plant, all driven by reciprocating engines of Messrs. Bellis & Morcom's make. The generators are all of Messrs. Bruce Peebles' make, with the exception of the last set installed, which is of Messrs. the Lancashire Dynamo & Motor Co.'s make, and is of 1,000 kw. capacity. Of the seven boilers installed three are fired by refuse. There are three condensers in all, one being installed to deal with the 1,000 kw. set. For some time attempts have been made to get water for the supply of the cooling towers by sinking an artesian well, but so far

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the efforts have not met with success. The feeders and distributors are all triple concentric, armoured and paper insulated. The feeders are connected in ring main form, and the distributors are connected between distributing centres.

The Yoker Power Station of the Clyde Valley Electric Power Co. supplies a district some nine miles long by about three miles broad. The station is also interconnected with the company's power station at Motherwell, which is some 20 miles away, and so can on occasion supply the Motherwell district with a certain amount of current. Three turbo-alternators are installed, two of 3,000 kw. and one of 600 kw. capacity. The turbines are of the Westinghouse double-flow type, the steam entering at the centre and so balancing the thrust. The blading is chiefly Parsons' type, but impulse blades are adopted for the first stage of expansion. The alternators generate three-phase current, at 11,000 volts and 25 periods, which is handled through a Westinghouse E.H.T. switchboard of modern construction. The oil-break switches are electrically operated from a control desk arranged with a diagrammatic representation of the generator and feeder circuits, and fitted with pilots and tell-tales to show the position of switches at all times. From the same board it is possible to control the speed of the main sets and the operation of the field rheostats. The switch controls and some of the electrically-driven auxiliaries are operated by direct current, but most of the heavy auxiliary plant is operated from the three-phase circuits. Two motor-generators and frequency-changers are installed for the purpose of giving D.C. for exciting purposes, and 50 period current for the local Clydebank supply, the distribution in the latter case being at 3,000 volts. The condensing plant presents some interesting features, and includes a Leblanc air pump and the oil-circulating arrangement. The boilers and coal- and ash-handling arrangements are all of the Babcock & Wilcox type, and call for no particular description.

Messrs. W. Beardmores & Co.'s Shipyard at Dalmuir presents an interesting example of a producer-gas driven station, and a large scheme of distribution. The latter has points of interest in the overhead cable lines and the general lay-out of cables, and the sub-station for the conversion of the Clyde Valley Electric Power Co.'s supply. There will be much of interest in the equipment of the shipyard and workshops. Messrs. Beardmores have a fair amount of naval work in hand, and one cruiser for H.M. Navy is now approaching completion.

The following works will also be open for inspection during the Convention:—

Messrs. Mavor & Coulson, Ltd., 47 Broad Street, Mile End, Glasgow; Messrs. Babcock & Wilcox, Renfrew; the Craigpark Electric Cable Co., Flemington Street, Springburn, Glasgow; the electricity works and combined dust destructor of the Greenock Corporation (see ELECTRICAL ENGINEERING, Vol. III., page 263); the electricity works of the Paisley Corporation; the Coltness Iron Co. (installation of large gas engines); Messrs. D. Bruce Peebles, & Co., East Pilton.

A LIST OF MEMBERS AND VISITORS ATTENDING THE CONVENTION WILL BE FOUND ON PAGE 378.

THE DEVELOPMENT OF HIGH-TENSION SWITCHGEAR

AT the annual general meeting of the Newcastle Local Section of the Institution of Electrical Engineers held on Monday, May 30th, Mr. H. W. Clothier (Messrs. A. Reyrolle & Co., Ltd.) gave an illustrated lecture on switchgear construction. Twenty years ago, he said, a switchboard consisted of a flat panel with the apparatus on the front and a tangle of cables at the back. As an example of an early board he mentioned one for a 2,000-volt supply installed in 1893, a time when it was considered unsafe to run alternators in parallel. This had connections such that any circuit could be switched on to any machine by means of plugs and a change-over switch. One striking feature of the early designs was the almost touching confidence in the safety of 2,000-volt supply as evidenced by the small amount of protection on the switch handles, &c. A back view of one of these non-synchronising boards illustrated the extreme difficulty to the designer of the separate circuit arrangement. In the case shown there were no less than 60 connections on each feeder panel. In contrast to this was shown a type of switchgear which became common when engineers had become convinced of the safety of parallel running of alternators. The single-phase cellular type of gear with machine panels in the middle of the board and feeder panels at the side occupied a length of 6 or 7 ft. in contrast to a separate circuit board for the same installation occupying 40 or 50 ft. There was a common 'bus-bar of ring main type with a link between each panel. The board was divided into two halves, half the machines and half the feeders being on either side of a dividing switch provided with synchronising arrangements for paralleling the two halves of the board. The board installed by Messrs. Ferranti in 1894 at Portsmouth was the first of the cellular type of switchboards put into actual operation. Between 1895 and 1902, the period of development of the H.-T. single-phase system, the gear designed by Mr. Ferranti was largely adopted.

Mr. Clothier then drew attention to one or two designs between the period of 1900 and 1905. The first was a gear by Mr. Cowan, of Messrs. Cowans, Ltd., which included a water break switch operated by means of a handle through link work. Another example was a switchboard installed at Dresden by the Helios Co., the main switch of which was of the plunger type, having a mercury break operated by means of a handle placed on the operating gallery above the switchgear. An interesting feature was the provision of an artificial load, upon which the generators were run up previous to being synchronised and placed upon the station load. The third type was a switchgear designed by Messrs. Lowrie and Hall, of Messrs. Fowlers, Ltd., of Leeds. In this gear there was an attempt to encase dangerous conductors, and switching was accomplished by means of plugs in four way sockets. The only dangerous part of the arrangement was that the high-tension fuses, placed at the bottom of the board, were not cased in.

The history of fuses was briefly reviewed by the lecturer by reference to the old Ferranti oil-break fuses. The German fuses of the same period had insulated handles and horns so placed that when the switch-fuse was withdrawn, or the fuse blown, the horns would dissipate the arc. The Brush Company's production, embodying the principle adopted at the present day in tubular fuses, was also shown. At the power station at Deptford, the single-phase conductors were originally placed on the wall of the station, and the switches were controlled by a system of levers similar to railway signal levers, the arm of the switch being 5 or 6 ft. long. A quick air break was obtained by means of a spring attached to the switch arm and held by a catch until the arm had taken a good portion of its outward travel. An interesting slide was that of the first oil-break switch put into commercial work in 1894 at the City of London power station at Bankside. Two main switch blades engaged on the inner surface of fixed contacts. The quick-break mechanism operated in a porcelain pot containing oil, being drawn down suddenly when the main switch blade was 3 or 4 in. from the contacts. The shock of the auxiliary break was taken by a dash-pot. As a contrast to this was shown a present-day three-phase oil-break switch with over-load release coils on two phases, and a no-volt release coil on the third phase, and the oil-break switchgear used at Carville. In the latter case there were strong metal cylinders with breaking contacts on the principle of the early Ferranti switch, which were operated by a remote control with direct current.

Reference was then made to the trouble experienced on the Bristol system, involving the burning up of the station switchboard. Another power station of very large capacity was linked up to the generator side of the board concerned by two large trunk feeders. It appears probable that a fuse failed and an arc drew out, burning away metal, and causing a bigger arc 8 to 10 in. long. It was impossible to cut off the board from the supply to the trunk mains from the other generating station for a quarter of an hour or twenty minutes as the arc did not go to earth, and the other power house was not sufficiently warned of the magnitude of the trouble that was occurring. The oil from the switches and fuses on the board dropped on to the floor, and set fire to cables underneath the switch gallery; a blast of air from the window intensified the fire to such an extent that practically every panel was destroyed. The new board supplied by Messrs. Siemens was split up in a better fashion, and switches with automatic overload release were installed. About this time considerable uncertainty existed in the minds of British switchgear designers and central station engineers as to the best type to use. A typical German gear was built up of wrought-iron frames, one frame supporting the switchgear, another the fuses, potential transformers, &c., and two gangways were provided at the back of the frames. The impression given of the American practice at this period was that larger powers were handled than in Great Britain, and there was a greater appreciation of the danger of high-tension work. The leading British designs of this period were not so large as American designs, but were safer, neater, and better-thought-out than the German designs.

The position at present appears to be that oil-break switches are now standard practice. A higher safety to life appears to be obtained in this country as compared with some others, and

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the tendency is still to increase this safety. In H.-T. apparatus, the use of concrete partitions, floors, and galleries has been extended, but accidents still occasionally happen, even with this precaution. A method now much used is to encase all H.T. conductors in metal, and to seal them up in compound or oil. The metal armouring formerly applied only to cables is now applied to switchgear, so that a continuous armouring from generators to load appears possible.

In speaking of the switchgear of the Newcastle-on-Tyne Electric Supply Co., Ltd., Mr. Clothier drew attention to the fact that within the last two or three years a new system for controlling the feeders had been adopted at Carville, a separate control room having been equipped with the remote control apparatus for the feeder switches, and a "power dispatcher" placed there with a diagram showing the connections to the extension feeders, and whether they are alive or dead at any time. He also showed the arrangement of switchgear which is being adopted at the new power-house at Dunston-on-Tyne, where a separate switch-house is being erected. The balanced system of protection is being used, and oil-break switches with motor control and isolating switches operated through concrete partitions are being utilised. The lecture concluded with a description of the iron-clad gear recently developed by Messrs. Reyrolle & Co., with relays for the balanced system of protection, and of a recent design of a remote control sub-station switchboard designed by Mr. Highfield for the Metropolitan Electric Supply system.

DISCUSSION.

Mr. C. FARADAY PROCTOR said, in referring to the Bristol trouble, that the reason why it was impossible to telephone to the larger power-house instructing them to cut off the supply was that the heavy current in the interconnecting cables disturbed the telephone circuits.

Mr. RISELEY said that it was interesting to notice the development which had taken place in the dimensions of the cellular boards; originally the contacts were at about 7 in. centres; this was increased to 10 in., while now spaces of 10 ft. between centres were to be found. He thought that the complication of safety devices due to fear of danger had brought up the cost per kilowatt of switchgear somewhat unduly. He also mentioned that the Author had not referred to the early Brush pillar switchgear in his historical review.

Mr. G. G. STONEY (Messrs. C. A. Parsons & Co.) could remember still earlier types of board, in which wood was very largely employed, notably that at Manchester Square station, which was about 150 ft. long. This answered quite well for capacities up to 150 kw. per generator, but on the installation of a 350 kw. turbo-set the switchboard went up in smoke.

Mr. HOLMES (Messrs. J. H. Holmes & Co., Newcastle) said that in 1883 he had an equipment to carry out at Wallsend of an installation consisting of a steam engine driving two dynamos, one for incandescent lights and the other for two arc lamps. The switches for the control of the circuits were mounted on wooden bases. On the opening night the architect remarked on the beautiful flexibility of electric light, as by turning the switch over slowly he found that the light could be lowered gently just like gas. As this was opposed to Mr. Holmes's previous experience, he investigated the matter, and found that by opening the switch slowly the architect had drawn out a beautiful arc which had burnt the wooden base to a considerable extent. The ultimate result of this was that in 1884 he designed the prototype of the present-day quick-break switch.

One or two other members referred to early switchgear.

Mr. CLOTHIER, in reply, thanked Mr. Riseley for drawing the attention of the meeting to the Brush pillar switch, which was really the commencement of ironclad gear. Its only fault was that it did not carry this principle far enough. Reference had been made to a growing complication in switchgear design, but he pointed out that it was not quite fair to contrast the switchboards of the present day designed for dealing with large powers with the simpler structures used in the early days, because as the sizes of generating stations and distributing systems grew, greater skill in design was required in order to secure continuity of supply. He did not agree in any way that it was advisable to save money by cutting down the element of safety to human life. He would, however, say that simplicity is the keynote for switchboard design. The more work which was done in designing a switchgear the less there was usually to show for it. In his opinion, a distinct step had been taken in the latest form of switchgear design—namely, that of the solid type iron-clad gear, which was the essence of simplicity and concentration.

In calling for a vote of thanks to Mr. Clothier, Mr. C. FARADAY PROCTOR said that it was of prime importance that historical records of the progress of the industry should be kept and periodically put before the members of the Institution. Mr. Clothier had obtained a marvellously complete set of historical photographs and drawings, but he (the chairman) appealed to other members who had photographs or details of switch construction of historical interest to forward them to Mr. Clothier, who would probably be in a position to make still further use of them for the benefit of the industry at a later date.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

GAS ENGINES.—We have received a pamphlet from Messrs. Sperling & Williams, 24 and 25 Fenchurch Street, E.C., sole export agents for Grice's gas engines and suction producer plants, containing particulars of these plants, and of interest as showing some of the arguments put forward by the gas industry against electric driving.

GRAPHITE LUBRICATION.—An illustrated pamphlet issued by the "Cromil" Engineering Co. (Newcastle-on-Tyne) describes the "Miller & Bennet" dry graphite lubricator and its applications. Powdered graphite is blown into the cylinder or other chamber in the form of a dust cloud by means of a sudden injection of live steam. No oil or grease is required. The system has been applied with success to the lubrication of pump and turbine glands, and a letter referring to its working in connection with a 1,600-kw. Oerlikon turbo set at Wood Lane is reproduced in the pamphlet. Lubricating mixtures, composed of graphite suspended in oil or water, a valve reseating machine, and glass fibre brushes for cleaning commutators are also referred to in the pamphlet.

LABORATORY EQUIPMENT.—An illustrated booklet is to hand from Robt. W. Paul (33 Leicester Square, London, W.C.) describing a simple laboratory equipment suitable for carrying out a number of experiments in electrotechnics. The instruments and apparatus are of the most modern type, and have been selected with special care. A list of experiments is appended. Mr. Paul informs us that the booklet has been approved by several leading technical teachers as describing a suitable equipment for an elementary laboratory.

CITY & GUILDS INSTITUTE.—The report of the Council of the City & Guilds of London Institute for the year 1909 has just been issued. This includes reports of the work carried on in the electrical engineering departments of the Central Technical College, and of the Technical College, Finsbury. Lists of scholarships and studentships and statistics of attendance, &c., are also included.

MOTOR GENERATORS.—An illustrated folder has been issued by the Allgemeine Elektricitäts-Ges., of Berlin, giving particulars and prices (German) of various patterns of motor-generators, with both D.C. and A.C.-motors, especially designed for supplying the arc lamps of cinematograph prjoectors. Tables showing the saving accomplished by using one of these machines in the place of series resistances are also given.

ELECTRIC GRINDER.—An illustrated booklet from the Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford, describes a convenient form of double-ended bench electric grinding machine, with fully enclosed motor, fitted to take emery wheels at both ends of the shaft.

TELEPHONE APPARATUS.—Two new lists of telephone apparatus have just been issued by Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster). One comprises wall and table sets for central battery circuits, including a hand micro-telephone, similar to the last Post Office pattern. The other deals with telephone condensers; these are of the rolled type with tinfoil and specially prepared impregnated paper.

MOVING COIL INSTRUMENTS.—An advance price list from Messrs. Crompton & Co. (Salisbury House, London Wall, E.C.) contains particulars of several patterns of iron-cased moving-coil ammeters and voltmeters, including round, sector, and edgewise forms, and a special pattern for use on iron-clad control pillars. A new design of ebonite case portable instrument is also listed.

FANS.—We have received a copy of a new pamphlet which is being issued by the Electric Supply Department of the Borough of St. Marylebone regarding the cost and hire of electric fans for the information of consumers.

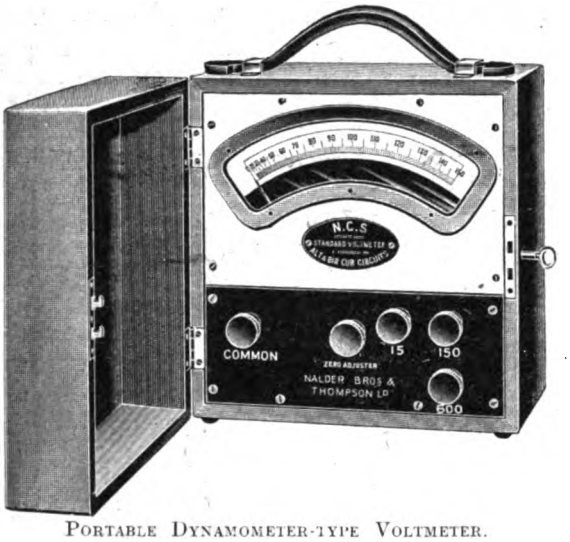
FITTINGS.—A new edition of Messrs. John Dugdill & Co.'s illustrated fittings catalogue contains particulars of a long series of jointed and other fittings made under Dugdill's patents. These include a special form of elbow joint which is easy to move, but will remain firm at any angle, and also telescopic and universal joint arrangements. These are particularly adaptable to strong works fittings, and enable the light to be placed in any position or direction. Ornamental fittings on the same principle are also made.

ELECTRICAL SUPPLIES.—Messrs. Siemens Brothers Dynamo Works, Ltd. (Caxton House, Westminster), have just issued a new price list of electrical supplies in the form of an attractive octavo volume conveniently arranged with a thumb index, so that any section can be referred to readily. The idea has been to cover all the articles used by an electrical contractor in his business, and which can be supplied direct from their supply department at 39 Upper Thames Street, or any of the branch establishments. Particulars of the reduced prices and latest types of tantalum lamps are, of course, included, and considerable space is devoted to the company's "Zed" cartridge fuses, the manufacture of which is now being taken up at Stafford. The popular Stannos system is included in the wiring material section, and mention should also be made of a new line of cheap knife switches, also made at Stafford. Various forms of lightning arrestor are also dealt with. It is needless to particularise all the contents, but reference must be made to the fine series of fittings, which includes some very artistic designs, as well as watertight and other fittings for special purposes.

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NEW PORTABLE A.C. AND D.C. INSTRUMENTS

MESSRS. NALDER BROS. & THOMPSON, LTD. (34 Queen Street, London, E.C.) have recently placed upon the market a line of portable instruments. These are of the dynamometer type, fitted with air damping to render them dead beat, and have been designed with a view to giving accuracy on either continuous or alternating-current circuits—namely, about ¼ to ½ per cent. of the top reading. Ammeters, voltmeters, and wattmeters are fitted in portable polished wood cases, with strap handle, lock and key, as illustrated in the accompanying figure. Rubber feet ensure that the instrument shall receive no sudden jar. An anti-parallax mirror is provided, and the pointers are of the usual edgewise pattern. The scales are finely divided, and diagonal lines enable observations to be taken to a considerable degree of accuracy. Zero adjustment is provided. The portable standard voltmeter illustrated has ranges of 15, 150, and 600 volts. The ammeters are wound self-contained for currents up to 100 amps., beyond which portable series transformers must be used. The drop across a 25 amp. instrument at full reading is 0·5 volt, and 0·2 volt for the 100 amp. instrument. The wattmeters are self-contained for pressures up to 300 volts, and currents up to 50 amperes. For pressures over 300 and up to 650 volts, an external resistance box is used, and for currents above 50 amperes portable series transformers. For H.-T. circuits potential and series transformers are employed. A feature of the instruments is that the air damping mechanism is arranged immediately under the face of the instrument, and is therefore easily accessible.



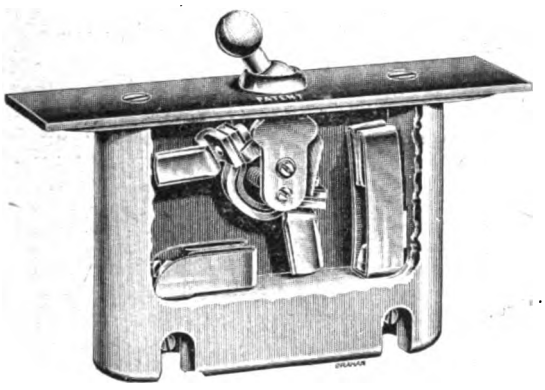
PORTABLE DYNAMOMETER-TYPE VOLTMETER.

Another new instrument is a portable wattmeter for lamp testing. This is also constructed on the dynamometer principle, and is suitable for A.C. and D.C. circuits. It is supplied for two voltages, with a two-way switch key. The usual sizes take ½ amp. or 1 amp. A lamp-holder and fuse on the side of the case, and a length of flexible wire fitted to a plug, are also provided. These dynamometer-type dead-beat instruments are also made with switchboard pattern cases.

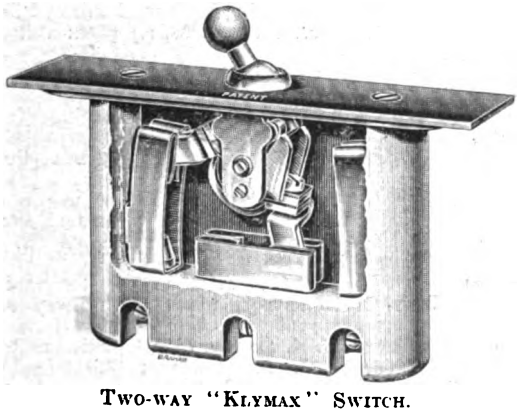
NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Lamps, Fittings, Switches, and Accessories.

The accompanying illustrations show an entirely new pattern of switch, to be known as the "Klymax" panel switch, which is being placed on the market by Messrs. A. P. Lundberg & Sons for flush work to meet the demand for a narrow pattern switch of minimum dimensions. In the illustration the porcelain case, which entirely surrounds the switch, is shown broken away to enable the movement to be seen. A quite novel patented arrangement of contact springs and blades is employed, and, as in other designs of Messrs. Lundberg & Sons, mica and porcelain are the only insulating materials used. The switch is supplied in two types, single-way and two-way, identical in size and external appearance.



SINGLE-WAY "KLYMAX" SWITCH.

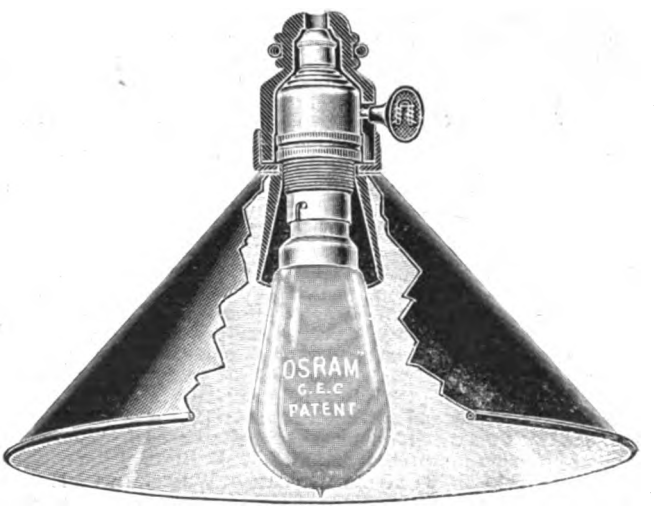


TWO-WAY "KLYMAX" SWITCH.

All moving parts are enclosed in a porcelain casing, and the fixing lugs are covered by a brass front plate, 3 13/16 in. by 1 in. A front of any material can be supplied to suit requirements. The method adopted allows the parts to be grouped into a very small space, and one front plate of comparatively small dimensions can be made to serve for a number of switches.

The break is quick and long, the contact arms being of the efficient knife-blade type entering double-contact springs. The switches can be fitted into suitable iron boxes to meet requirements. When double-pole and intermediate switches are required, these are simply and neatly obtained by coupling the knobs of two single- or two-way switches respectively, by a short cylinder piece. Two-pin wall connections of various gauges can also be arranged on the same porcelain parts, enabling combination sets to be made up in minimum sizes.

The accompanying illustrations show a new insulating lamp-holder shield, which the General Electric Co., Ltd. (57 Queen Victoria Street, E.C.), are placing on the market with a view to compliance with the suggestions of H.M. Electrical Inspector of Factories under the Home Office Rules. The recommendation



INSULATING SHIELD WITH SHADE ATTACHED.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published June 2nd, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

6,758/09. **Electrical Power Transmission Gear.** W. P. DURTNALL. A polyphase system with three different speeds. The high-speed steam, petrol, or oil engine drives the magnet-wheel of a 4-pole polyphase generator with a fixed stator. The latter supplies current to the stator of an 8-pole induction motor, which is also attached to the engine shaft. The squirrel-cage rotor of this motor is coupled to the first motion shaft of the vehicle or hoisting gear to be driven. It rotates independently of the engine shaft, or may be coupled to it by an electro-magnetic clutch for direct drive. A change-over switch between the generator and motor enables the electrically produced rotation of the motor field to be added to or subtracted from that due to the mechanical rotation of the motor-stator. Two claims, one figure.

10,680/09. **Automatic Motor-Starter.** W. D. KILROY and EVERSHED & VIGNOLES, LTD. The starter handle is operated by means of a solenoid device exerting a constant force over its range. The handle shaft is geared to a notched wheel engaging with a pivoted lever acted upon by a differentially wound electro-magnet. This is constantly excited by its shunt winding, but the series winding, which is in opposition, causes the lever to be held down against the action of a spring, and so to lock the notched wheel until the current has fallen to such a value that the shunt and series excitation are about equal. On every step, therefore, the current must fall to a certain predetermined value before the starter arm can advance another step. Three claims, six figures.

11,482/09. **Arc Lamps.** W. J. DAVY. In order to prevent the deposit of ash on the inside of the globe, an annular cup-shaped shield is provided, with its lower inner edge slightly below and close to the rim of the economiser. Baffles between the outer casing and the globe produce a draught of air along the under-side of the shield and up through the annular space between the economiser and the shield, which carries up with it the particles of ash projected from the arc. Four claims, two figures.

11,538/09. **Impulse Turbines.** J. HOWDEN. If the interior of the naves of the rotor discs of steam turbines of the impulse type are made an exact fit on the rotor shaft, the steel surfaces are liable to seize and render removal for repair very difficult. To prevent this, a thin coating of copper or copper alloy (with, in some cases, an outer layer of nickel) is deposited electrolytically on the interior surface of the nave. This gives an exact fit and obviates seizure. Further, a coating of copper with an outer coating of nickel is deposited on the outside of the naves to reduce the friction should the rotor and the stator discs come in contact. Two claims, one figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Names in italics indicate communicators of inventions from abroad.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: PEASE [Flexible cable armouring] 11,981/09; VERNIER [Electric conductors] 12,146/09.

Dynamos, Motors, and Transformers: HAEFELY [Insulation of coils, &c.] 16,457/09; ALLGEMEINE ELEKTRICITÄTS GES. [Polyphase commutator machines] 26,046/09.

Electric Ignition: BROOKS and ALSTON, 15,802/09; NOBEL'S EXPLOSIVES CO. and EVANS [Electric ignition of fuses] 16,709/09.

Electrometallurgy and Electrochemistry: COWPER-COLES [Compound electrodes for electrolytic baths] 11,843/09; HÄRDEN [Furnaces] 26,266/09; HELFENSTEIN [Furnaces] 26,845/09.

Incandescent Lamps: SOC. FRANCAISE D'INCANDESCENCE PAR LE GAZ (*System Auer*) [Metal filaments] 15,193/09; WEBER [Metal filaments] 18,808/09; KRAUS [Pocket lamps] 18,863/09.

Instruments and Meters: SIEMENS SCHUCKERTWERKE GES. [Apparatus for indicating differences of pressure] 17,719/09; SIEMENS & HALSKE A.-G. [Meters] 22,922/09.

Switchgear, Fuses and Fittings: IRELAND [Tramcar controllers] 12,139/09; STOCKALL [Automatic time switches] 14,625/09; PEARSON [Ironclad switches] 14,790/09; MIHALIK [Water-tight joint filling] 14,822/09; KELVIN & JAMES WHITE, LTD., EVANS and WILSON [Terminals for shunts] 15,006/09; MACKENZIE (*Sundh Electric Co.*) [Contacts] 15,075/09; KLEBER [Lamp-holders] 21,672/09.

Telephony and Telegraphy: SHARMAN [Master-switch for wireless stations] 11,242/09; NICHOLSON and HIGHAM [Apparatus for forming and reading telegraphic cipher messages] 12,005/09; GILL [Signalling system] 25,196/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Telephone systems] 7,211/10.

Traction: LAURIE-WALKER and NIBLETT [Tramcar ploughs] 11,540/09; LAKE (*St. Clair Air Brake Co.*) [Brakes] 11,721/09; IRELAND [Indicating controllers] 12,139/09; GAMES [Wheels] 15,132/09; MUNRO and RAILLESS ELECTRIC TRACTION CO. [Crossings and junctions] 17,106/09.

Miscellaneous: DICKSON [Illuminated signs] 17,208/09; CASTLE [Fire alarms] 22,490/09; GRAVES [Chain welding machine] 23,323/09; DOBBIE [Magnetic compasses] 2,277/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: GEB. SIEMENS & CO. [Electrodes] 9,076/10; SIEMENS SCHUCKERTWERKE-GES. [Searchlights] 11,054/10.

Electric Ignition: BARTLETT [Ignition of gas lamps] 11,479/10; COMPAGNIE POUR LA FABRICATION DES COMPTEURS À GAZ [Ignition of gas lamps] 11,722/10.

Electrometallurgy, &c.: ESTELLE [Battery electrodes and depolarising agents] 9,964/10 and 11,837/10; SEWARD, VON KÜGELGEN and VON BIDDER [Electrolytic production of sodium] 11,175/10; THOMSON and FITZGERALD [Furnaces] 11,716-7-8/10 and 11,720/10.

Incandescent Lamps: JAHODA [Metal filaments] 15,496/09.

Storage Batteries: STERN, 11,781/10.

Miscellaneous: BURSTYN [Plate condensers] 11,787/10.

The following amended Specification can now be obtained.

S. MARIETTI [Supports for metal filaments] 14,483/08 (see ELECTRICAL ENGINEERING, Vol. V., p. 714).

Opposition to Grant of Patents

14,898/09. **Conduit Manhole Cover.** R. AMES. Opposition has been entered to the grant of this patent. It is for a manhole cover designed to prevent the disintegration of the asphalte or macadam paving at the edge.

15,659/09. **Centrifugal Fan.** K. MAXANER. This patent is opposed. The specification was abstracted in ELECTRICAL ENGINEERING, April 21st, 1910, p. 274, and describes a fan, the driving motor of which has an annular armature rotating about a fixed field system.

18,228/09. **Wall-plug.** J. F. and E. S. CONRADI (British Central Electrical Co.). This patent is opposed. The specification was abstracted in ELECTRICAL ENGINEERING, April 28th, 1910, p. 290, and describes a wall-plug in which the flexible passes out of the plug at right angles to the axis of the pins.

Revocation of Patent

19,483/05. **Electric Lifts.** E. M. T. BODDAM. The application made for the revocation of this patent on the ground of inadequate manufacture in this country has been deemed to be abandoned. The patent was abstracted in ELECTRICAL ENGINEERING, March 17th, 1910, p. 194.

Amendment of Specification

8,438/08. **Prepayment Meter.** C. E. HIBBERD seeks leave to amend this specification in order to remove certain ambiguities.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. BAGGETT [Focussing lamp mechanism] 3,594/99; H. C. LEVIS (*General Electric Co., U.S.A.*) [Iron filing electrode] 4,134/04.

Distribution Systems, &c.: J. W. BROWN [Conduit pipe joints] 3,426/99.

Electrometallurgy, &c.: P. HÉROULT [Smelting furnace] 3,912/02; J. Y. JOHNSON (*Soc. des Produits Amylacés*) [Electrolytic production of starch] 3,930/02; C. A. KELLER [Furnace] 3,790/04.

Instruments, &c.: THEILER & CO. [Induction motor meter] 3,274/03; W. E. GROVES [D.C. combined voltmeter, ammeter, wattmeter, and testing set] 3,572/03; H. H. LAKE (*R. Arno*) [Induction motor meter] 3,891/04.

Switchgear, &c.: L. W. CROSTA [Fuse or terminal box] 4,016/03; E. TYER [Multiple-way switch for railway signals] 3,265/05.

Traction: H. H. LAKE (*E. A. Sperry, U.S.A.*) [Electric braking and controller] 4,198/97; J. S. RAWORTH [Electric braking systems] 3,657-8/03; A. SUNDH and A. MAGNUSON [Control of A.C. motor equipments] 15,045/05.

Miscellaneous: J. T. SCHAAFF [Electric operating attachment for typewriter or type-setting machine keyboards] 3,281-1A/05; A. W. KING [Aluminium solder] 3,589/05; F. RITTMEYER [Water-level indicator] 3,599/05.

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in question reads as follows:—"It is possible as an alternative to earthing, to enclose the lampholder entirely with insulating material so that neither it nor the metal cap of the lamp can be touched, and even to attach a metal shade in such a way that it is not in connection with the lampholder and could not become charged. It is essential, however, that any insulating material used for this purpose should be of a fire-resisting nature." The effective way in which the holder is shielded is apparent from the illustrations. The material used for the shield is absolutely fireproof, and a certificate to this effect has been obtained from Mr. S. G. Castle Russel (Electrical Adviser to the Phœnix Fire Office). The device secures the insulation of the shade if one of enamelled iron is used, and the shade can easily be fitted in a few seconds without unwiring the lampholder.



COATES' INSULATING LAMP-HOLDER SHIELD.

A new tubular pattern of Osram lamp, which the General Electric Co., Ltd. (71 Queen Victoria Street, E.C.), are placing on the market, is illustrated here. These are being supplied in the 17 watt (16 h.c.p.) size for 100-135 volts, with small B.C. terminals, at the list price of 3s. 6d., and their shape renders them particularly adaptable to many popular fittings now in demand. It will be noticed that a new method of mounting the filament, involving the use of an intermediate support, is used. Hitherto there has been some difficulty in adapting some forms of existing fittings with small holders to metal filament lamps, except where the use of lower voltage lamps was possible.



NEW TUBULAR OSRAM LAMP.

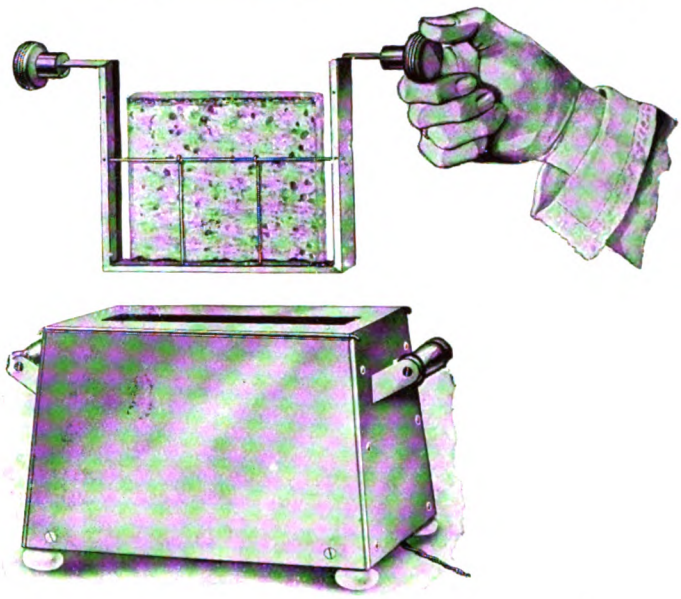
Heating and Cooking Apparatus.

Some novelties in electric heating apparatus on the Bastian quartz principle have been introduced. The simple little heater on this principle was described in ELECTRICAL ENGINEERING, Vol. V., p. 631, and the more recently introduced oven and radiators in ELECTRICAL ENGINEERING, Vol. V., p. 938. An attractive toaster is one of the latest designs. This consists of two vertical grids about 1¾ in. apart, between which is hung a wire carrier holding the bread to be toasted. Each grid consists of eight quartz tubes about 6 in. long, arranged horizontally one above the other. The wire helices are connected in series, and the complete toaster consumes from 400 to 450 watts. As shown in the illustration, the toaster is enclosed in a polished aluminium case with double walls to prevent loss of heat. The consumption is so low that the toaster can be used on the lighting circuit at the cost of only a few pence per week. It can also be used for keeping a kettle boiling, or for heating food. The quartz tubes are at a bright red heat during working, and are therefore well adapted for toasting purposes.

The second figure illustrates a water boiler with quartz heating elements. This consists of a copper bath, in the lower part of which are ten copper tubes running horizontally from side to side. Each tube contains a quartz tube with its wire helix. Eight tubes are connected to one switch and consume 2,000 watts. The other two are connected to the other switch, and, consuming only 200 watts, are left on for keeping the water boiling. Two gallons of water can be boiled in from 25 to 35 minutes according to the starting temperature. A four-gallon size consuming 4,000 watts is also supplied. The wire helices can be readily replaced without taking out the quartz tubes, but they run at a comparatively low temperature, and are stated to have a life of three years.

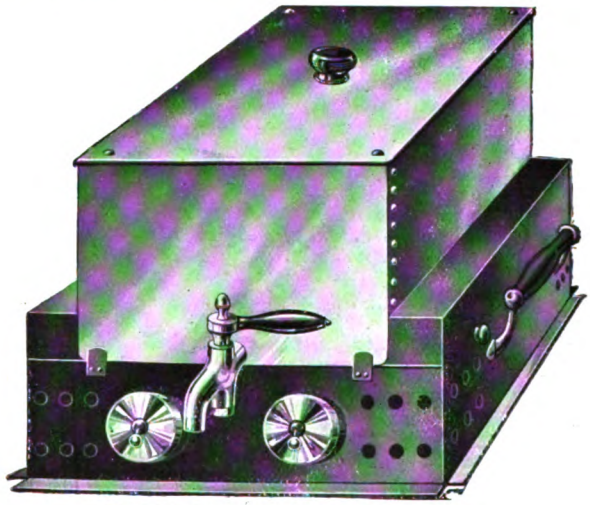
Electric flat irons on the same principle can also now be obtained. In these, the quartz tubes are laid side by side close up against the metal face of the iron; above the tubes is asbestos packing to concentrate the heat at the face. A 6 lb. iron of this pattern consumes only 335 watts. A novelty is an iron which can be converted from a 5 lb. to a 3 lb. iron by removing a portion attached by a thumb screw.

In the early part of this year, "Nichrome" wire, an alloy



THE "QUARTZALITE" TOASTER.

of nickel and chromium, was substituted for pure nickel wire in all the Bastian heaters. The resistance is higher, and so shorter lengths of wire are required. The life is also increased considerably. Lastly, this wire has practically no temperature coefficient, so that the sudden rush of current experienced when switching on a cold heater of pure nickel is avoided.



THE "QUARTZALITE" WATER HEATER.

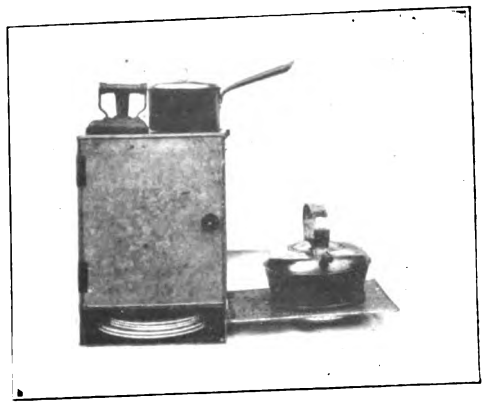
The "Quartzalite" heating and cooking devices can be obtained from Messrs. Drake & Gorham, Ltd., the British Westinghouse Co., Ltd., the Wardle Engineering Co., Ltd., the Electrical Co., Ltd., the Edison & Swan United Electric Light Co., Ltd., and other well-known firms.

The illustration on the next page shows a complete electric cooking outfit, designed by Messrs. F. A. Wilkinson & Partners, Ltd. (Harpenden, Herts), and placed on the market at the extremely low price of 39s. 6d. The outfit comprises a sheet metal oven 12 in. wide by 12 in. deep by 17 in. high, fitted with shelves. A 1,000-watt heating element consisting of a wire helix laid in a spiral groove in an earthenware plate is fitted to a flap hinged to the side of the oven. When the flap is up, the oven takes less than 8 minutes to attain a cooking temperature. All the ordinary operations are carried on with the flap up, but for rapid boiling the flap can be lowered and a kettle or saucepan placed direct on the element

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as illustrated. Ordinary cooking utensils are employed, and the heating element works at a bright red heat, both of which facts should tend to make this oven popular with the general public. The life of the wire coil is said to be well over 1,000 hours, and it can be readily replaced when burnt out.

A heavy cast-iron oven for general domestic purposes can also be obtained. The internal dimensions are 13 in. wide by 13 in. deep by 20 in. high. Two heating elements similar to that described above are enclosed in cast-iron caps which are screwed over apertures in the two sides of the oven. They can thus be readily removed to replace a coil without dismantling the oven. The latter is provided with a sheet steel lining, the space between the oven walls and the lining being filled with



THE 1,000-WATT "ECONOMIC" COOKER.

lagging. The heaters generally consume about 1,000 watts each, but any desired consumption can be arranged for. Tests showed that starting with a cold oven and using heaters consuming just under 1,400 watts together, a temperature of 402° Fahr. was reached in 40 minutes, the outside temperature being 50° Fahr. On opening the oven to insert a 4½ lb. joint, the temperature fell to 320° Fahr., but during the next 50 minutes, while the joint was cooking, it rose to 373° Fahr., the consumption being gradually reduced from 1,350 watts to 875 watts. If a hot water supply is required, a boiler is inserted in the bottom of the oven with an additional heating element. The hot water circulates, and is stored in a hot water cistern. The list price of this oven is £7, and the extra cost of the hot water equipment is £2.

A heating element similar to those used in the ovens is supplied, adapted for use as a hot-plate or stove. This was described and illustrated in ELECTRICAL ENGINEERING, Vol. V., p. 451. In another form, the heater is supported on a cylindrical aluminium base, and forms a neat and artistic radiator. In all cases, the heating coil is protected by an expanded metal cover clipped on to the grooved plate. Several improvements have recently been made in these devices, and a new pattern of plug has been designed. They are made in two sizes, for 700 and 1,000 watts respectively.

All the above apparatus is suitable for both A.C. and D.C. supply systems, and can be supplied for any pressures between 50 and 500 volts. Messrs. Siemens Bros. Dynamo Works, Ltd., are selling agents for the "Economic" stoves and their component parts.

Miscellaneous.

An electrolytic bleaching apparatus for removing stains from white linen or cotton articles, and suitable for use in laundries, hospitals, hotels, and private houses, is being placed on the market by the Electrolytic Apparatus Syndicate, Ltd. (47 Queen Anne's Chambers, Broadway, Westminster, London, S.W.). This apparatus, which has been designed by Mr. J. T. Niblett, consists of an 8-volt accumulator or battery of dry cells, to which is connected a device, called the electrolyser, similar in shape to a telephone receiver. On the face of the electrolyser are arranged six concentric platinum rings connected alternatively to the positive and negative poles of the battery and protected by a perforated disc of insulating material. The stained portion of the article to be treated is placed over a saucer and a solution (prepared from a special mixture of chlorides supplied in the form of a powder) is poured over it. The electrolyser is then rubbed gently over the stain, which disappears in a few minutes. What happens is that the solution is electrolysed at the surface of the electrolyser and hypochlorites are formed.



ELECTROLYTIC BLEACHING APPARATUS.

The feature of the apparatus is that the hypochlorites are produced locally and brought into contact with the stain in a nascent condition. The chloride preparation is neither corrosive nor poisonous, and will not injure the most delicate fabric. Ink, wine, tea, fruit, and mildew stains can be treated successfully with this apparatus, but most mineral stains cannot be eradicated. Stains on silk cannot be dealt with, as the solution is injurious to silk.

A complete apparatus with an accumulator or dry cells, suitable for private houses, is supplied in a box at a very moderate price. For large hotels or laundries an apparatus, as illustrated in the accompanying figure, is supplied. This consists of an 8-volt accumulator arranged on a board, in series with a lamp and switch. The accumulator is charged from the D.C. lighting mains with the lamp in series, and the electrolyser is worked from the accumulator. It is not advisable to work the electrolyser direct off the mains, as the operator might easily get a shock. When the article to be treated is small it can be wholly immersed in a bath of the solution. A rod with two electrodes at its extremity for electrolysing the solution is placed in the bath as shown. This rod electrolyser can be connected to the mains through a lamp, as the operator does not handle it or come in contact with the solution. The rod takes 0·5 amp., and the small electrolyser 0·25 amp. For large laundries, special electrolysers taking 1 and 1·5 amps. are supplied. In all cases the voltage required is 8 volts or a little less. The apparatus is being put on the market under the name of the "Bleqtos" system.

THE ELECTRICAL INDUSTRY AND TARIFF REFORM

THE discussion (promoted by the National Electrical Contractors' Association) as to whether a Free Trade or a Protectionist policy would be of the greater benefit to the electrical industry of this country, was concluded at the Caxton Hall, Westminster, on Monday. As already reported in ELECTRICAL ENGINEERING (May 26th, p. 347), the first part of the debate took place on Monday, May 23rd, when Mr. J. E. Kingsbury, Mr. J. S. Raworth, and Mr. E. Cowan spoke in favour of Free Trade, and Mr. H. Hirst, Mr. J. Harland Bowden, and Mr. Russell Fitch in favour of Protection.

Mr. E. GARCKE (Joint Managing Director of the British Electric Traction Co., and Chairman of the Brush Electrical Engineering Co.), in opening the resumed discussion, asserted that the average percentage of unemployment in this country was double that of Germany, that England was suffering more than other countries from trade depression, and that emigration was greater here than from any other country. The principles of the Trades Unions were of a distinctly Protectionist nature, but though the British workmen were careful to limit competition amongst themselves, they did not trouble to protect the products of their combined labour. It was admitted that too much competition was bad, and he would ask Mr. Kingsbury how competition could be regulated, so far as the foreigner was concerned, except by a tariff. Free exchange of commodities was an ideal for which the world was not ready. The Tariff Reform party advocated tariffs not because they liked them, but because other nations continued to maintain them. It was argued that all imports must be balanced by exports, but how if the imports were the products of skilled manufacture and the exports were chiefly coal? The effect of Free Trade was that profits were being gradually eliminated, as, though we could buy in the cheapest market, we were obliged to sell in the cheapest also. The manufacturing trade of the country might show a large turnover, but there was little profit on it. No country could subsist on consumption alone, and all ultimately depended on profit. Free Trade encouraged the formation of trusts and monopolies abroad. We were getting poorer and poorer, and were only living on the wealth accumulated in prosperous times. Our exports of home produce to France, Belgium, Germany, and the United States were less than half our imports from the same countries. Imperial preference was essential if we were to maintain our trade with the colonies. Finally, he urged that no

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laws were immutable, and that what was once the best policy might not be so now.

Mr. H. OPPENHEIMER (Manager of the International Electrical Co., representatives in Great Britain of Mix & Genest, Ltd., Berlin) stated that the beginning of Germany's industrial development dated with the founding of the Zollverein in 1868, and the internal establishment of Free Trade. Before that date each of the twenty-seven States was separately protected. Another help to Germany's progress was the introduction of the metric system in 1872. The reason of the apparent decline of Great Britain's industrial supremacy since 1880, as referred to by Mr. Hirst, was that about that time other countries began to realise that they could manufacture. Their progress could not be stopped. One of the greatest legislative blunders was the Merchandise Marks Act, which, he considered, was an expensive free advertisement to Continental manufacturers. The electrical industry was not what it should be, but it would become beyond recovery if Tariff Reform were to come to the rescue.

Mr. GUSTAV BYNG (Chairman of the General Electric Co.) disputed Mr. Kingsbury's assertion that Free Trade gave advantages for cheap production. In his experience Free Trade did not enable him to get his raw materials, such as copper, glass, porcelain, &c., cheaper than in protected countries. He was told that labour was cheaper under Free Trade on account of cheap food and clothes, but the Free-Trader told the working man that his wages were higher under Free Trade. He (Mr. Byng) thought that wages would go down and down if Free Trade continued. But there were other factors besides material and labour; quantity, skill, capital, and invention were all increased by Protection. There was no doubt that manufactures were carried on on a larger scale and with lower costs of production in protected countries. It was a false law that if one industry was killed by competition another would rise in its place. No new industry could be established under Free Trade, and no industry could grow under Free Trade.

Mr. R. HAMMOND said that this was a question which could only be discussed from a national point of view, and not from the standpoint of any particular industry. England was in a unique position, and the returns for last year proved the success of its Free Trade policy. These returns showed that 242 millions of food-stuffs came into the country during the year. Besides the food-stuffs, 166 millions of raw materials were imported, making a total of 408 millions to be paid for. This was not paid for in gold. Out of the 378 millions of exports, only 37 millions was coal (and the bulk of this even was for use in our own ships). The remainder represented for the most part goods manufactured in this country, which were still preferred to foreign goods, as the quality and price were right. There were 125 millions of foreign manufactured goods imported into the country, which were balanced by another 125 millions exported in exchange. Exports would fall off to the extent to which imports were kept out. With regard to decaying industries, the boot trade was at one time decaying, and under Protection would have been only temporarily improved. Under Free Trade, however, they had brought in American machinery, had thoroughly improved their methods, and were now able to compete with the American manufacturers.

Mr. H. H. BERRY (Berry, Skinner & Co.) referred to himself as a victim of Free Trade. When the Swan lampholder patent expired, he equipped works in this country to manufacture lampholders, but found it impossible to compete with foreign manufacturers, who had their own market as well as ours, in spite of the fact that the whole manufacture was originally in this country. Now only 20 per cent. of the lampholders supplied were manufactured here. Any success he had achieved in other directions was due to the protection afforded by the Patent Office. Free Trade caused unemployment and waste of capital, because we were not competing with the foreigner on equal terms.

Mr. W. G. BOND (Director of some of the Associated Companies of the British Electric Traction Co.) pointed out that, according to the Board of Trade returns, our trade had increased 19 per cent. between 1902 and 1908, and that the profits had risen from 487 million to 509 million, or by about 5 per cent. in the same period. The years of greatest imports corresponded with what were known as "boom" years. Again, in 1908, Great Britain's exports were £9 10s. per head, while those of Germany were only £5 8s. per head. In the recent revision of the American tariffs, it was the most flourishing industries which got the most protection, and not those which needed it most. It was to the benefit of all to buy in the cheapest market.

Mr. A. BRUCE ANDERSON (Managing Director of Ferranti, Ltd.), referring to Mr. Kingsbury's appeal to consider the matter from the standpoint of the effect on the whole nation and not on the electrical industry only, said that there was no reason why the benefit of the electrical industry should not mean a benefit to the whole nation. After referring to the increase in the agricultural population in Germany and comparing it with the decrease in this country, Mr. Anderson pointed out that the unemployment returns of the Trades Unions only referred to one-tenth of the working population, and that the unemployment outside the Unions was appalling. He refuted the accusation of selfishness on the part of Tariff Reformers, saying that they only wanted a fair field against foreign competition.

Before calling upon Mr. Kingsbury and Mr. Hirst to reply, the Chairman, Mr. H. W. Butler, stated that the meetings had been so successful that the Secretary of the Association had decided to organise meetings to discuss the same and similar subjects next winter.

Mr. J. E. KINGSBURY, answering the various criticisms of his views, stated that unemployment was a social question which would not be affected by fiscal policy. With regard to Mr. Byng's instances of raw material being dearer in this country than elsewhere, he mentioned that copper wire was cheaper in this country than in protectionist France. Mr. Raworth had stated that 90 per cent. of the tramway machinery in this country came from America, but he had been making enquiries himself, and one of his informants said that the figure did not exceed 5 per cent. In the case of a certain large tramway undertaking completed within the last ten years, he was assured that the machinery was wholly of British manufacture. Mr. Raworth had criticised the Electric Lighting Act of 1882; this was a protective measure, and was now known to have been very harmful to the industry. Continuing, Mr. Kingsbury stated that our business was in a sounder condition to-day than ever it was. With regard to the use of machinery, the prejudice of the workman against machinery had not been quite overcome, and he felt it his duty to emphasise the fact that machinery increased production and eventually the labour required. He did not wish to depreciate England's work, but he did not agree with Mr. Hirst that practically all inventions come from England. The arc lamp, the telephone and the dynamo all came from abroad. The value of our market to foreign manufacturers was, as a rough estimate, about 1 or 2 per cent. of their total output. It was not possible to estimate so close as this, and so the argument that the certainty of our market was of value to them was fallacious. Manufacturing in large quantities was certainly the root of the whole question, but, if the consumption was not large enough to justify the expenditure of the necessary capital, it was better not to manufacture but to purchase cheap from abroad. Finally, Mr. Kingsbury referred to several British manufactured goods—Huntley & Palmer's Biscuits, Keiller's Marmalade, and Sunlight Soap—which had a large sale abroad, and pointed out that the effect on all the country's industries should be considered.

Mr. H. HIRST, in his reply on behalf of Tariff Reform, made a good point at first in reference to Mr. Oppenheimer's eulogism of the German Zollverein. Tariff Reformers, he said, wanted to do exactly what the Zollverein had done, namely, to do away with the customs duties between the countries of Greater Britain, viz., to establish internal Imperial free trade. This would not only be commercially advantageous, but it would cause the Empire to become more united, in the same way as it had drawn together the various States of Germany. We had now to pay what the foreigner asked for corn, as we could not produce enough for ourselves. With regard to wages, he mentioned that in Germany the status of the teaching and other professions had been raised at three successive periods recently on account of the attraction of the best brains into industrial work. He complained that there were no definite statements in Mr. Kingsbury's speech which he could attack. The beginning of the decline of England's industrial supremacy in 1880 was, he thought, chiefly due to the fact that this was about the date of the introduction of tariffs in Germany by Bismarck. Under Tariff Reform he expected that the manufacturers would be able to pay much higher wages than at present, which would more than cover the possible rise in the price of food and clothing. New manufacturing works were now being put down, and it was, he thought, because tariff reform was "in the air." It was not true that a new industry rose out of an industry killed by foreign competition; it was not so easy for the workpeople to learn a new trade. It had been said that it did not pay the foreigner to sell under cost price, but he knew of cases where the foreigner had imported under cost price until the British industry was killed, and then the prices had gone back to what they were before, or even higher.

East London College.—Three special lectures on the illumination of interiors are being given on Wednesdays, June 8th, 15th, and 22nd, by Professors J. T. Morris and C. A. Smith. Yesterday's lecture dealt with principles and daylight illumination, the second with artificial illumination by gas and electricity, and the third with petrol air-gas systems. Applications for tickets of admission should be made to the Registrar at the College.

Extensions to the Shawinigan Falls Plant.—It is announced that the generating plant of the Shawinigan Water & Power Co. is to be more than doubled by the addition of a new power-house of 75,000 h.p. to the existing 55,000 h.p. plant, and taking its water supply through pipes from the same forebay. According to the *Canadian Electrical News* the distribution system of this company is the largest in Canada, consisting chiefly of 50,000-volt lines of aluminium on wooden poles, and including a 25,000 volt subfluvial cable 7,000 feet long, at Three Rivers, Quebec.

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MEMBERS AND VISITORS ATTENDING THE I.M.E.A. CONVENTION

THE following is a list of the Members and invited guests who had intimated their intention of attending the Convention up to the time of our going to press.

The abbreviation *Ch'n* stands for Chairman of the Electricity Committee, *C'r* for member of the Electricity Committee, *E.E.* for Chief Electrical Engineer.

Adam, R. (*Ch'n*, Govan).
Allen, S. T. (*E.E.*, Carlisle).
Allen, W. Gough (*Ch'n*, Wolverhampton).
Andrews, Leonard (*Key Engineering Co.*).
Angus, H. W. (*E.E.*, Eccles).
Ashworth, Jas. (*Ch'n*, Heywood).
Atchison, C. C. (*E.E.*, Rochdale).
Atkinson, H. S. (*Ch'n*, Cleckheaton).
Ayton, F. (*E.E.*, Ipswich).
Babb, Thos. G. (*Chief Assist. E.E.*, Taunton).
Bache, Walter J. (*E.E.*, Cheltenham).
Ball, G. (*Ch'n*, Stockport).
Bastian, Jas. (*Stockport*).
Bastow, S. E. (*Bruce Peebles & Co.*).
Beauchamp, J. W. (*E.E.*, Tunbridge Wells).
Bell, Stuart (*Siemens Bros. Dynamo Wks., Glasgow Branch*).
Billing, Chas. P. (*C'r*, Bristol).
Black, A. S. (*E.E.*, Southport).
Bland, A. V. (*C'r*, Morecambe).
Blascheck, C. A. (*E.E.*, Canterbury).
Beecham, Alderman J. (*Ch'n*, St. Helens).
Bell, J. A. (*E.E.*, Aberdeen).
Binns, W. (*Gen. Man.*, Reading Corporation Trams.).
Bishop, H. Collings (*E.E.*, Newport, Mon.).
Blackman, A. S. (*E.E.*, Sunderland).
Bloxam, T. W. (*E.E.*, Belfast).
Bolam, J. H. (*E.E.*, Weymouth).
Bones, Fras. R. (*C'r*, Hastings).
Boyd, J. (*C'r*, Bristol).
Boyd, W. J. (*Ch'n*, Londonderry).
Bremner, Ashton (*E.E.*, Burslem).
Brewster, Ald. W. R. (*Ch'n*, Bootle).
Britton, S. L. E. (*E.E.*, Chester).
Broekman, L. (*Leeds Branch Manager, Chloride Elec. Storage Co.*).
Bruce, J. G. (*E.E.*, Willesden).
Bruce, Ald. Wm. (*Ch'n*, Sunderland).
Brydges, J. K. (*E.E.*, Eastbourne).
Buchanan, John (*Ch'n*, Govan).
Burbidge, A. H. (*E.E.*, Kilmarnock).
Burnett, H. R. (*E.E.*, Barrow-in-Furness).
Butler, H. W. (E.P.S. Co.).
Campbell, G. (*Holophane Co.*).
Campion, R. H. (*E.E.*, Dewsbury).
Carr, R. M. (*E.E.*, Leek, Staffs).
Chattock, R. A. (*E.E.*, Birmingham).
Chisholm, G. S. (*Siemens Bros. & Co.*).
Christie, J. (*E.E.*, Brighton).
Clegg, Stanley (*E.E.*, Lincoln).
Clothier, J. H. (*E.E.*, St. Anne's-on-Sea).
Clothier, T. D. (*E.E.*, Bootle).
Clough, A. (*E.E.*, Liverpool).
Collins, Ald. J. H. (*Ch'n*, Mansfield).
Collis, Alfred G. (*Cowans, Ltd.*).
Colvill, G. H. (*C'r*, Swansea).
Cooke, W. H. (*E.E.*, Luton).
Cooper, A. G. (*E.E.*, Colne).
Couzens, H. H. (*E.E.*, West Ham).
Cox, J. D. R. (Babcock & Wilcox).
Craig, G. (*Ch'n*, Leith).
Cramb, Alex. C. (*E.E.*, Croydon).
Crawford, N. (*Bellis & Morcom*).
Cross, Ed. (*E.E.*, Rotherham).
Crow, Ald. W. (*Ch'n*, West Ham).
Crowther, J. P. (*E.E.*, Worksop).
Crowther, J. W. (*C'r*, Sheffield).
Davidson, C. S. (*E.E.*, Barnes).
Davies, Alderman R. C. (*Ch'n*, Chester).
Day, A. A. (*E.E.*, Bolton).
Day, Chas. (*Mirrlees Watson Co.*).
Denton, H. H. (*E.E.*, Crewe).
Dick, J. R. (*W. Lucy & Co.*).
Dickinson, E. (*Ch'n*, Wigan).
Dixon, H. L. (*E.E., Leatherhead and District Electricity Co.*).
Dixon, Wm. (*C'r*, Lancaster).
Dormann, E. (*Aron Meter Co.*).
Eckersall, N. (*W. T. Glover & Co.*).
Ferguson, R. F. (*E.E.*, Hastings).
Ferranti, S. Z. de (*President-Elect, Institution of Electrical Engineers*).
Fisher, Andrew (*Ch'n*, Paisley).
Foale, W. S. (*E.E.*, Portsmouth).
Foulds, H. (*Faraday House*).
Francis, O. F. (*E.E., Kirkcaldy*).
Friederichs, H. F. (*E.E.*, West Hartlepool).
Gatehouse, T. E. ("*Electrical Review*").
Gilchrist, J. (*Ch'n*, Falkirk).
Gill, John C. (*E.E.*, Peterborough).
Good, W. F. (*Ch'n*, Maidstone).
Goslin, E. T. (*E.E., Glasgow Trams.*).
Gray, Harold (*E.E.*, Accrington).
Gregory, J. P. (*B.T.-H. Co.*).
Harrison, Haydn (London).
Hawkins, H. J. (*Deputy E.E.*, Salford).
Heald, J. (*Ch'n*, Lancaster).
Heath, Geo. (Stamford Hill).
Helme, D. (*E.E.*, Nelson).
Hewlett, E. Holcombe (*E.E.*, Mansfield).
Higham, C. (*Vice-Ch'n*, Blackburn).
Hollingsworth, E. M. (*E.E.*, St. Helens).
Homer, J. F. (*Ch'n*, Handsworth).
Hopkinson, A. H. (*J. Hopkinson & Co*).
Hornby, R. (*Siemens Bros. Dynamo Wks.*)
Howard, H. L. (*E.E.*, Barking).
Huddleston, J. M. (*Siemens Bros. & Co.*).
Hudson, Robt. (*C'r*, Sunderland).
Hurlbatt, E J. (*Dick, Kerr & Co., Manchester*).
Hutchinson, A. J. (*E.E.*, Farnworth).
Jackson, J. (*Ch'n*, Partick).
Jackson, W. A. (*E.E.*, West Bromwich).
Jacob, Arthur (*British Aluminium Co.*).
Johnston, C. M. (*E.E.*, Shrewsbury).
Jowett, Ald. W. H. (*Ch'n*, Morley).
Juttke, J. (*Aron Meter Co.*).
Kerr, H. G. (*C'r*, Govan).
Kerr, W. T. (*E.E.*, Hereford).
Kilburn, J. E. (*C'r*, Dewsbury).
Kilpin, Ald. S. L. (*Ch'n*, Bedford).
King, F. W. (*C'r*, Bootle).
King, J. H. (*C'r*, Burton-on-Trent).
Kinghorn, D. M. (*E.E.*, Southwark).
Knight, Douglas (*E.E.*, Ealing).
Lackie, W. W. (*E.E.*, Glasgow).
Livingstone, D. (*C'r*, Hull).
Lloyd, Ald. S. (*Vice-Ch'n*, Bristol).
Logan, T. (*C'r*, Partick).
Long, F. M. (*E.E.*, Norwich).
Lunn, J. R. P. (*E.E.*, Darlington).
McLean, J. Hardie (*Midland Elec. Corpn. for Power Distribution*).
MacLean, A. B. (*Craigpark Cable Co.*).
McMillan, J. (*E.E.*, Falkirk).
Macrory, R. V. (*E.E.*, Londonderry).
Madgen, W. L. (*Brush Co.*)
Mallins, C. W. (*Tram. Man., Liverpool Corporation*).
Mathias, F. V. (*E.E.*, Warrington).
Merrette, W. J. (*Ch'n*, Cheltenham).
Miller, H. W. (*Berry Construction Co.*).
Milton, C. O. (*E.E.*, Maidenhead).
Mountain, A. B. (*E.E.*, Huddersfield).
Murray, Lee (*Bruce Peebles & Co.*).
Nash, E. A. (*St. James's & Pall Mall Electric Light Co.*).
Nevill, H. A. (*E.E.*, Wakefield).
New, E. Sanford (*D.P. Battery Co.*).
New, Max (*General Electric Co.*).
Newington, F. A. (*E.E.*, Edinburgh).
Newington, S. W. (*E.E.*, Oldham).
Nisbett, G. H. (*B.I. & H. Co.*).
Nixon, F. A. (*E.E.*, Handsworth).
Okell, E. G. (*E.E.*, Plymouth).
Osborne, N. J. (*C'r*, Southend).
Papworth, J. W. (*E.E.*, Stirling).
Parkinson, C. (*E.E.*, Paisley).
Pauls, S. (*E.E.*, Middleton).
Pearce, S. L. (*E.E.*, Manchester).
Pearson, Ald. W. (*Ch'n*, Eccles).
Pearson, Ald. G. (*Ch'n*, Bristol).
Phillips, F. (*Ch'n*, Newport, Mon.).
Phillips, R. W. L. (*E.E.*, Bedford).
Pickersgill, A. (*E.E.*, Cleckheaton).
Pickvance, W. G. (*E.E.*, Wrexham).
Popple, Thos. (*Ch'n*, Heywood).
Preece, G. G. L. (*W. T. Glover & Co.*)
Pringle, P. J. (*E.E.*, Burton-on-Trent).
Proctor, H. Faraday (*E.E.*, Bristol).
Prusmann, C. A. L. (*E.E.*, Swansea).
Purse, F. W. (*E.E.*, Watford).
Raistrick, G. (*Ch'n*, Shipley).
Raphael, F. C. ("*Electrical Engineering*").
Renfree, T. R. (*British Electric Transformer Co.*).
Richards, W. (*Ch'n*, Ilkeston).
Riley, M. (*C'r*, Morley).
Robinson, T. C. (*Richardsons, Westgarth & Co.*).
Robson, Ald. E. (*C'r.*, Hull).
Rogerson, W. M. (*E.E.*, Halifax).
Roles, Thos. (*E.E.*, Bradford).
Rowland, R. (*E.E.*, Stretford).
Ruddle, Mark (*E.E.*, Dublin).
Rutherford, A. P. (*E.E.*, Leith).
Sankey, B. (*E.E.*, Whitehaven).
Schattner, E. B. (*Electrical Apparatus Co.*).
Schofield, S. D. (*E.E.*, Shipley).
Scholey, H. (*Dick, Kerr & Co.*).
Seabrook, A. H. (*E.E.*, Marylebone).
Sells, F. S. (*General Electric Co.*).
Sharp, E. E. (*Venner & Co.*).
Shaw, C. M. (*E.E.*, Worcester).
Shawfield, C. E. C. (*E.E.*, Wolverhampton).
Sillery, W. (*E.E.*, Partick).
Sinclair, A. (*Ch'n*, Swansea).
Sinclair (*Vice-Ch'n*, Falkirk).
Slevin, J. (*E.E.*, Wigan).
Sloan, R. P. (Manager, *Newcastle-on-Tyne Elec. Supply Co.*).
Smethurst, Ald. J. (*Ch'n*, Warrington).
Smith, J. J. (*E.E.*, Stockton-on-Tees).
Smith, Arthur T. (*E.E.*, Leigh, Lancs.).
Smith, Ald. J. P. (*Ch'n*, Barrow-in-Furness).
Smith, R. W. (*Drake & Gorham*).
Smith, William (*C'r*, Halifax).
Sowter, W. J. U. (*E.E.*, Bray).
Staniland, Norman (*E.E.*, Hornsey).
Steinitz, J. J. (*Brush Co.*).
Stewart, C. L. (*E.E.*, Rawtenstall).
Stokes, H. (*E.E.*, Ilkeston).
Stott, Jas. (*E.E.*, Heywood).
Tapper, J. E. (*E.E.*, Beckenham).
Taylor, H. M. (*E.E.*, Middlesbrough).
Taylor, Ald. T. (*C'r*, Mansfield).
Tester, W. A. (*E.E.*, Lancaster).
Tough, Geo. (*E.E.*, Coventry).
Tudman, A. R. (*E.E.*, Colwyn Bay).
Turnbull, C. (*E.E.*, Tynemouth).
Turner, H. Davey (*C'r*, Willesden).
Vignoles, W. A. (*E.E.*, Grimsby).
Ward, J. C. A. (*Callender's Cable Co.*).
Watson, C. (*C'r*, Accrington).
Watson, S. J. (*E.E.*, Bury).
Webster, A. ("*Electrical Engineering*").
Weekey, R. F. (*Jandus Arc Lamp Co.*).
Wheelwright, P. P. (*E.E.*, Blackburn).
Whiteside, J. (*Vice-Ch'n*, Stretford).
Wilkinson, Geo. (*E.E.*, Harrogate).
Wilkinson, H. (*E.E.*, Radcliffe).
Wilkinson, J. (*C'r*, Warrington).
Wilkinson, J. (*E.E., Hull Tramways*).
Williamson, C. (*Vice-Ch'n*, Greenock).
Wilson, C. (*Robertson Lamp Works*).
Wilson, Ald. J. H. (*Ch'n*, Hornsey).
Wilson, R. M. (*Jandus Arc Lamp Co.*).
Winter, Ald. D. L. (*Ch'n*, Rotherham).
Wood, A. P. (*Lancashire Dynamo Co.*)
Wordingham, C. H. (*Electrical Engineer-in-Chief to the Admiralty*).
Wyld, W. (*E.E.*, Birkenhead).
Wylie, Judge (*Ch'n*, Stirling).
Zingler, V. (*Siemens Bros. & Co.*).

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LOCAL NOTES

ACTON: *Position of Electricity Undertaking.*—A special meeting will be held to-morrow to consider a report by the Town Clerk, which will constitute a history of the electrical undertaking. At the last meeting of the Council many members candidly confessed they did not understand the position. In fact, there was a hint that members of the Electricity Committee are not very familiar with the details of the undertaking.

ARGENTINE: *New Electric Supply Company.*—The *Financial News* states that a joint stock company is to be constituted in Rosario for supplying electric light and power to the city. The capital of the new undertaking is to be 17,500,000 francs, in which the Rosario Tramway Co. will be interested to the extent of 4,000,000 francs. The new company will supply electricity to the tramway company.

Electric Supply Statistics.—The annual report for 1909 of the Deutsch-Ueberseeische Elektrizitäts Aktiengesellschaft, which, besides supplying electrical power to the city of Buenos Ayres, has also important electrical interests in Montevideo, Santiago, and Valparaiso, is a very satisfactory one. The company's capital now amounts to £4,500,000. The net profit for the year was £405,600, compared with £382,400. The dividend, which has stood at 9½ per cent. since 1906, is now raised to 10 per cent.

BARROW-IN-FURNESS: *Electricity Profits.*—In our note last week upon the accounts of the Barrow-in-Furness electricity accounts, we regret that by a clerical error, the result of the year's working was incorrectly given. The profit of £249 for 1909-10 compares with a deficit of £384 in the previous year, so that the result for 1909-10 was an improvement of £633.

BEESTON: *Proposed Tramways.*—A Committee has been appointed to approach the Nottingham Corporation on the question of tramway extension.

BIRMINGHAM: *Extension of Boundaries.*—A Provisional Order has been issued, extending the boundaries of the City of Birmingham so as to include Aston Manor, Erdington, Handsworth, King's Norton, and Northfield and Yardley. This extension will mean an increase in the area of the city from 12,639 acres to 39,089 acres; the population from 558,357 to 874,857, and the rateable value from £2,915,506 to £4,175,915. The tramways and electricity undertakings of the various public bodies to be incorporated are to be transferred to the Birmingham Corporation, and the officials who suffer pecuniary loss by reason of the incorporation are to be compensated.

BLACKBURN: *Tramway Accounts.*—The Corporation tramway accounts for 1909-10 show a net profit of £453, against a loss of £4,804 in the previous year. There was a decrease in the total receipts of £917, due to bad trade, which the Committee had foreseen early in the year. Consequently the car mileage had been reduced, with satisfactory results so far as working expenses were concerned.

BOLTON: *Electricity Accounts.*—The electricity accounts for 1909-10 show a net profit, after meeting capital charges, of £7,119. Of this the sum of £6,900 is transferred to relief of rates. The number of units sold was 11,993,271, against 10,677,764 in the previous year. The total generating costs were 0·535d. per unit, and including capital charges, 1·125d. per unit, compared with 0·583d. and 1·199d. in the previous year.

BOOTLE: *Electricity Accounts.*—The profits on the electricity undertaking for 1909-10, after meeting capital charges, allow of £1,725 being added to depreciation fund, £200 to accident insurance fund, and £1,440 to relief of rates.

CANADA: *Electric Power Supply.*—The *Times* correspondent at Toronto states that the municipal system organised by the Ontario Government for the distribution of electrical energy at Niagara Falls is expected to be in operation by the end of the year. The first points of supply will be at London and St. Thomas, which are 100 miles west of the Falls.

COLCHESTER: *Electricity and Tramway Accounts.*—There was a net profit of £414 upon the Electricity Undertaking last year. The tramway accounts show a deficit of £2,531, compared with a loss of £3,940 in the previous year. Electrical energy is paid for at 1½d. per unit, and it is felt that this is excessive.

COVENTRY: *Reduction in Charges.*—In future for energy used for motive power the charge for the first 2,500 units per quarter is to be reduced from 1½d. per unit to 1½d. per unit. Where the consumption is 50,000 units or over per quarter, a flat rate of one penny per unit is to be charged. All lighting consumers are to be charged for energy used for domestic purposes other than lighting at the rate of a penny per unit.

CROYDON: *Electricity Accounts.*—There was a gross profit of £33,433 upon the electricity undertaking. After meeting capital charges, the sum of £4,000 has been transferred to relief of rates.

DERBY: *Price of Tramway Energy.*—The Tramways Committee have been refused a reduction in the price of electrical energy from 1½d. to 1d. per unit.

EDINBURGH: *Opening of Electric Tramway.*—The first electric tramway in Edinburgh, which runs from Ardmillan Terrace to the Corporation markets at Gorgie, was opened this week.

FOLKESTONE: *Corporation and Supply Company.*—At the last meeting of the Town Council the Clerk reported that if the Corporation wished to purchase the electric undertaking from the Folkestone Electricity Supply Co., at the expiration of the 15 years agreed upon, notice must be given before the first of January next. It was resolved that notice be not given.

GLASGOW: *Tramway Receipts.*—The receipts for the Corporation tramways for the year to May 30th were £893,591, an increase of £4,260. The receipts per car mile were 10·22d., and the number of passengers carried was 222,730,571, an increase of 986,002.

GLOUCESTER: *Electricity Profits.*—There was a net profit of £840 upon the electricity undertaking for the past year, compared with £10 in the previous year. The number of units sold was 1,390,000, against 1,452,000.

LEICESTER: *The Late Mr. Colson.*—The Leicester Branch of the Electrical Contractors' Association has passed a vote of condolence with the widow and family of the late Mr. Alfred Colson, Borough Electrical Engineer.

LIVERPOOL: *First Class Cars.*—The receipts from the first class tramcars running in Liverpool amount to nearly 14d. per car-mile, against 11d. per car-mile, which is the average of the ordinary cars.

LONDON: *London County Council: Through Bookings.*—The Highways Committee recommend that authority be sought in the next session of Parliament authorising through booking between the Council's tramways and certain of the London Underground Electric Railways.

Bethnal Green.—Electric Supply.—After further consideration, the Electricity Committee again recommend the Council to adopt an offer by the Shoreditch Council to supply electricity in bulk for a period of seven years. The recommendation was adopted, and the Electricity Committee will now proceed to obtain the necessary consents, &c., and report again to the Council.

Shoreditch.—Supply to Bethnal Green.—The figures at which the Borough Council is to give a bulk supply to Bethnal Green at one or more points on the boundary are as follows:—250,000 units per annum, and under 500,000, 1·15d. per unit; 500,000 units per annum, and under 750,000, 1·10d.; 750,000 units per annum, and under 1,000,000, 1·05d.; 1,000,000 and over, 1d., subject to a seven years' agreement being entered into, and to a coal clause providing for any rise or fall in coal to be followed by a corresponding rise or fall in the above prices.

Woolwich: Supply in North Woolwich.—For some time the Electricity Committee has been considering the question of carrying electric cables through the Woolwich subway, in the event of the Council deciding at a future date to supply electricity in the North Woolwich area direct. The London County Council has decided to allow the Council to lay cables through the tunnel for twenty-one years in consideration of a payment of £50 a year. This offer has been accepted.

NOTTINGHAM: *Tramway Accounts.*—After meeting all charges, interest, sinking fund, and reserve, the accounts of the Corporation tramways for the past year show a balance of £20,000, which is transferred to relief of rates. The reserve and renewals fund now amounts to £62,257. The gross receipts were £56,772.

PAKEFIELD: *Electric Supply.*—A private company proposes to apply for an electric lighting provisional order, and the Council have been asked for their consent.

SEVENOAKS: *Electricity Supply.*—Messrs. Mordey & Dawbarn are being consulted with regard to an electric supply scheme for this district.

SOUTH AFRICA: *Electrical Developments.*—The Delagoa Bay Development Co. are acquiring a controlling interest in the Laurenço Marques Electric Light Co. Messrs. Mordey & Dawbarn are acting for the electric light company. At present the Delagoa Bay Co. also supply electricity.

ST. HELENS: *Electricity Profits.*—After meeting interest and sinking fund charges, the profit of the electricity undertaking for the past year was £1,031, of which £600 have been credited to renewals fund, and £431 to reserve.

SUNDERLAND: *Position of Tramway Company.*—Mr. Justice Swinfen Eady, in the Chancery Division last week, appointed Mr. C. Eves receiver and manager of the Sunderland District Electric Tramways, Ltd. This appointment was the result of an application on behalf of the first mortgage debenture holders, who foresee no possibility of their interest being paid in July, when it falls due.

SWANSEA: *Electricity Works Assessment.*—The assessment of the electricity works has been increased to £3,500, compared with £1,300. The Town Clerk is preparing a report on the subject.

TORONTO: *Projected Tube Railways.*—According to the *Standard*, Messrs. Jacobs & Forgie, an English firm of engineers, have arrived in Toronto to report upon a proposed system of tube railways. The report is expected by July 1st.

WEST INDIES: *Lighting and Traction.*—The Bermuda Electric Light, Power, & Traction Act, 1910, authorises the incorporation of a company with this name for the electric

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lighting of Hamilton. The Bermuda Trolley Company's Act is under consideration, and there seems to be every prospect of the Canadian company obtaining the necessary authority to go ahead with this undertaking.

WIGAN.—*The Tramways Undertaking.*—The Council have engaged Mr. C. W. Mallins, General Manager of the Liverpool Corporation tramways, to report on the financial position and management of the tramways.

WORCESTER: *Electricity Accounts.*—After payment of £3,646 for interest, £963 the equivalent to dividends on cancelled stock, and £5,559 for redemption of capital, the electricity accounts for 1909-10 show a deficit of £1,401. The final contribution for redemption of three years loan of £4,012 for replacement of Powick plant is included in this year's accounts. The main cause to which the deficiency may be attributed is the fall in revenue from private lighting, a large proportion of the consumers having adopted metal filament lamps.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ECCLES.—A Local Government Board inquiry was held last week, concerning a loan of £5,234 for the purposes of the electrical undertaking.

ERITH.—The Council require the following:—(1) Lancashire boiler; (2) a 750-kw. impulse type turbo three-phase alternator and exciter. Particulars from the Borough Electrical Engineer, and tenders by June 20th.

GRIMSBY.—Application is to be made to the Local Government Board for sanction to borrow £4,000 for the extension of mains, and £1,500 for services.

HAMPSHIRE.—An electric light and power plant, &c., is required at the County Asylum, Knowle, Fareham. Particulars from the Clerk, and tenders by June 28th.

LONDON: *Bethnal Green.*—The Council have at last decided to undertake a scheme of electric supply.

ROTHERHAM.—The Town Council is to apply to the Local Government Board for sanction to borrow £27,852 for the electricity undertaking. The chief items are as follows:—Mains and transformers, £10,000; one 1,000 kw. turbo-alternator condensing apparatus and switchboard, £5,000; 3½ miles high-tension feeder cable, £6,175; feeder and distributor mains for supplying the Broom District, £2,222; one 250 kw. rotary converter set, one 250 transformer set, and high-tension switchboard set (all for generating station), £1,050; ditto, at Howells, Wincobank, £975.

SHEFFIELD.—An expenditure of £78,207 upon extensions at the Neepsend power station is contemplated. These extensions are mainly due to the increase in the power and heating demand. Quite a new source of demand has developed for the Electric Smelting Works. Already two furnaces have been connected to the mains, and others are awaiting connection.

SWANSEA.—In an advertisement last week, it was stated that tenders are required by Monday, June 23rd, for motors and motor starters. This should read June 27th.

WEST BROMWICH.—Paper-insulated lead-covered feeder and pilot cables are required. Particulars from the Borough Electrical Engineer, and tenders by June 20th.

Miscellaneous

LONDON: *London County Council.*—Tenders are invited by July 5th for 250 electric tramcar bodies, 250 sets of centre-bearing swing bolster car-trucks, and 250 complete electrical equipments for operation upon both conduit and trolley system. Particulars from the Chief Officer of the Council, 62 Finsbury Pavement, E.C.

MAIDSTONE.—A proposal has been laid before the Corporation to extend the tramways to Chatham, at an estimated cost of £60,000.

NORTHAMPTON.—Preliminary plans and estimates have been prepared for the extension of the tramways to Far Cotton, the estimated cost being £14,560, made up as follows:—Permanent way, £9,670; overhead equipment, £1,220; cables and feeders, £1,420; four cars, £2,250.

NOTTINGHAM.—Preparations are being made for the construction of the Carlton Road tramways, the Bill concerning which will shortly be considered by the Unopposed Committee of the House of Commons. The estimated cost is £14,000.

RUSSIA.—Recent Consular reports state that there is an increasing demand for electrical material and accessories of all kinds in Saratoff.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

BARRY.—Alterations to Holton Road School (£2,120). T. B. Tordoff, Sec., Education Committee, Barry U.D.C.

BEXHILL-ON-SEA.—School (£5,000). F. Wilson, Sec., Education Committee, Bexhill Town Council.

BIRKENHEAD.—School, Lee's Avenue. R. T. Jones, Sec., Education Committee, Town Council.

BIRMINGHAM.—Factory for Dunlops, Ltd. Architect, A. Edwards, Bennett's Hill, Birmingham.

BOLTON.—School, Wolfenden Street (900 places). T. Wilkinson, Sec., Education Committee, Bolton Town Council.

CHELMSFORD.—Electric theatre and shops, Duke Street, for the National Theatre de Luxe, Ltd.

CHESTER.—School, Queen's Park (£11,100). Sec., Education Committee, Chester Town Council.

COVENTRY.—School, Mile Lane (£16,850). Executors of Charles Garlick, builder, Coventry.

DERBY.—Picture palace (£2,500). Architect, G. S. Valentine, 18 Charing Cross Road, W.C.

DURHAM.—School, Waldridge Lane (£4,000). W. Rushworth, architect, Shire Hall, Durham.

EPSOM.—Nurses' home and alterations to girls' home at Woodcote (£2,027). Architect, A. C. Williams, 53 Doughty Street, W.C.

FOLKESTONE.—Picture theatre (£3,000). Architect, G. Valentine, 18 Charing Cross Road, W.C.

GLASGOW.—Extensions, Glasgow Tobacco Wholesale Premises, James Watt Street (£7,000). R. Thomson, architect, 276 St. Vincent Street, Glasgow.

LEYTONSTONE.—High School (£11,278). Architects, Messrs. W. & J. H. Jacques, 2 Fen Court, Fenchurch Street, E.C.

PERTH. Academy buildings (£2,700). H. E. Clifford, architect, 225 St. Vincent Street, Glasgow.

P.O., Mill Street (£2,500). F. D. Robertson, West End Cottage, Fife Keith, Banff.

PETERBOROUGH.—School, Millfield (£5,000). W. Boyer, architect, Market Chambers, Peterborough.

PORTSMOUTH.—Hotel, in connection with Day Training College. Sec., Education Committee, Portsmouth.

WEST FIFE.—Extensions to infectious diseases hospital (£10,000). Architect, E., Simpson, 16 King Street, Stirling.

TENDERS RECEIVED AND ACCEPTED

BELFAST.—The Electricity Committee have accepted the tenders of Messrs. J. H. Holmes & Co., for the supply of a booster set and switchgear, and of Messrs. Cowan's, Ltd., for switchboard extensions.

BURTON-UPON-TRENT.—The Council have accepted the tender of the Brush Electrical Engineering Co. for a synchronous motor-generator at £257 10s.

COLCHESTER.—The Electricity Committee have accepted the tender of Messrs. Veritys, Ltd., for six disconnecting pillars, and that of Messrs. W. T. Henley's Telegraph Works Co., Ltd., for cable.

EASTBOURNE.—The Council have accepted the tender of Messrs. W. T. Henley's Telegraph Works Co., Ltd., at £130, for cable.

ECCLES.—The tender of the British Insulated & Helsby Cables, Ltd., has been accepted for cable at £459 11s.

HECKMONDWIKE.—Subject to the consent of the Local Government Board to the necessary loan, the tender of Messrs. Deane & Beale at £2,418 has been accepted for a condensing plant.

LEYTON.—The District Council have accepted the tender of the Reason Manufacturing Co., Ltd., for the annual supply of electrolytic ordinary and slot meters.

LONDON: *London County Council.*—The following tenders have been received for 39 double-deck car bodies; 39 sets of electrical apparatus, and 40 sets of car trucks required in connection with special cars for use on hilly routes:—

39 double-deck car bodies: Hurst, Nelson & Co., Ltd. (accepted), £14,040; Brush Electrical Engineering Co., Ltd., £14,469; United Electric Car Co., Ltd., £14,742; Metropolitan Amalgamated Railway Carriage & Wagon Co., Ltd., £15,366.

39 sets of electrical equipments:—British Westinghouse Electric & Manufacturing Co., Ltd., £12,753; Dick, Kerr & Co., Ltd., £13,006 10s.; British Thomson-Houston Co., Ltd., £13,045 10s.

40 centre-bearing four-wheeled bolster trucks:—United Electric Car Co., Ltd., £4,880; Hurst, Nelson & Co., Ltd., £4,980; Metropolitan Amalgamated Railway Carriage & Wagon Co., Ltd., £5,040.

The tender of the British Westinghouse Co. has been accepted at £2,280 for 40 sets of magnetic track and wheel brake equipments for double-deck cars.

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Woolwich.—The tender of Messrs. F. Sage & Co. has been accepted for fitting up the new electrical showroom of the Council in Powis Street, at £619 10s.

METROPOLITAN WATER BOARD.—The Board has accepted the following tenders:—Appleby Crane & Transporter Co., Ltd., provision and erection of a motor generator (to be manufactured by the General Electric Co.) for coal transporter apparatus, £105; Rees Roturbo Manufacturing Co., centrifugal pump and electric motor for Ealing, £55 10s.

STRETFORD.—The tender of the General Electric Co., Ltd., for a 500-kw. steam-driven generator at £2,764 has been accepted, and a spare armature at £325.

APPOINTMENTS AND PERSONAL NOTES

Mr. S. E. Fedden, General Manager and Engineer of the Sheffield Corporation Electric Supply Department, has unfortunately been ill, but is now making very satisfactory progress towards recovery. He will, however, not have regained sufficient strength to journey to Glasgow for the Incorporated Municipal Electrical Association Convention next week. Mr. Fedden was to have opened the discussion on "Cheapening the Cost of Mains and Services" on Thursday. His place will now be taken by Mr. S. J. Watson, of Bury, who will be followed by Mr. F. Ayton, of Ipswich, as mentioned in another column. Mr. Fedden's absence will be much regretted, for he was a very regular attendant at the meetings. He read a Paper on "Street Lighting by Electricity" at the second annual meeting of the Association, and since then has read two other Papers at annual conventions, was president in 1907, and has taken part in the discussions at practically every meeting.

Mr. Charles Bright, F.R.S.E., asks us to state that his appointment recently announced by the Australian Commonweath is a home (London) appointment for partial services, and will not, therefore, as appears to have been supposed, take him to Australia.

The recommendation of the Coventry Electric Light Committee that the salary of the Borough Electrical Engineer, Mr. G. Tough, be increased from £350 to £450 per annum has been passed by the Council.

Messrs. Clark, Forde & Taylor, 4 Great Winchester Street, London, are taking into partnership Mr. R. M. Sayers. This will not alter the style of the firm, which remains as before.

We regret to announce the death of Alderman Carey, who was a highly esteemed member of the Cardiff Corporation, and who has done splendid work as chairman of the Electric Lighting and Tramways Committee.

COMPANIES' MEETINGS AND REPORTS

SHANGHAI ELECTRIC CONSTRUCTION CO.—Sir Alfred Dent stated at the annual meeting last week that the Municipal Council of Shanghai had agreed to a modification of the terms of the company's concession, to the extent of the abrogation of their liabilities for road maintenance, to a suspension of the royalty for the year 1910, and also to a slight concession in cost of power. To the board's surprise the ratepayers declined to support the recommendation of the council, and the proposals as regarded road maintenance and royalty were rejected. The result had been delay in the improvement of the service, and in a return to the shareholders on the large capital they had expended. There was a loss for 1909 of £949. The loss in exchange for the native currency into Mexican dollars amounted to £15,541, whilst royalties to the Council, and maintenance of roads amounted to £2,774.

WINNIPEG ELECTRIC RAILWAY CO.—The accounts for 1909 show net earnings of $863,405, and the surplus, after payment of four quarterly dividends, amounts to £263,405. This has been added to profit and loss account, making a total credit of £861,430. In November last year the company's hydraulic works on the Winnipeg River broke down through the bursting of one of the penstocks, but the steam plant was brought into use, and a partial service was maintained.

KALGOORLIE ELECTRIC POWER & LIGHTING CO.—The profit for 1909 has enabled the payment of the preference dividend and the placing of £4,000 to depreciation and renewals. The company are installing an additional generating unit in view of the large amount of power required by the Great Boulder Perseverance Co., and orders for this have been placed.

IMPERIAL TRAMWAYS CO.—The report for 1909 states that no dividend has been received from the company's investment in the London United Tramways Co., which means a loss of £21,111. Consequently, no dividend can be declared upon the preference or ordinary shares. The net revenue was £16,747, and after meeting debenture interest a balance of £4,006 is carried forward. At the annual meeting last week, Sir George White said that in view of the depreciation in the market value of their holding in the London United Tramways Co., it would be unwise to make any payment on account of the cumulative preference shares. The directors had waived their fees, and would continue to do so until a dividend was paid. Previously to 1909, not only had the preference dividend been met, but the dividends on the ordinary shares had averaged 10 per cent. for the previous sixteen years. The present unsatisfactory position is due to the lack of dividend on the large holding of preference shares in the London United Co.

CAPE TOWN & DISTRICT GAS CO.—At the annual general meeting of this company last week, complaint was made that the Cape Town Municipality should be allowed to supply electricity in competition with the company in Woodstock, which is outside the Cape Town municipal area.

UNITED ELECTRIC TRAMWAYS OF MONTEVIDEO.—The net profit for the year to March 31st was £74,981, and a dividend at the rate of 6 per cent. for the year is declared. Renewals and contingency fund is credited with £15,000.

ANGLO-ARGENTINE TRAMWAYS CO.—At the annual meeting on Thursday, the proposal to increase the second preference share capital by £500,000, and the ordinary capital by £1,500,000, and increasing the rate of dividend on the first and second preference shares from 5 to 5½ per cent., was passed. The 5 per cent. debenture stock is also to be increased by £6,000,000.

TRACTION AND POWER SECURITIES.—There was a credit balance of £24,848 for 1909, to which has to be added £5,775 brought forward. Investment reserve is credited with £25,000, and the balance is carried forward. Investment reserve now stands at £110,000.

DIESEL ENGINE CO.—The net profit for 1909, including £6,075 brought forward, was £9,031. After meeting the 5 per cent. preference dividend, and placing £5,000 to general reserve, a balance of £3,093 is carried forward.

BRUSH ELECTRICAL ENGINEERING CO.—Mr. E. Garcke presided at the annual meeting on Monday. Referring to the heavy loss for the past year, the chairman said the troubles of the Brush Co., in common with many others, were mainly due to excessive competition from abroad. But for this, terms could no doubt be made amongst British manufacturers with regard to the present mutually destructive competition. The unsatisfactory position of affairs had been accentuated during the past few years by the advent of the metal filament lamps. Further, the company had been badly hit by the absence of any extensions of tramways or light railways, which had rendered their large car building shops idle. In these circumstances there was nothing to be done but to attend closely to the details of the business, to reduce expenses to the smallest possible limits, and to hold on until conditions improved. Fortunately, the current half-year had been to some extent better. Mr. Garcke concluded with warm praise for the manner in which the officers and staff were contending against adverse difficulties.

NATIONAL ELECTRIC CONSTRUCTION CO.—The accounts for 1909 show that after providing for debenture interest, depreciation, &c., the credit balance of £9,661 brought down was reduced to £6,322.

Cable Fire.—According to the *Manchester Courier*, the breakage of a wire strung overhead in a subway under Church Street, St. Helens, caused an outbreak of fire in the subway on Monday. It is stated that both the electric and gas supplies had to be temporarily cut off, and that a Post Office telegraph cable in the subway was destroyed.

Institution of Mining Engineers.—At the London meeting of the Institution of Mining Engineers, last week, it was announced that among the authors of Papers to whom the Council had awarded prizes was Mr. R. Nelson (H.M. Electrical Inspector of Mines), for his Paper on "Electricity in Coal Mines," read last year. (See ELECTRICAL ENGINEERING, Vol. V., page 527, June 10th, 1909.)

Naval Appointments.—New regulations have been approved by the Admiralty for the appointment of electrical engineers at the Admiralty and in the Royal dockyards. Electrical engineers will be selected from first assistant electrical engineers, but vacancies for the latter can be filled by outside candidates. Candidates must have passed through a suitable training course and have had at least five years' practical engineering work, part of which time must have been spent in a responsible position as electrical engineer. As a rule every second vacancy will be filled by an outside candidate, the others being taken by second assistant electrical engineers or dockyard *employés* who have held at Admiralty scholarship. Appointments in vacancies for second assistant electrical engineers will be made by means of a competitive examination, at which inspectors or electrical fitters and first-class draughtsmen of three years' seniority and persons qualified by Admiralty scholarships will be eligible to compete. The Admiralty scholarship will be instituted tentatively, for a period not exceeding six years, and will be awarded to an electrical fitter apprentice who has completed his four years' course of study in a dockyard school.

OSRAM·LAMPS

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Electric Control.

HOW THE "WATKIN SWITCH" REGULATES ELECTRICITY FOR LIGHT OR POWER.

It is not too much to say that the greatest obstacle to the general adoption of electricity for lighting, heating, engineering, and other purposes has been the difficulty of regulating and adjusting the current in accordance with the requirements which vary not merely from day to day, but from hour to hour.

Take, for instance, the matter of lighting, whether for the home, a business office, or the factory. The superiority of electricity alike in point of efficiency, of cleanliness, and health is indisputable. Yet at the same time in actual use electric lights suffer from the drawback that they cannot be modulated according to the illumination required, that they cannot be turned half or a quarter on, as can be gas, by the turning of a tap, but that they must either be clicked on at full cock or clicked off altogether.

By the invention of the Watkin Switch and Electric Current Controller, that drawback hitherto associated with electric lighting and the use of electric power for domestic and other purposes is overcome. For this ingenious patented instrument enables full and perfect control to be ever exercised over the electric current used for any purpose, with a resultant saving in expenditure greater than has been hitherto thought possible. Whereas the ordinary electric installation merely provides for the current to be on at "full" or to be turned off, the Watkin Switch enables that electric light or electric power to be applied and varied in seven different and graduating degrees. By the Watkin switch the electric current becomes as readily and completely under control as does water or gas by the turning of the tap. Thus it allows an electric lamp to be reduced to give no more illumination than a night-light, and from that bead of light it can be graduated through seven stages to its full and standard power. What this fact connotes in actual use is shown by the illustration that the cost of a Watkin Switch for one lamp is 17s. 6d., and its use effects a saving on that lamp of £1 per annum, with an even higher proportionate saving on the original cost for a number of lamps. For, in addition to its saving of the actual electric current (by allowing it to be modulated at will), the Watkin Switch economises the wear and tear of the lamp, especially in the case of metallic filament lamps, the life of which is doubled by the adoption of this epoch-making invention.

A Marvellous Saving

Here it may be noted that no alteration of fittings or wiring is necessary for the institution of the Watkin Switch, which is equally applicable to direct or alternating currents. Results of the complete and exhaustive tests of the invention by the Electrical Standardizing and Testing Institution, Faraday House, W.C., are embodied in a certificate which reports that from 12½ to 80 per cent. of electric current is, and may be, saved by the use of the Watkin Switch, the insulation of which satisfactorily passed the test up to 1,000 volts.

Its application to electric lighting is only one of the many uses to which the Watkin Switch is being applied with revolutionary and highly satisfactory results. Fitted to electric radiators it enables the heating of a room to be adjusted with the utmost nicety, precision, and economy. Already a large demand for the Watkin Switch has sprung up in India for the perfect control it affords over electrically-driven fans and punkahs. In the use of such domestic conveniences as electrically-heated irons and equally in the use of electrically-driven surgical apparatus, the Watkin Switch supplies that full and delicate control which has long been desired but never before obtained.

Perhaps the best idea of the usefulness and indeed indispensability of the Watkin Switch for users of electricity in any form whatever may be gathered from the fact that, though placed on the market within only the last few months, it is already being supplied to his Majesty's Government, to the Government of the Commonwealth of Australia, the Indian Government, the New Zealand Government, the Cape Colony Government, and the Offices of Works in London, Bombay, Cape Town, Dublin, Pretoria, and Sydney; to the Corporations of London, Glasgow, Bradford, Dundee, Croydon, Birmingham, &c.; and to leading railways and shipping companies, business firms, hospitals, and public institutions throughout Great Britain. The manufacturers and sole patentees of the Watkin Switch (which is a British invention and a British manufacture) are The Adams-Watkin Co., Ltd., 56 Victoria Street, S.W., where all communications should be addressed.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 to £59 5s. per ton (last week, £59 5s. to £59 15s.).

ALLEN WEST & CO.—We understand that Messrs. Allen West & Co., Ltd. (Lewes Road, Brighton), are now handling the business in stamped grids formerly carried on by Messrs. Wellman, Seaver & Head, Ltd.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—The Electric Sterilising, Carbonising, and Stripping Co., Ltd., is to be wound up voluntarily. Mr. H. Appleyard, Prudential Buildings, Market Place, Dewsbury, is liquidator. A meeting of creditors will be held at the above address on June 20th at 2.15 p.m.

Mr. C. S. Beale, 72 Bishopsgate Street, London, has been appointed liquidator of the Typewriting Telegraph Corporation, Ltd.

The public examination of Mr. W. H. Trentham, electrical engineer, 39 Victoria Street, S.W., will be held at Bankruptcy Buildings, Carey Street, London, on June 28th, at 11 a.m.

CANADIAN AGENTS WANTED.—A London firm of electrical and mechanical engineers wish to appoint agents at Montreal, Toronto, Halifax, Winnipeg, and Vancouver. Particulars from the High Commissioner for Canada, 17 Victoria Street, London, S.W.

CHANGE OF ADDRESS.—Messrs. Charles Macintosh & Co., Ltd., have removed from 1 and 3 Golden Lane, to 22-3 Jewin Street, London, E.C.

THE BECK FLAME LAMP CO.—We are informed that the Beck Flame Lamp Co., Ltd., are carrying out some important municipal contracts, which include several hundred lamps for the lighting of Sydney, Cape Town, and Worthing. Encouraged by their success, they have decided to build additional workshops, and, by arrangement with the carbon manufacturers, are greatly increasing their stocks.

NORTHAMPTON ELECTRIC LIGHT & POWER CO.—The existing shareholders are being offered the opportunity of subscribing to an issue of 15,000 £1 ordinary shares at a premium of 2½ per cent.

Newcastle Local Section, I.E.E.—The annual general meeting of this section was held on Monday, May 30th, at the Armstrong College, Newcastle-on-Tyne. A vote of thanks to Mr. C. Faraday Proctor for his long continued service as Honorary Secretary of the Section was moved by Mr. H. W. Clothier, the newly elected Hon. Secretary, and seconded by Prof. Stroud, the retiring Chairman.

Renold Chains at the Japan-British Exhibition.—Messrs. Hans Renold, Ltd. (Progress Works, Brook Street, Manchester), have an effective display of their well-known chains on a stand in the Machinery Hall of the Japan-British Exhibition. The four small chain drives shown include sizes for powers ranging from 3 to 40 h.p., and speeds from 400 to 1,300 ft. per minute. The silent chain drive is provided with a shock-absorbing sprocket, part of the cover-plate of which has been cut away to expose one of the springs. On the same stand a complete range of patent silent, bush roller, block, stud, balance, textile and pipe wrench chains are exhibited. A mortising chain outfit with guide bar and sprocket is also shown, with blocks of wood illustrating the sizes of mortise that can be cut.

The Batti-Wallahs' Society.—At an extraordinary general meeting on Monday, a resolution was passed altering the title of the P. and O. Batti-Wallahs' Society, by deleting "P. and O." It is now the intention to admit electrical engineers as members, irrespective of any association with the P. & O. company. Mr. Walter Riggs, a Past President of the Batti-Wallahs' Society, has placed his sailing barge *Alde* at the disposal of the members from July 30th to August 8th, for the purpose of a cruising trip. Members intending to join the party are requested to communicate with the Hon. Secretary, Entertainment Committee, Mr. A. W. Robinson, 116 Charing Cross Road, London, W.C.

Prosecution *re* Home Office Rules.—On Thursday, in the Hamilton Sheriff Court, Scotland, the Clyde Valley Electric Power Co. were charged with having, on March 3rd last, allowed a labourer, J. Noble, to work on a H.T. switchboard at the Cambuslang sub-station, which was not adequately protected. The part on which the man was working was not separated from the live part by screens, and he came in contact with an 11,000-volt conductor and was killed. A representative of the company pleaded guilty, but explained that though it was impossible to make the whole board dead, it was the practice to provide screens. The responsibility for their use rested with the district engineer in charge. Noble had had considerable experience of electrical work. The board was erected in 1906, whereas the new regulations only came into force in January of this year. A fine of £20 was imposed.

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ELECTRICAL ENGINEERING

NO. 181 [VOL. VI., NO. 24] THURSDAY, JUNE 16, 1910. [PRICE ONE PENNY.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

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All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn*

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

A SUPPLEMENT "ELECTRICAL ENGINEERING IN MINES" IS INCLUDED (GRATIS) IN "ELECTRICAL ENGINEERING" ON THE FIRST THURSDAY OF EVERY MONTH.

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SUMMARY

THE Annual Convention of the Incorporated Municipal Electrical Association was opened in Glasgow on Tuesday. Mr. W. W. Lackie, in his Presidential Address, dealt with a variety of subjects. He thought it would be for the best welfare, not only of the supply undertakings, but also of the wiring contractors, if the supply authority were to furnish the lamps to consumers. Dealing at some length with methods of charging, he suggested a flat rate calculated from the average rate that would have been charged the consumer in the previous year on the maximum demand system, and that a "Rating Committee" should meet once or twice a year to settle disputes. Two Papers by Messrs. Cramb and Collings Bishop dealt with the commercial development of electricity supply undertakings, and outlined the details of the organisation of a sales department. In the discussion, Mr. F. Ayton expressed his intention of training lady canvassers in order to push the sale of domestic electrical apparatus. Some strong remarks were made in support of municipal wiring, and Mr. C. H. Wordingham was alone in advocating that electric supply undertakings should not do this work. Mr. Cramb and Mr. Ayton both advocated the policy of leaving the contractor out of the question altogether, the former saying that the present position was that the central station manager should sell the apparatus and the contractor take the discount. Other speakers referred to the fact that whilst the wiring contractors had had the field to themselves for years, the sale of heating and cooking apparatus had never been pushed. (Pages 385 and 393.)

THE original Marconi patent describing several important features of wireless telegraphy expired on June 2nd last, the Marconi's Wireless Telegraph Co. having decided not to proceed with the application which was made for an extension of term. The Company has brought an action against the British Radio Telegraph & Telephone Co. for alleged infringements of patents relating to syntony, the magnetic detecter, and the rotary spark-gap transmitter. The infringement is denied, and the Marconi patents in question are claimed to be invalid. (Page 386.)

AT the Congress last week of the Tramways and Light Railways Association at Dublin, a description of the Dublin tramway undertaking was given by Mr. R. S. Tresilian. A standard form of brake-shoe, put forward for discussion by Mr. J. A. Panton, was discussed, and Papers were read by Mr. J. R. Salter and Mr. H. England on "Tramway Economics" and "Railless Traction" respectively. Both these authors agreed that there was a limit of frequency of service below which a tramway could not possibly pay, and the latter considered the possibilities of trolley omnibuses in this connection. (Page 387.)

THE "Z" Electric Lamp Manufacturing Co., Ltd., have been successful in their opposition to the grant of a patent to the Glühlampenwerk Anker Ges. for

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the use of phospham to prevent blackening of metal filament lamps due to the disintegration of the filaments. (Page 390.)

THE judgment of Mr. Justice Parker, which decided that Messrs. Marples, Leach & Co. (now Adnil Electric Co.) are selling lamps which infringe one of the "Z" Company's patents, is to be appealed against. (Page 390.)

IN a Paper read on Tuesday before the Institution of Gas Engineers, Mr. J. Abady reviewed the question of municipal street lighting both by electricity and gas. He did not touch upon the controversy between the two systems, but confined his remarks to a discussion of forms of contract and the size, spacing, and arrangement of lamps to obtain good illumination. He favours charging for the actual light rather than for the energy supplied, and points out the advantages of small units close together. (Page 391.)

THE International Electrotechnical Commission has issued its first annual report. So far the work has consisted mainly of organisation, but reports on nomenclature and symbols are before the various Committees. International rules for electrical machinery will shortly be considered, and a report on the rules already in existence is being prepared. (Page 392.)

AN endeavour is being made to obtain an injunction to restrain the Leicester Corporation, who work under a Provisional Order, from carrying out electric wiring and selling electric fittings, &c. The case commenced on Monday, and evidence of considerable interest was given, including proof of the sale of an electric lamp to a non-ratepayer, and the wiring of a private electrical installation outside the borough boundary. The Corporation contend that they are entitled to wire consumers' premises and to supply consumers with fittings under Section 10 of the Electric Lighting Act of 1882, which empowers them to "do all such acts and things as may be necessary and incidental to" the supply of electrical energy. (Page 397.)

AT the Annual Meeting of the Electrical Contractors Association in Edinburgh on Monday, Mr. Harland Bowden was duly installed as President. Among the matters discussed were the question of guaranteeing the work of members of the Association, and a proposal to endeavour to obtain an amalgamation of the interests represented by the various organisations of consulting engineers, station engineers, manufacturers, cable makers, and the E.C.A. Committees were formed to deal with both of these matters. (Page 398.)

A DEPUTATION from the Acton Borough Council is to arrange terms with the Metropolitan Electric Supply Co. with regard to the electricity undertaking.—The abandonment of the conduit system at Bournemouth now only awaits the sanction of the Board of Trade.—The Eastbourne electricity accounts show a net profit of £2,200, or nearly ten times that of the previous year.—At Mirfield the price of supply is to be raised on account of the use of metal filament lamps.—The power station at the Rosyth Naval Base has been destroyed by fire.—The last two sections of the reconstructed York tramways were opened last week. (Page 399.)

APPLICATIONS have been made during the week for the following loans to the Local Government Board:—Newport (£31,255); Nuneaton (£4,804); St. Anne's-on-Sea (£3,000); St. Helens (£10,230); Sheffield (£78,207). Extensions, at a cost of over £11,000, are contemplated at West Bromwich. (Page 400.)

THE report of the British Electric Traction Co. records a net profit, including the amount brought forward, of £150,760. A dividend of 3s. per share is to be paid on the preference shares, and £15,000 carried to reserve and £14,067 carried forward. (Page 401.)

A LONG letter from Mr. A. C. Eborall comments on some phases of modern switchgear, and contains a suggestion that, with the very large units likely to be used in future, the expense of the automatic switchgear may become prohibitive, and protection may have to be obtained by adopting a different class of machine. A letter from a well-known metal filament lamp firm relates to a forthcoming patent action. (Page 403.)

THE Donnersmarckhütte Oberschlesische Eisen- und Kohlenwerke Akt.-Ges. of Zabcze, Germany, have been granted leave to appeal against the judgment of Mr. Justice Parker in March, which decided that the Ilgner patent for electric driving of reversing rolling mills is invalid. The notice of appeal was not given until two days after the expiry of the period allowed. (Page 403.)

AMONG the specifications published by the Patent Office on Thursday last was one by W. E. Ireland for a tramcar controller with auxiliary contacts and a pilot circuit to warn the driver if the controller has been left in the wrong position when changing ends.—A process for strengthening tungsten filaments by introducing a small percentage of tellerium into the mixture before squirting is covered by C. H. Weber.—Methods of preparing filaments of vanadium and titanium are described by the French Auer Company.—C. H. Pearson describes an interlocked cover for iron-clad switches.—Opposition has been entered to the grant of a patent by the Chemische Fabrik Griesheim-Elektron for an arc furnace for treating gases. (Page 404.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JUNE 16TH.

Incorporated Municipal Electrical Association.

10 a.m. At Institute of Engineers and Shipbuilders, Glasgow. Discussions on (1) "Advantages of Continuous Records of Costs and of Steam Consumption," to be opened by G. Wilkinson (Harrogate) and C. E. C. Shawfield (Wolverhampton); (2) "Cheapening of the Cost of Mains and Services," by S. J. Watson (Bury) and F. Ayton (Ipswich).

2 p.m. Visits to Electricity Works, &c.

7 p.m. Annual Dinner at Windsor Hotel.

FRIDAY, JUNE 17TH.

Incorporated Municipal Electrical Association.

10 a.m. Annual General Meeting at Institute of Engineers and Shipbuilders, Glasgow.

MONDAY, JUNE 20TH.

Institution of Mining Electrical Engineers.

Visit of Warwickshire and South Staffordshire Branch to works of the Electric Construction Co. at Wolverhampton.

TUESDAY, JUNE 21ST.

National Electrical Manufacturers' Association.

2.30 p.m. Committee Meeting at Balfour House, Finsbury Pavement, London.

Faraday Society.

8.0 p.m. At Chemical Society's rooms, Burlington House, Piccadilly, London. (1) "Electrometallurgy of Ferro-Alloys and Steel," by Paul Girod. (2) Exhibition of new Mercury Vapour Lamps by Dr. F. Mollwo Perkin.

WEDNESDAY, JUNE 22ND.

Institution of Civil Engineers.

8.0 p.m. "James Forrest" Lecture. "Recent Developments of Telegraphy and Telephony," by Sir John Gavey, C.B.

Poplar School of Engineering.

(Association of Electrical Engineering Students.)

Debate on "Gas *versus* Electricity."

Institution of Electrical Engineers.—The removal of the offices of the Institution to the new building will begin on Monday, June 20th, and from Thursday, June 23rd, the address of the Institution will be Victoria Embankment, London, W.C. The new telephone number will be Gerrard 764.

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FIFTEENTH ANNUAL CONVENTION OF THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION IN GLASGOW

THE fifteenth Annual Convention of the Incorporated Municipal Electrical Association, which commenced in Glasgow on Tuesday, is being attended by a larger number of members and visitors than any previous convention. There were over 400 persons present in the Rankine Hall of the Institute of Engineers and Shipbuilders in Scotland, when the Hon. A. McInnes Shaw, Lord Provost of Glasgow, officially welcomed the Association. In a short speech he drew attention to the great progress which the electrical industry has made since the Association held its annual Conference in Glasgow in 1901, under the presidency of Mr. W. A. Chamen, who was then City Electrical Engineer. Bailie Willock, Convener of the Glasgow Electricity Committee, also spoke a few words of welcome, to which Mr. W. W. Lackie, the President, replied.

Mr. Lackie then delivered his Presidential Address.

PRESIDENTIAL ADDRESS.

Mr. LACKIE reminded his hearers that this was the third time the Association had met in Glasgow. The first time was in 1901, under the chairmanship of Mr. Chamen, and on the second occasion the visit was on one day only, when the Convention was held in Edinburgh under Mr. Newington's presidency in 1905. In Glasgow in 1901 electrical energy cost, including interest, depreciation and sinking fund, 2·96d. per unit, as against 1·73d. to-day. Excluding the standing charges, the works costs then were 1·41d. per unit as against 0·562d. per unit to-day. Very important work, Mr. Lackie continued, had been done by the Association's Council during the past year. The amendments made in the Electric Lighting Acts Amendments Bill and embodied in the Act which was passed had been practically all in accordance with the expressions of opinion received from the representatives of the Municipalities interested. To the Scottish Municipalities whose areas had been threatened, it was particularly gratifying that an amendment was accepted at the last moment protecting both authorised private companies and authorised municipal undertakings from unfair and unreasonable competition on the part of unauthorised companies. The clause of the Bill regarding the raising of capital by municipalities for the purpose of wiring consumers' premises, and the hiring-out of motors, had been dropped out entirely. If the clause authorising the work in consumers' premises to be done "through a contractor only," had been passed, it would have been contrary to the existing Electric Lighting Acts and Orders, and undoubtedly would have been found quite unworkable. If these words became law, it would have become necessary to engage a contractor to erect the main fuses and switches, and to connect, disconnect, remove, and repair all meters. "I think I am not overstating the facts, nor doing violence to the reputation for efficiency of the local contractors," said Mr. Lackie, "when I say that there is not an electrical contractor in Glasgow, nor in any other municipal area, who would feel himself qualified to undertake this work as cheaply or as well as the municipalities are doing it at the present moment."

The President then went on to point out that a private supply company may let on hire motors, and may fit up and maintain complete light and power installations on consumers' premises, and they may buy land and feu it for consumers' premises. Before a municipality can do any of these things they must get Parliamentary sanction, and such sanction, in many cases, would be refused—and, Mr. Lackie added, in some cases rightly so. On the other hand, municipalities had, in many burghs, undertaken the supply of electrical energy at a time when no company would have ventured to do so. They could borrow money at a low rate of interest, enabling them to give a cheaper supply, resulting in a proportionately larger amount of plant being installed in consumers' premises and benefiting the manufacturer who makes all the plant both for the supply authority and for the consumer. Some kind of protection, Mr. Lackie thought, should be extended to those municipalities who, after having acted as pioneers, now find their areas surrounded or invaded by private supply companies, who could select the more profitable consumers, and were also in a position to secure a large power user by offering a specially low rate which, while it did not pay the company, might be an indirect means of profit. This led to unfair comparison in the same district between the charges made by the municipality and the company. In like manner Mr. Lackie was averse from a municipal concern harassing a company in this way.

On the question of depreciation and its relation to sinking fund, the speaker expressed the following views :—Depreciation of value due to wear and tear is met by the sinking fund if it is properly calculated upon the probable life of the plant. On the other hand, if the ordinary maintenance chargeable to revenue is not sufficient to keep the plant up to its original efficiency, this should be met by provision for depreciation. Lastly, obsolescence he considers not to be true depreciation. A prudent authority would annually lay aside a sum for replacing old plant with more modern plant of higher efficiency, but such a course, he pointed out, is not compulsory under the Electric Lighting Acts. Moreover, it is not legal to create a deficit by setting aside a sum either in the name of depreciation or of reserve fund. Only such sums as are profits are available for this purpose. The Court of Session in 1880 had held that the deduction for wear and tear to be made under the section of the Act above referred to is deduction for diminished value as a means of earning income, and not as a saleable subject, and that inasmuch as the plant in question was undiminished in value for the purpose of earning income, no deduction from income tax charge could be made beyond repairs already allowed for.

Reviewing the past year's progress, Mr. Lackie observed that, while gas engines had been improved, most of the new plant had consisted of reciprocating steam engines for small and steam turbines for large units. Municipalities could not afford to indulge in hazardous experiments with untried forms of plant. Suppliers of electrical energy had been seriously affected by the general depression in trade emphasised by the effect of the metal filament lamp, which had caused many stations to cease putting down additional plant for a year at least. When the metal filament lamp came on the market it was said that it would be necessary to obtain three applications for every one previously received, but this has not been found to be the case, for the obvious reason that all the applications previously received were not for lighting purposes, and all the lighting is not even now done by the metal filament lamp. Moreover, during the past few years there had been applications for the larger power supplies; one was glad to think that no such radical change in the efficiency of motors could take place. Touching on a more debatable question, Mr. Lackie next expressed the opinion that it would be for the best welfare, not only of the supply undertaking, but also of the wiring contractors, if the lamps were left to the supply authority, either to be supplied and the price included in the charge per unit, or sold direct to the consumer by the supply authority. If the former method were adopted, one lamp, he suggested, might be given for every 100 or 200 units used, and if the latter, the price would be, at most, net cost.

The great improvement in heating and cooking appliances was briefly alluded to, and the President had observed that the chief effect of the temporary lull in output had been that municipal engineers had had time to re-examine their methods of organisation to see if any untapped economies could be effected.

The last part of Mr. Lackie's address dealt with the system of charging for electricity supply. He recognised that a flat rate per unit is what is wanted by most consumers, and he suggested that, in Glasgow, for instance, a change from the maximum demand to the flat rate might be effected by charging the same as the average rate paid by each consumer during the previous year on the maximum demand system. The maximum demand would still be taken during the year, and the average rate worked out. This would mean that there would be flat rates for different consumers or for various kinds of consumer, ranging from 3½d. per unit to ½d. per unit, decreasing from the former to the latter by tenths or even hundredths of a penny, and he therefore suggested that a rating committee might be appointed, and sit once or twice a year to hear and settle cases in dispute. He conceived that such a method might even lead to increased consumption of energy: for consumers paying 3½d. and ¾d., working out to an average price of, say, 2d., would only remember the 3½d. rate, and when they found that they were only to be charged 2d., would not exercise

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the rigid economy which is often practised in connection with the 3½d. rate. An innovation which might also be made would be, instead of charging a rate per unit, to charge so much per 10 units; this would enable the making of fractional reductions smaller than the minimum possible reduction of ¼d. per unit with the present method of charge. For instance, the rates in Glasgow vary from 3½d. to ¾d.; this would work out at 2s. 11d. per 10 units for light, and 7½d. per 10 units for power. The fixed rate system of charging, say, £4 or £5 per kw. per annum plus a low rate of ½d. or ¼d. per unit, had been tried ten years ago in Glasgow by Mr. Chamen, but they had serious complaints from lighting consumers because of their bills being as heavy in summer as in winter, although many used practically no light in summer. On the "knotty" question of specially low rates to users of a large amount of energy for an exceptional number of hours in the year, two remarks were made. The suggestion that the municipal electricity supply undertaking should, in certain circumstances, give power supplies to large industrial concerns even at a loss, for the sake of the secondary profit that may accrue through the employment thus provided, Mr. Lackie thought to be based on unsound reasoning, as municipal enterprise stands or falls according to whether or not it can justify its existence by continued financial solvency. Secondly, he suggested that those who have a number of large lighting or power users connected to their mains should come to some agreement as to the basis upon which the rates of charge to such consumers should be founded, as this would mitigate the difficulty in satisfying consumers who insist on quoting one supply authority against another to prove that the local rates are exorbitant. This means that the engineer concerned has to write to the other cities of approximately the same size and presenting the same conditions as his own to get the particulars of the charges there, and then by comparison to show the consumer who has instituted the inquiry that, after all, the local rates are not exorbitant.

Mr. Lackie concluded by expressing the hope that the meetings and discussions during the next few days might not only extend knowledge, but confirm old friendships and make new ones.

The usual vote of thanks was proposed by Alderman J. P. Smith (Barrow-in-Furness), and seconded by Mr. C. H. Wordingham.

THE PAPERS AND DISCUSSIONS ARE REPORTED ON PAGES 393-397.

THE MARCONI PATENTS

MR. G. MARCONI and Marconi's Wireless Telegraph Co., Ltd., having decided not to proceed with their application for an extension of the life of the original Marconi patent, this patent expired in the ordinary course on June 2nd last, fourteen years after the date of application. The patent in question is No. 12,039 of June 2nd, 1896, and described, among other things, the metal filing coherer, the use of mercury in coherers, various methods of decohering, the combination of a relay with a filing coherer, spark-gap transmitters of various forms, and several different arrangements of transmitting and receiving apparatus, including the connection of the transmitter and the coherer to earth.

The Marconi Co. applied to the High Court in December last for an extension of the life of the patent, but, as has been stated above, the application has not been proceeded with, and no hearing has taken place. The ground upon which an extension of the term of a patent may be granted is that the patentee has been inadequately remunerated for his patent. The period of extension may be seven years, or in exceptional cases fourteen years. The claims of the patent in question were remarkably broad, but the Marconi Co. never attempted to make use of them to suppress the work of their rivals. This was probably chiefly due to the fact that the competition of other systems has not been of sufficient commercial importance to justify legal proceedings.

As already announced in our columns, however, the Marconi Co. have commenced legal proceedings in respect of some of their later patents, and an action against the British Radio Telegraph & Telephone Co., Ltd., will probably be heard by Mr. Justice Parker about next December. The Marconi Co. allege infringement of their patents Nos. 7,777 of 1900, 10,245 of 1902, and 4,593 of 1907, all granted to G. Marconi and the company. The first patent describes the use of a transformer between the aerial and oscillator circuits, the periods of oscillation of these circuits being the same or harmonics of each other, and the use of similar receiving transformer circuits tuned to the transmitting circuits. The second patent is for the well-known magnetic receiver, comprising a band of iron subjected to the influence of a varying magnetic field, a coil round the band through which the received oscillations are passed, and a second coil connected to a telephone. The third patent is for a high-speed toothed-disc machine for producing electric discharges at a very high frequency.

It appears that the British Radio Telegraph Co. have equipped the s.s. *Nonsuch*, of Messrs. Bowles Bros., London, with a wireless outfit to which the Marconi Co. take exception, as they deem it an infringement of these three patents. On the other hand, the British Radio Telegraph & Telephone Co., while refusing to admit that they have infringed the patents in question, contend further that these patents are invalid, and have a whole budget of prior patents by Sir Oliver Lodge, Dr. S. P. Thompson, F. Braun, Nikola Tesla, Prof. E. Wilson, and R. Scharf, and also a number of other publications, which, in their opinion anticipate Marconi. They are prepared to indemnify users of their apparatus against any claim in respect of the Marconi patents. The Marconi Co. are also instituting proceedings against the United Wireless Telegraph Co. of New York for infringements of patents Nos. 12,326 of 1898 and 7,777 of 1900, and are warning users of wireless telegraph apparatus that they are liable to an action for damages if they employ apparatus which infringes the Marconi patents.

Telegraph Traffic.—The cable between Gibraltar and Tangier broke down on the 10th inst. The Malta-Tripoli section has not yet been put into working order, and the Assab-Perim cable, which has been down since July 8th, 1909, also remains in that condition.—The various restrictions in connection with communication in Central and South America still hold.

Parliamentary.—The London County Council Tramways and Improvements Bill came before a House of Commons committee on Thursday, and consideration of it is being continued. The Bill contemplates an expenditure of £931,335 for the construction of new tramways, the reconstruction of horse tramways, and the widening and making of new streets. The Bill is opposed by the Borough Councils of Islington and Lambeth, the Gas Light & Coke Co., and owners of property along the proposed routes. The first line considered was one between Brixton Hill and Herne Hill, joining up with the Norwood tramway line. Further evidence was given on Saturday and on Monday, and the committee was adjourned.

The Metropolitan District Railway, the Metropolitan Railway, and Wimbledon and Sutton Railway Bills were read a second time in the House of Commons on Thursday.

The Weston Cell.—A Paper entitled "The Limitations of the Weston Cell as a Standard of Electromotive Force" was read by Mr. S. W. J. Smith recently before the Physical Society. Experiments on cadmium amalgams are discussed from the point of view of the modern theory of alloys. Theory and experiment alike suggest that there is no range at any temperature over which the E.M.F. of a Weston cell is absolutely independent of the percentage of Cd in the amalgam. Even if the materials are quite pure, the existence of surface energy must cause some variation. Within the range over which the E.M.F. is usually taken as constant the E.M.F. appears to rise, very slowly, with increase in the cadmium content. The rate varies, but is never more than a few millionths of a volt for one per cent. Cd. From the data it seems possible also to discover the precise way in which the use of the richer two-phase amalgams may lead to variability of the E.M.F. of the Weston cell. The interpretation advocated is that the irregularities are due to electrolytic skin effects arising out of want of uniformity of composition of the surface grains. The probable reason why the temperature coefficient of E.M.F. of a Weston cell, always small, actually vanishes near 0° C. is indicated. An outline of the way in which the phase rule can be used to exhibit the nature of the incomplete equilibrium of the Weston cell is also given.

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CONGRESS OF THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION

THE annual Congress of the Tramways Association, which was to have been held early in May, but was postponed owing to the death of the King, was held in Dublin on Thursday and Friday of last week. The first day was devoted to the reading and discussion of Papers, and the second to visits to works, &c. Abstracts of the Papers and discussions are given below:—

The Dublin United Tramways.

The Paper by Mr. R. S. TRESILIAN (Secretary to the Dublin United Tramways Co.), read on the Thursday, describes the development of the Dublin tramway systems from 1867 to the present day. After giving some notes on the original horse tramways and the gradual amalgamation of the various companys (one of which, the Dublin Southern Co., converted a portion of their system to electric traction in 1896) into the Dublin United Tramways Co., he recounted the events leading up to the granting, in the year 1897, of an Act of Parliament authorising the use of electric traction on all the lines. The work was carried out with Mr. H. F. Parshall as consulting engineer. The Ringsend power station was set to work in August, 1899, and in June, 1900, practically the whole system was worked by electric traction. The present rolling stock, continued the author, comprises 314 cars, all of the double-deck type, and six new double-deck cars fitted with Hurst-Nelson bogie trucks and G.E. 80 equipments, are in process of construction at the company's works at Inchicore. In 1901 it was decided that all the power should be generated at Ringsend, and the Clontarf and Balls Bridge stations were closed down. In the half-year ended 31st December, 1901, 46·34 miles were open for service, 23,816,084 passengers were carried, an average of 129,380 per day, and £128,416 was earned.

The Ringsend station is on the bank of the Grand Canal Dock and coal is obtained from barges thereon by a grab, trucks, and conveyor. The engine-room plant consists of six 700-b.h.p. Allis's engines of the vertical cross-compound type, running at 90 r.p.m. The flywheels are 19 ft. in diameter, and weigh 31 tons each. Five of the engines have keyed on to their shafts 10 pole 550 kw. continuous-current generators, and the sixth engine drives a 2500-volt three-phase alternator of like capacity. Since the opening of the station, one of the engines has been fitted with a three-phase alternator in addition to the original D.-C. generator. This was done by removing the flywheel and erecting a flywheel alternator in its place. In 1907 a 1,000 kw. Willan-Parsons turbine with Westinghouse alternator was installed. A 250 kw. rotary convertor by the B.T.-H. Co. forms a connecting-link between the systems. The switchboard is of the B.T.-H. Co.'s manufacture. The sub-stations at Blackrock, Dalkey, and Clontarf differ only in capacity. That at Blackrock contains three rotary converters, each 200 kw. capacity, and nine single-phase 80 kw. transformers. The rotaries are of the six-pole type and run at 500 r.p.m. The cables from the power station at Ringsend are laid in cement-lined iron pipes bedded in concrete. Both the high-tension and feeder cables are carried in these, there being two high-tension cables from Ringsend to Clontarf, three to Blackrock, and one from Blackrock to Dalkey, and 19 feeder cables feeding the 19 sections into which the system is divided. The cables are paper insulated and lead covered. Where the traffic is heavy, No. 00 Phono-Electric trolley wire is employed, as this wire has been found to give very little wear even with a fast service of cars operating, and does not become crystalline. In outlying districts the wire is of hard drawn copper, most of it of 00 B. and S. gauge. All trolley wire is anchored at each suspension after it has been in service for two years, thus preventing broken wires from falling in the street.

The company has since 1883 conducted a parcels delivery system, not only over its own lines but in conjunction with the Dublin and South-Eastern Railway Co. to about seventeen miles south from Dublin, and has instituted a system for haulage of goods, minerals, &c.

Concluding, the author states that for the half-year ended the 31st December, 1909, the receipts, including those of the Clontarf and Hill of Howth Tramroad Co., which is now worked by the Dublin United Co., amounted to £152,952 7s. 8d., and the passengers carried to 27,119,849, an average of over 147,000 per day, the mileage operated being over 54 miles.

Brake-Shoe Standardisation.

Mr. J. A. PANTON (chief assistant engineer, Liverpool Overhead Railway), in his Paper on the above subject, pointed out that as the outlay on brake-blocks often amounts to 10 per cent. of the car maintenance, more attention should be paid to the amount of material scrapped in discarded brake-shoes. At the present time some 40 to 60 per cent. of the material received is returned to the scrap heap. The brake-shoes are not nearly worn out, but are worn to such an extent that their consignment to the scrap heap is a wise precaution against accident. It is found that a soft cast-iron shoe in cooling after a hard and heavy application takes a sharper curve on the face than on the wheel, and when re-applied, unless thick, will crack and break off. A few years ago blocks were frequently made in one solid piece, so that the brake-block itself could be attached direct to the truck lever. However, this method increased the weight of that portion of the block that goes into scrap, and it also required more time and labour in changing. Again, blocks are frequently found worn thin at one end, while the other end has barely been in contact with the wheel, and it is safe to say that not more than two-thirds of the available material is usually worn away. Brake-blocks, according to their material, are classed by the author as follows:—The first class covers the soft iron shoe, which is the most efficient though least desirable, on account of rapid wear. The second class embraces the part chill and composite shoes with hard and soft inserts, which occupy a useful and intermediate position in braking efficiency and durability. The third class includes heavily chilled and white iron shoes, which are the least effective in braking, though most durable.

In dealing with the co-efficient of friction, the author makes the following remarks:—The importance of determining the effect upon the wheel becomes apparent when one considers the possibility of a shoe showing a high resistance to wear, which may, in fact, be protected at the expense of wear upon the wheels. It is suggested that a specification should be framed on these lines, covering frictional qualities of brake-shoes provided that shoes when tested shall give results as follows:—Upon a chilled wheel in effecting stops from a speed of 35 m.p.h. a mean co-efficient of friction of not less than 22 per cent. when the brake-shoe pressure is 2,800 lbs., and a steel-tyred wheel in effecting a stop from a speed of sixty miles per hour, a mean co-efficient of friction of not less than 18 per cent. when the brake-shoe pressure is 2,800 lbs., or an average of 20 per cent. for all purposes. That the rise in the value of the co-efficient of friction at the end of a stop shall be within such limits. That the value of the co-efficient of friction for a point 15 ft. from the end of the stop shall not exceed the mean co-efficient of friction by more than 7 per cent.

The author is of the opinion that while a high co-efficient of friction is in the abstract a desirable characteristic to be possessed by a brake-shoe, operating conditions make uniformity of action desirable for the purpose of securing uniformity both in time and intensity of its action, in order that the surging of trains and trailing cars may be prevented.

Improvements in brake-shoe heads have been made in the past by separating the head from the shoe, accomplishing a saving in first cost and scrap weight, but the practice still remains expensive on account of lack of interchangeability. Under heavy breaking conditions, malleable iron holders take a permanent bend or set much to the detriment of shoe wear and braking conditions. Within the last two years steel back brake-shoes have been introduced. The best argument in favour of steel back shoes is that they can be worn down very thin without danger of breaking and causing derailment of the car.

The comparison of wearing properties of different shoes is only possible under standardised conditions, and comparisons should be made not on the basis of cost per thousand car miles, but on the basis of percentage of metal worn. The standard brake-shoe should be one-third the diameter of the wheel tyre (within reasonable limits) and applicable to any wheel from 30 to 33 in.

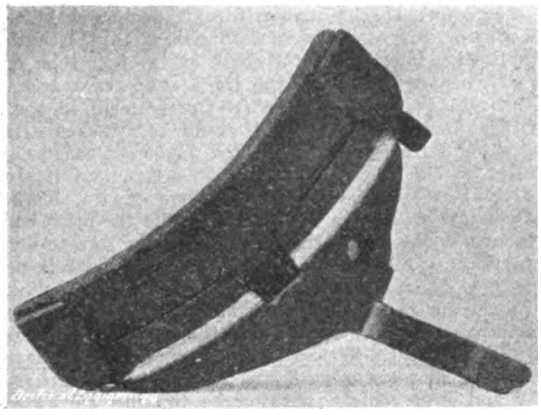
The pressure applied to the brake-shoe should not exceed 75 per cent. of the total weight of an empty car. The gearing should be arranged to obtain the pressure with a standard pull of 50 lbs. applied by the driver. Whatever the pressure the results clearly distinguish between the slow-wearing and the rapid-wearing shoe. All shoes wear more rapidly on a steel-tyred wheel than on a cast-iron wheel. In general terms, it may be said that for the absorption of a given amount of work, the wear on brake-shoes upon the steel-tyred wheel is twice as rapid as upon a cast-iron wheel. A standard shoe should develop for

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each pound of metal worn away 350,000,000 ft. lbs. of work in contact with a cast-iron wheel, and 200,000,000 ft. lbs. of work in contact with a steel-tyred wheel.

Standardisation does not mean standard material, but does mean standard dimensions for all classes of material to suit the different conditions, and to attain the standard co-efficient of friction and wear herein described.

In the author's proposed standard brake-head and brake-shoe shown in the figure, the plan contemplates keying the contacts at the centre lug of the brake-head, while the ends of the brake-head fit close to the full length and width of the brake-shoe back, that function being a great support to the shoe. The



PROPOSED STANDARD BRAKE SHOE.

raised recess at each side of the iron lug, in conjunction with the end abutments, is merely to keep the shoe in vertical alignment, and should fit the holder and lug so snugly as to prevent any upward or downward movement of the shoe, the centre lug transmitting the load directly to the beam, by virtue of the usual wedge-shaped key. It is important also to notice that the brake-head shown has been so designed that however much the block may be worn, the brake-head cannot be injured. Some unnecessary metal has been removed from the flange and back of shoe. The author believes that better results in braking would be secured if all the braking were done on the tread of the wheel, and none on the flange.

The author estimates that the universal adoption of the standard shoe would effect a saving of 50 per cent. in the material scrapped.

DISCUSSION.

The discussion opened with a contribution from Prof. ERNEST WILSON, who gave results of some experiments at King's College on the efficiency of geared brake spindles, from which it appeared that, with 50 lbs. pull on the handle, about 16 per cent. of the pull would be taken up by friction.

Mr. J. R. SALTER (General Manager, South Lancashire Tramways Co.) said that the number of car miles which could be run with a set of brake blocks depended too much upon the nature of the track and the human element for accurate comparisons to be possible.

Mr. EDWARDS (Resident Engineer, South Lancashire Tramways Co.), in a written communication, said that the cost of brake maintenance given by the author, viz., 10 per cent. of the total cost of car maintenance, was very high, and on the S. Lancashire Tramways the corresponding figure was only 2·2 per cent., or 0·012d. per car mile. He considered 2¼ lbs. of scrap shoe cutting matters rather fine, as it only left $\frac{1}{16}$ in. thickness of metal for tread of shoe. They had used both cast-iron and cast-iron with metal inserts, and both cost the same for maintenance, although the life of composite blocks was 9,000 car miles, as against 4,000 for cast-iron. Composite blocks were better on wet, greasy rails.

Mr. F. SAUNDERS said that soft cast-iron for brake blocks could be obtained for £5 7s. 6d. per ton, and chilled £8 10s.

Mr. R. J. HOWLEY (British Electrical Federation) said that undertakings would greatly benefit if managers would agree to standardise. The design of brake shoes was an important matter, and they should be so designed that it would not be necessary to scrap a large amount of metal at each renewal. It was also necessary to study the personal comfort of the passengers. In his experience they did not always obtain the best results from chilled blocks, and he preferred best grey cast-iron.

Mr. A. A. BLACKBURN (Car Works Superintendent, Belfast Corporation Tramways) said that data obtained in connection with work on the Liverpool Overhead Railway was in no way comparable with street tramways. In Belfast they found the wear of brake blocks was different on different routes, depending upon gradients, condition of track, and material of road surface. Mr. Blackburn instanced one route near the seashore where the wear was very heavy, due to sand blowing on to the track. He did not think that the brake shoe caused wear on the wheel flanges, and thought such wear was caused by the track.

Mr. MCCULLAGH (Liverpool) said great difficulty was sometimes experienced when changing drivers from light to heavy cars. The coefficient of friction should be a fixed quantity, and the life of blocks would depend upon weight of car.

Mr. J. A. PANTON, in reply, said the figure given in the Paper, 10 per cent. of the cost of car maintenance, was the result of standard American practice. His brake blocks cost £10 per ton, but he maintained it paid to use them in preference to other patterns.

Tramway Economics.

This Paper by Mr. J. R. SALTER (General Manager, South Lancashire Tramways Co.), dealt with some general points connected with the commercial principles upon which tramways are run. It was pointed out that although in the relations between standing charges and running expense there was much analogy to electric supply undertakings, the effect of load factor was not so great as the capital cost that has to be incurred for dealing with the heavy hours of the day, is a small proportion of the whole. The author gave a series of curves showing the relation between car miles run per route mile and headway in minutes, the proportional cost of running and standing per car mile, assuming certain figures for the sake of comparison. The curves showed that with a less frequent service, the standing charges represent a rapidly increasing proportion of the total cost per car mile, whilst with a more frequent service, the standing charges represent a rapidly decreasing proportion of the total cost per car mile. There is a critical point in the service at which the standing charges per car mile are equal to the running costs per car mile, this point on the curve being at a 14 minutes' service. Again, the increase in the total costs per car mile above the critical point is very much more rapid than is the decrease in the total costs below the critical point, and in consequence the more frequent the service, the less important do the capital charges become.

It is also apparent from these curves that with the rapidly increasing capital charges due to the reduction in the service, and with a practically constant running charge, that the less frequent the service, the less is the proportion or percentage of the working expenses to the total costs or equivalent gross receipts; and as a corollary, the more frequent the service, the greater is the percentage of the working expenses to the gross receipts to obtain a given result. It would seem, therefore, that tramway undertakings must look rather to an increase in the gross receipts by increasing the car mileage, and thus reducing the standing charges than to a reduction in the working expenses to improve their financial position.

The curves also show the error of striving after high receipts per car mile. In all these considerations, the number of car miles per route mile per annum seems to be the determining factor, and Mr. Salter considers it extraordinary that so little use is made of this factor. He thinks that this figure could well be introduced into tramway accounts, and divided by 10,000 could be called the density factor.

The next point considered is the question as to the point at which, having regard to the increasing capital charges, with a reduction in the service, the construction of a tramway is justified. With a service of this character, and with the fares obtaining in this country, it is unlikely, except in very special circumstances, that the receipts per car mile will exceed 11d.; this being the case, it would appear on the basis of the curves that an average 17½ minutes' service is in the neighbourhood of the limit at which a tramway undertaking can be remunerative. The question then arises whether such methods as motor-omnibuses or railless traction systems can be employed, but it is pointed out that such figures as 11d. per car mile can only be attained with the large carrying capacity which a tramway offers for dealing with "rush" traffic, and examples are given to illustrate this. It would therefore seem, continues the author, having regard to the fact that the carrying capacity of any self-propelled vehicle is only half the carrying capacity of a tramcar, that at least double the number of vehicles will have to be provided. With motor omnibuses it is unlikely that the expenses per car mile will be less than 10d., and to compare, therefore, the expenses of running such a system with that of a tramway, the cost per car mile for operating must be doubled to provide the seating capacity. Although, therefore, the motor omnibus is relieved from many of the capital charges which are so serious to a tramway with a small service, the working expenses are so high that this method of transit is not as remunerative as a tramway, even at a 30 minutes' service. It must not, however, be overlooked that the provision of the two 'buses, or the splitting up of the capacity, would result in a very much quicker service, and would undoubtedly conduce towards increasing the number of passengers during the slack periods.

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With the railless traction system, the carrying capacity is only about one-third that of a tramcar, and the expenses on this system may be assumed at 5½d. per car mile; but in this case, if we are to provide for the excessive carrying capacity to obtain the average receipts, we find again that the systems are incomparable until a 30 minutes' service is reached.

This therefore leads to the conclusion that tramway undertakings need have no fear of being replaced by self-propelled vehicles unless the cost of operating them is reduced at least one-half, or unless, with the same operating costs, the carrying capacity can be doubled, until we arrive at a 30 minutes' service, assuming that the same fares are obtainable in each case.

The Paper concludes with a recapitulation of some of the terms of the Act under which through running between Bury, Heywood and Rochdale is conducted.

DISCUSSION.

The discussion was opened by Mr. C. W. MALLINS (General Manager, Liverpool Corporation Tramways), who went into the qualifications required by a successful tramway manager, and considered that commercial training was of more importance than engineering knowledge. With regard to the doctrine laid down that tramway undertakings must in the future look rather to an increase in the gross receipts by increasing the car mileage, thus reducing the standing charges, than to a reduction in the working expenses, to improve the financial position, he was of opinion that a service should not be increased or diminished on any given system or route except after a careful scrutiny for a considerable period of the car mile earnings per hour of the working day, and whenever the receipts are found to exceed a certain figure the service should then be increased, and where they fall below a certain figure the service should be decreased, unless there is some special reason for doing otherwise. He heartily agreed that any less frequent service than 17½ minutes would not justify the building of a tramway with any hope of financial success.

The discussion was continued by Mr. Jas. Devonshire, Mr. Stephen Sellon, Mr. H. E. Blain, Mr. J. Hatton, and Mr. W. Clough, and most of the speakers differed from Mr. Mallins regarding the qualifications necessary for the successful tramways manager. The question of traffic load factor was also discussed, and one speaker remarked that if all the vacant seats in their cars could be filled during off hours at ½d. per head they would reap a rich harvest.

Mr. SALTER, in reply, said that he thought the fact that some tramway systems were managed by men who were not engineers only went to show the disadvantage under which these particular systems were worked, and therefore they were entitled to extra credit for the good results they had achieved under such an adverse circumstance. Regarding the question of traffic load factor, he thought that, considering that 80 per cent. of the takings on most tram systems consisted of 1d. fares, not much could be done in increasing the revenue by granting cheap fares at certain periods of the day.

Railless Traction.

The Paper on this subject by Mr. H. ENGLAND (General Manager, Wakefield & District Light Railway Co.) commenced by giving a few figures, from which he argued that owing to the larger influence of the standing charges on the costs per car mile as the service is less frequent, no tramway service under ten minutes minimum average can be expected to pay under ordinary circumstances. Motor 'buses as a substitute are dismissed in very few words. The author admits that given long-distance fares and suitable running conditions they can certainly pay, but considers that it has been many times demonstrated that such services are not financially successful when dealing with short-distance traffic.

Passing on to "railless" traction, mention is made of the early attempts in Paris, and of the lines at present at work or under construction on the Continent. These include eight lines, aggregating some 60 miles, on the Filovia system in Italy, five Austrian examples of the Mercédès-Stoll system, and seven German lines, and one French line on the Schiemann system (the last ground including some goods lines opened as early as 1903).

The Filovia System employs two 12-h.p. motors mounted on the chassis, one driving each rear wheel through gearing and a chain. The controller of the series-parallel type is fitted with magnetic blow-out, and is provided with five forward contacts and reverse. There are two mechanical brakes and an electric brake. The chassis is fitted with a single-deck body, seating 24 passengers, and weighing, with passengers, 53 cwt. A speed of 18½ miles on level roads is obtained, and half that speed up a grade of 5 per cent. The trolley, built on the "Cantono" patent, consists of an ordinary trolley boom with a head consisting of a four-wheled truck affixed by means of a ball socket joint.

The chief feature of the Mercédès-Stoll system is the use of 20-h.p. gearless motors built into the wheels of the same pattern as used in the Mercédès electric automobiles (*see* ELECTRICAL ENGINEERING, Vol. I., page 690). The cables are carried through the interior of the axles, and the motor armatures are keyed to the axle. The controller has six forward positions; three series and three parallel, and three positions for reverse. Three brakes are fitted; an electric brake and two mechanical brakes. The body in use in Vienna is constructed to seat twelve passengers, and standing-room is provided for twelve more. The car complete weighs 2½ tons. The trolley consists of a frame or carriage fitted with four wheels. The wheels run on the tops of the wires, and the current-collecting device is attached to the car by means of flexible cables. A pendulum weight is attached to the centre of the trolley carriage to keep the carriage balanced, and the wheels well pressed down on the wires. The conducting cable is wound round a small drum which is mounted upon the chassis, and about twelve yards of spare cable is carried which can be played out to allow the car to run on the whole width of the road. The Schiemann system uses a single 22-h.p. motor on the front forecarriage, and usually has iron tyres on the rear wheels.

The Paper then gives particulars of the Railless Traction Co.'s demonstration car at Hendon, which was fully described and illustrated in ELECTRICAL ENGINEERING, Vol. V., page 855. In this case the chassis follows the design of the usual motor omnibus chassis, and wheels with single solid rubber tyres on the front, and twin tyres on the rear, are employed. Two 25-h.p. motors, mechanically independent, each motor driving one-half of the counter shaft through bevel gears, are used. A controller of the series parallel type is fixed, and foot and hand brakes are provided for the driving wheels and counter shaft. A single-deck body, with seating capacity for twenty-four passengers, is used. The trolley of the double pole type is fitted with a head of new design. The company state they are about to place on the market heads of different patterns; one head carrying three trolley wheels, the two outer wheels of which are connected, both making contact with positive wires, and the centre wheel with negative wire. Another design employs two trolley wheels, one for positive and one for negative wires.

The author considers the last system the most up-to-date and best adapted to British requirements, and points out that the company has attempted to avoid any risk of "live" cars by designing a three-wheeled trolley head mounted upon two connected trolley booms; the two outer wheels being for positive wires and the inner wheel for the negative wire, the idea being to connect the steel frame and metallic parts of the car through the trolley wheel to the negative wire. This construction necessitates the use of three wires instead of two, and six instead of four, which is expensive and objectionable. The company has devised an alternative design employing a head with positive and negative trolley wheels, and using two wires only; and an arrangement is fixed to give audible warning should the polarity of the wires be through any cause reversed.

The author estimates that a trackless trolley system can be fully equipped, provided current is purchased from a supply authority, at about £3,000 per mile of route, but, of course, much would depend upon the local conditions in each case. He then gives a table of estimated working expenses, adding up to 6·164d. per car mile (as against the average figure of 6·494d. for tramways). The above figure includes 1d. per car mile for tyre maintenance, and does not include any contribution to the county authorities for road maintenance. Mr. England sees great possibilities in the system for the conveyance of minerals and goods, and concludes by regretting that powers to operate railless cars have to be obtained by Parliamentary Bill. This fact is a serious stumbling-block to the development of railless traction. The cost of securing the consent of Parliament may cost as much as the equipment of a small system, and promoters will therefore hesitate before embarking upon any scheme.

DISCUSSION.

Mr. J. DEVONSHIRE (Chairman) thought the object of such a system would be for the purpose of making extensions in less populous districts, with a view to feeding existing lines, and that being so he was in cordial agreement with the author.

Mr. A. H. POTT (North Metropolitan Electric Tramways) said his company had carried out experiments with an electric trolley 'bus, and he suggested that the Mercédès system was the least desirable from an engineering point of view. A pioneer system such as this must be able to work in with an existing tramways system, and the Mercédès system was the least able to do so; they must be able to run on an ordinary trolley line. If such a system is to be cheap, the capital cost must be very low, and unless existing car sheds, overhead equipment, &c., can be utilised, there is nothing in the trolley 'bus. The author thought that trailer cars will be used, but had he considered the possible attitude of the Board of Trade and London County Council to such a suggestion? Regarding the author's figures, he had compared like with unlike; why, if corrugated iron car-sheds, wooden poles, &c., could be used for

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railless systems, could they not also be used for ordinary tramway systems? Repairs were given at 1·543d. per car mile, whereas probably tyre maintenance alone would exceed that figure, and surely the wear and tear of a motor-'bus must be much greater than a large car. In the case of the railless 'bus his company had tried, on an average route, the current consumption worked out at 1·8 units per car mile for a car capable of only accommodating 26 passengers, therefore there was no economy there. Generally the speaker was of opinion that the railless system would not be extensively adopted.

Alderman IVEY (West Ham) referred to the possibility of undertakers using this system having eventually to pay road maintenance through the districts run.

The Tramways Act of 1870.

A short Paper by Mr. FRED COUTTS (General Manager and Engineer to the Paisley District Tramways Co.), entitled "Should the 1870 Act be Revised?" pointed out the necessity for simplifying Parliamentary procedure in relation to the construction of tramways, and the anomaly of having to carry on electric tramway undertakings under the Tramways Act of 1870. This Act had never undergone any modification, and had become so obsolete as to render it only fit to be included in the list of Parliamentary Acts which have now ceased to be of practical use. The period of twenty-one years as the period allowed for purchase by the local authority he suggested should be increased to forty-two years, as although, in some instances, a longer period than twenty-one years was allowed, this concession had invariably been dearly bought for the local authorities. Clause 5, which compels promoters to secure the consent of two-thirds of the local authorities concerned, should be cut out, as also should Clause 9, which prevents a tramway being laid with less than 9 ft. 6 ins. of roadway between the outer rail and the footpath, if one-third of the owners or occupiers object. Mr. Coutts laid stress upon the question of cost of the upkeep of roads, and pleaded for some relief from the present compulsion on the part of tramway companies to maintain the whole of their tracks, in view of the fact that the cars caused wear only upon the rails. At present the tramway track was being maintained for the benefit of the other users of the roads; frequently a motor omnibus company, and any large horse contractor, could tell that he can, wherever a tramway track is laid, increase his load by at least 25 per cent. The paper also suggested a few clauses that might be inserted in the Act in the interests of the travelling public; for instance, all other vehicles should be compelled to carry front and rear lights, and all slow-going traffic should keep clear of the tramway track. The appointment of a committee to devise a scheme which should be placed before Members of Parliament was urged.

Students' Section of the I.E.E.—The sanction of the Council has been given for the students' annual visit to take place this year in Birmingham and the surrounding district. Permission has been obtained to inspect, among others, the following works:—The British Thomson-Houston Co., Ltd. (Rugby), Messrs. Siemens Bros. & Co., Ltd. (Stafford), Messrs. Alfred Hickman & Co., Ltd. (Bilston), The General Electric Co., Ltd. (Witton), Messrs. Bellis & Morcom, Ltd. (Birmingham), an electrified coal mine, the University of Birmingham, the Corporation Generating Station, Summer Lane, Birmingham. The party will leave Euston on Monday morning, July 25th, visiting Rugby on the way down, and will return to London on the following Saturday afternoon, July 30th.

A New Petrol Electric Motor-'bus.—A demonstration has been recently given of a new design of omnibus on the Pieper or "auto-mixte" system, which has been brought out by the Daimler Co., and contains many novel features. Two separate 12 h.p. "Silent Knight" engines are employed, one to drive each rear wheel through a worm gear, so that no differential is required. On the shaft of each engine is a machine which can be used either as a motor or as a generator to charge a battery carried on the vehicle, and a magnetic clutch. As in previous examples of the Pieper system, no change of gear ratio is made, but the extra torque for starting and hill-climbing is supplied by the motor, drawing current from the battery, while at times, of light load, or when braking electrically, it acts as a dynamo and charges the battery. The engines need not be kept running when the vehicle is standing, as they can be started up electrically with the car. Reversing is effected entirely electrically. The engines and "dynamotors" are placed outside the frame on each side of the vehicle, and the metal body is designed on engineering principles, and is integral with the frame. Wire wheels are used, and the whole vehicle has a lightness and compactness for the number of persons carried which has not been attained hitherto. Control is partly on the electrical controller and partly on the throttle. The vehicle is to be known as the K.P.L. Omnibus, as it embodies the patents of Knight, Pieper, and Lanchester. It is said to be practically noiseless, and it is hoped that even allowing for the battery, its upkeep will prove cheaper than the noisy gear-driven 'buses which throng the London streets.

THE USE OF PHOSPHAM IN METAL FILAMENT LAMPS

THE "Z" Electric Lamp Manufacturing Co., Ltd., have been successful in their opposition to the grant of a British patent to the Glühlampenwerk Anker Ges. of Berlin for a method of preventing the disintegration of metal filaments and consequent blackening of the bulb by the introduction of gaseous compounds, such as arseniuretted hydrogen or phosphoretted hydrogen, produced by placing certain chemicals in the bulb. Three mixtures were specified, each containing phospham, phosphorous, and either phosphorus- or arsenic-hydride. Disclaimers admitting the previous use of phorphoretted hydrogen and of gases produced by heating phospham were appended to the specification.

The application for the patent in question (No. 19,847 of 1908) was made in September, 1908, and an abstract appeared in ELECTRICAL ENGINEERING of Oct. 21st, 1909, p. 924, after acceptance of the complete specification by the Patent Office. Opposition was then entered by the "Z" Electric Lamp Manufacturing Co., on the ground of anticipation by their British Patent No. 21,654 of 1906 granted to J. Y. Johnson, which covers a process of decarbonising metal filaments by heating them in a gas produced by heating phospham. The introduction of phospham into the bulb in the form of a paste on the stem or supports, is described in this specification.

The hearing before the Comptroller took place last month. Mr. Gordon appeared for the applicants, and Mr. Walter, K.C., Mr. Colefax, and Mr. K. R. Swan for the opponents. Mr. Gordon argued that the opponents' patent was concerned with the extraction of carbon by the direct action of phospham, whereas the object of the applicants' invention was to prevent the disintegration of the filament whether carbon were present or not. This was done by setting up a permanent gaseous atmosphere from any one of the three mixtures described. In reply, the opponents argued that carbon was always present in metal filaments, and, if not the direct cause of blackening, had some effect on it. Phospham, in any combination, they argued, tended to prevent blackening. This argument was based on the decision of Mr. Justice Parker in the recent action for infringement brought successfully by the "Z" company against Messrs. Marples, Leach & Co. (see ELECTRICAL ENGINEERING, March 10th, 1910, page 171). The opponents also argued that their process left a gaseous atmosphere produced from phospham in the bulb exactly as claimed by the applicants. In his decision, refusing the grant of the patent to the Glühlampenwerk Anker Ges., the Comptroller, Mr. W. Temple Franks, stated that the important constituent in the applicants' mixtures was evidently phospham, and pointed out that phospham was not mentioned in their German specification. There was an absence of any definite statements as to quantity. Even if the "Z" Company's patent were based on an erroneous theory as to decarbonisation, the use of phospham had been shown to prevent disintegration and blackening, and he did not think a patent could be granted for a proper statement of the theory (assuming the Glühlampenwerk Anker Ges.'s explanation to be the correct one). He therefore refused the patent, awarding the opponents twenty-five guineas in respect of their costs.

Heating Apparatus and Electricity Supply.—A good many supply authorities are enquiring for heating apparatus to be supplied on special terms for assistance in creating interest in electric heating and working, and we understand that the British Prometheus Co. (Salop Street Works, Highgate, Birmingham) are willing to enter into negotiations on this subject with central station engineers in cases where the charge for current for heating purposes is sufficiently low to permit of electrically-heated apparatus being used at a reasonable cost. They naturally cannot make a hard and fast rule as to the supply of goods on approval, but they are prepared to submit definite proposals in each case on terms and conditions entailing very small initial outlay on the part of supply authorities, or to make up apparatus to meet special requirements at rock bottom prices.

The "Z" Metal Filament Lamp Patent.—In the Appeal Court on Saturday, a motion by Messrs. Marples, Leach & Co. (now Adnil Electric Co.), who have been held by Mr. Justice Parker to have infringed the "Z" Electric Lamp Company's patent No. 21,654 of 1906, was mentioned. The decision of Mr. Justice Parker is being appealed against, and Messrs. Marples, Leach & Co. asked for permission to put in further evidence. It was eventually agreed to allow the motion to stand over until the hearing of the appeal, when the point will then be raised. Mr. Terrell, K.C., stated that the Bergmann Co. of Berlin, who are the real defendants in the action, had since carried out experiments at a cost of £1,600, and it is desired to place the results before the Court.

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STREET LIGHTING

A PAPER dealing with several aspects of the street-lighting question, and entitled "Public Lighting from a Municipal Point of View," was read by Mr. J. Abady, chairman of the Works Committee of the Westminster City Council, before the Institution of Gas Engineers on Tuesday. Mr. Abady dealt first with the relative advantages of several forms of contract for street lighting from the points of view of the facilities for satisfactory observance of the terms of the contract; the efficient maintenance of the required standard of lighting; and the facility or encouragement for either party to take advantage, during the contract period, of the introduction of improved methods, to either reduce the cost of producing the light, or obtain a greater light for the same cost.

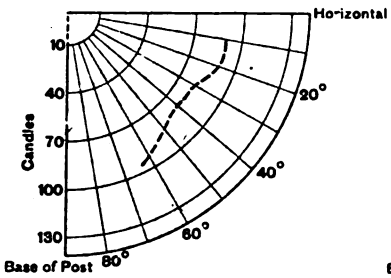


FIG. 1.—INVERTED BURNER IN LANTERN. 86 C.P.

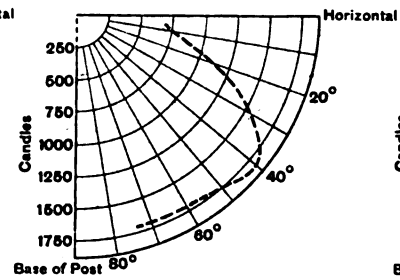


FIG. 2.—EIGHT-AMPERE FLAME ARC (OLD PATTERN). 1,435 C.P.

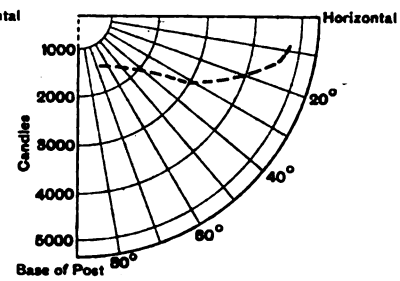


FIG. 3.—"EXCELLO," 660-WATT FLAME ARC, WITH DIOPTRIC GLOBE. 2,812 C.P.

The due observance of the terms of a contract for the supply of and payment by energy, maintenance being undertaken by the contractor for energy, hinged largely upon the facility for measuring the energy supplied, and there were objections both to the average meter system and to basing the charge on tests of consumption *in situ*. Again, in the case either of electric or gas lighting, there is not sufficient safeguard for the maintenance of the standard of lighting, nor inducement for the introduction of improved or more economical methods.

The form of contract which is for the supply of and payment by energy, maintenance being undertaken by a separate contractor acting for the municipality, or by the municipal public lighting department itself, was on a different footing as regards maintenance, for while the municipality has greater control over efficiency, the interests of the contractor for the energy are very much at the mercy of the municipality. If the maintenance contractor neglects the maintenance, the energy contractor suffers; while if the municipal lighting department (taking as it often does the energy from another municipal department which is in competition with a competitive form of lighting) is interested in doing what it can for its sister department, it is plain that the competitive form of lighting suffers, and real competition is at an end. With regard to the facility or encouragement to either party to introduce improvements which would reduce cost or increase the lighting without increase in cost—there is a position strikingly different to that under the first form of contract. Provided the contract does not limit the pressure of the gas supply, the municipality can obviously, if it chooses to pay for them, instal improved lamps and give its public a better light, without affecting the contractor's position in the least. What it cannot do, however, is to give the same light by the introduction of improved lamps, and reduce the cost of gas or electricity, and so reduce the cost to the public of its lighting bill.

The third form of contract to be considered was that for supply of light, payment being made for so much light irrespective of the energy required to produce it. The working of this form of contract depends largely on the nature of the clause relating to the testing, and the author puts forward a clause, of which extracts are given below. This is on the same general lines as that contained in the much-discussed Westminster contract, but differs slightly in the drafting.

The candle-power shall be arrived at by taking the average of two sets of readings in any position with regard to the light under test—one set at an angle of 20° and a second set at an angle of 50° to the horizontal. Not less than three and not more than six readings, at regular intervals of not less than thirty or more than sixty seconds, shall be made at each angle; and the average of the readings shall be termed the reading or illuminating power at that angle. If, upon a test being made, the illuminating power of any lamp falls below the prescribed standard and is not more than 10 per cent. below it, a test may be made of each of the two nearest lights; and if the aggregate of the light from the three lamps equals the aggregate required by the contract, no damages shall be recoverable. The tests only to be made in reasonably clear weather—not during rain, mist, or fog—and in the presence of a representative of the contractor should he so desire. The intention of this contract is that the contractor shall assure himself, by continued test and inspection, that the lamps he provides are, during lighting hours, fulfilling in all respects the requirements of this contract; and he shall not claim relief from the conditions of this contract on the grounds of non-notification on the part of the Council of any failure to comply with the terms of this specification.

Mr. Abady explains that the angles were chosen with a view to fairness to all forms of lighting, as it is found that in the majority of cases, of both gas and electric lamps tested, the mean of the light given at 20° and 50° practically coincides with the mean hemispherical intensity, and therefore represents the value as candle-power. Tests on a candle foot basis he regards as unsatisfactory for the purpose, as there would have been introduced all kinds of difficulties and problems (as to the behaviour of light rays with respect to surfaces and view point), about which photometrists themselves are not agreed. This form of contract also facilitates the adoption of improved methods, because if the contractor finds he can produce the same light at a cheaper cost, or a better light for the same cost, he would surely approach the corporation and offer to share the benefit of such improvement.

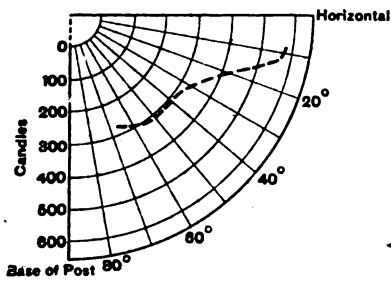


FIG. 4.—OPEN ARC, 500-WATT. 363 C.P.

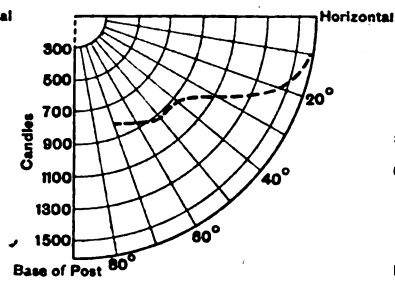


FIG. 5.—HIGH-PRESSURE UPRIGHT BURNER IN LANTERN. 1,193 C.P.

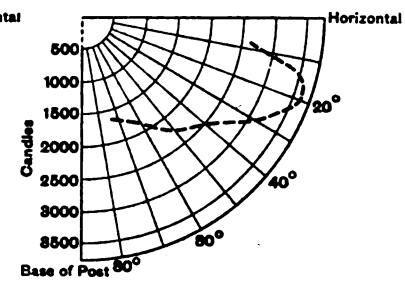


FIG. 6.—THREE HIGH-PRESSURE INVERTED BURNERS IN LANTERN. 2,965 C.P.

The author then passed on to the general consideration of the size, height, and spacing of lamps to obtain "adequate lighting." Tables of figures were given showing the relative influence of the height of the lamps and their distance apart upon the distribution of light. Further tables are given showing the relation between height of post and candle-power required.

It was pointed out that if lamps are so placed in the streets that the 10° ray of one lamp meets the 10° ray of the next, then one will be relying for the lighting of each area upon the unaided illumination of a single lamp, and the illumination on

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a line between the lamps will decrease in the porportion of 1 : 32 (with portions of the street having even less illumination) unless it can be corrected by either providing lamps with higher candle-power at 10° than greater angles of depression by the use of reflector or otherwise.

In this connection the accompanying polar curves are of interest :—Fig. 3 is from a 660-watt "Excello" arc lamp with dioptric globe; and it will be seen that this is entirely in the right direction, and that the light gets less and less as one approaches the angle nearest the column. Fig. 5 is from a high-pressure vertical incandescent burner; and Fig. 6 from a high-pressure 3000-candle-power triple inverted burner. It will be seen that here also the lighting curve is in the right direction, but not to the same extent as the "Excello" lamp. They contrast signally with the light curves of some of the other specimens, which comprise all types of light and are the diagrammatic representation of figures obtained, not from makers' but from independent tests. A bad example is Fig. 2—a flame arc without dioptric globe. That is the sort of thing which would give a mass of brilliant, dazzling, glaring light near the column and comparatively little in the midway position. A bad example of a gas lamp is Fig. 1—an inverted burner in lantern. Failing the possibility of making lamps with such a polar curve as will compensate for this disproportionate distribution curve, the only method of producing anything approaching even lighting is to bring the lighting units closer together, for it is no remedy to increase the power of the units on each column. It will also be possible to reduce the candle-power of the sources of light, because there is always an excess of light near the column on account of the initial candle-power necessary to give enough light at the distant points. A suitable arrangement (though not possibly an ideal one) of what might be termed "overlapped" lighting, is to plot the positions so that the 20° angle of one lamp meets the 20° angle of the next, or in many cases 15° will be sufficient.

The following examples of the lighting of the streets in the City of Westminster are of interest :—

Street.	Description.	Height of Light. (Approximate.)	Distance Apart. (Approximate.)	Approximate Arrangement.
Atterbury Street ...	60 c.p. Incandescent	12 ft.	130 ft.	10° meets 10°
Berwick Street ...	100 ,, ,,	12 ,,	80 ,,	15° ,, 20°
Bond Street	500 ,, Open arc	20 ,,	140 ,,	15° ,, 15°
Bow Street	100 ,, Incandescent	12 ,,	55 ,,	20° ,, 20°
Kensington— (Main Road) ...	60 ,, ,,	12 ,,	60 ,,	20° ,, 20°
Palace Street... ...	60 ,, ,,	12 ,,	90 ,,	15° ,, 15°
Princes Gate	60 ,, ,,	12 ,,	45 ,,	20° ,, 30°
Regent Street ..	3000 ,, Flame arc	23 ,,	170 ,,	15° ,, 15°
Sackville Street ...	100 ,, Incandescent	12 ,,	80 ,,	15° ,, 20°
St. George's Road ...	500 ,, Open arc	20 ,,	150 ,,	15° ,, 15°
St. James's Street ...	900 ,, Arc	20 ,,	145 ,,	15° ,, 15°
Shaftesbury Avenue.	100 ,, Incandescent	11 ,,	45 ,,	20° ,, 30°
Tachbrook Street ...	500 ,, Arc	20 ,,	150 ,,	15° ,, 15°
Tothill Street ...	60 ,, Incandescent	12 ,,	45 ,,	20° ,, 30°

INTERNATIONAL ELECTROTECHNICAL COMMISSION

THE first annual report of the International Electrotechnical Commission covers the work of this body up to the end of the year 1909. Fifteen committees are now constituted, and reports of their work will shortly be forthcoming. Reports on Nomenclature are now before the committees, and a large number of terms and symbols have been collected and agreed upon. (The first portion of the British collection was given in ELECTRICAL ENGINEERING, Vol. IV., p. 218.) With regard to the proposal of the British Committee on the question of the unit of candle-power (see ELECTRICAL ENGINEERING, Vol. V., pp. 619, 646), it is stated that, although this committee has informed the Central Office that it does not intend to take any further steps in regard to this proposal, a report on the subject will be issued. The question of international rules for electrical machinery will shortly be considered, and a report on the rules already adopted by various countries for continuous-current apparatus is now being prepared. The countries adhering to the Commission are America, Belgium, Brazil, Canada, Denmark, France, Germany, Great Britain, Hungary, Italy, Japan, Mexico, Spain, Sweden, and Uruguay. The Indian Government has made a grant towards the funds, and Austrian and Russian committees are practically formed. Two or three unofficial meetings at Brussels are being organised by the Belgian Committee for the purpose of giving members of the various committees an opportunity to become personally acquainted. These will be held from August 8th to 13th, and will assist in the preparation of the programme to be laid before the official plenary meeting of the Commission in Berlin next year.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

THE ENGINEERS' STANDARDISED PUBLICATIONS ASSOCIATION.—We have received from the Engineers' Standardised Publications Association (Craven House, Kingsway, W.C.), one of the Association's files, with the first batch of lists in the standardised form, together with a card index of the same. The lists in the electrical section include R. W. Paul's testing sets and other "unipivot" instruments; Messrs. D. H. Ponella & Sons' "Ampere" cells and lighting accessories; motors, starters, &c., of W. A. Stevens, Ltd. (Maidstone); Messrs. Purcell & Nobbs's "electroyl heaters," and the time switches of Messrs. Venner & Co. The other main divisions of the classification are steam, water, gas, oil, and air, civil engineering, mining, manufactures, machinery for various manufacturing trades, tools, and transmission machinery, and materials. Each section is further sub-divided.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

SWITCHBOARD INSTRUMENTS.—A new catalogue is to hand from Messrs. Crompton & Co., Ltd. (Salisbury House, London Wall, London, E.C.), describing new patterns of ammeters and voltmeters of both the moving coil and moving iron types for switchboard use.

METAL FILAMENT LAMPS.—The Foster Arc Lamp and Engineering Co., Ltd., are sending out copies of their metallic filament lamp showcard, measuring 11 ins. by 16 ins. It depicts the consternation of a meter reader at the effect of the introduction of these lamps on the quarter's consumption.

The South African Institute of Electrical Engineers.—The April issue of the Transactions of this institute contains a report of a Paper on the application of electricity to medicine and surgery with special reference to Roentgen rays and high-frequency currents, by Mr. W. H. Perrow, embracing a general survey of the subject, and including some interesting notes on a variety of applications.

The Electrical Industry and Tariff Reform.—On page 376 of our last issue, in our report of the discussion on Tariff Reform *v.* Free Trade, which took place on Monday, June 6th, by a clerical error the National Electrical Manufacturers' Association was referred to as the National Electrical Contractors' Association in the first line.

Wireless Telegraphy.—A wireless station with a range of 300 miles has been inaugurated at the Cape, and will be used for communication with the ships of the Union Castle line, all of which are to be equipped with wireless telegraph apparatus, and other steamships. There is already a commercial wireless station at Aden, and another is projected at Gibraltar, in addition to the Admiralty station.

Engineering and Scientific Association of Ireland.—The annual excursion of this Society, which took place on Saturday last, included a visit to the Great Northern Railway power house, Sutton, which supplies power to the Hill of Howth tramway service. The battery sub-station, which is provided with an E.C.C. booster for regulating the voltage supply to the cars, was also visited. The battery is also used for running the service at night.

Wavertree Telephone Exchange.—On Saturday last, the 11th inst., at 1 p.m., the National Telephone Co. transferred the subscribers connected to its Wavertree Exchange to a new central battery equipment installed in new premises at Wellington Road, Wavertree, Liverpool, which have been specially designed. The new equipment has been manufactured and installed by the Western Electric Co., Ltd., of North Woolwich, and is of the No. 1 C.B. type, consisting of 12 subscribers' positions, giving accommodation for 1,440 lines, four incoming junction positions, and one exchange testing position. The equipment is of similar design to those previously described in ELECTRICAL ENGINEERING.

The Electric Supply Publicity Committee.—A further issue of publicity matter has been made in the form of a four-page illustrated folder on ventilation, and a card for enclosing in correspondence on the uses of electricity for the seasons—the fan for summer, the radiator for winter, the griller and kettle all the year round. A certain amount of newspaper advertising has also been done in London dailies. The last effort in this direction took the form of two full-page illustrated articles dealing with the various uses of electricity in the home. These appeared in an evening paper consecutively about a week apart.

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PAPERS READ AT THE I.M.E.A. CONVENTION

COMMERCIAL ADVANCEMENT OF ELECTRIC SUPPLY.

By A. C. CRAMB.

(Chief Electrical Engineer, Croydon.)

Mr. Cramb commenced his Paper with a quotation from an article by an American engineer, in which he criticised the "procrastinating somnolence" of the electric departments in Great Britain. He insisted upon the necessity of a proper expenditure on business getting and a thorough scheme of organisation of the commercial side of the business modified to suit the conditions of each particular undertaking.

For undertakings of appreciable size, he advocated the appointment of a competent sales assistant, working immediately under the direction of the engineer-manager. At the moment, he said, there is a lack of suitable men, but "many engineers with natural aptitude for business getting would soon become fully competent to carry out this work if many posts with a sufficiently remunerative salary were offered."

The policy of Sheffield, West Ham, and Marylebone was cited as being the most fruitful in increasing business. The public who have been educated by the gas companies to expect to be able to buy, hire, and hire-purchase almost everything in connection with gas supply, naturally expected the same of electrical supply. But gas companies, he said (who generally supply under the condition that increases in dividend are co-dependent on a reduction in price to the public), rather than reduce the price of gas, use large sums of money in fitting up houses free, or nearly so, and in doing a great deal of work for the public with a view to keeping out the electric supply which generally has not such powers.

In the case of undertakings in which the business is confined to the sale of electrical energy, the author suggested a sales staff consisting of a sales manager at £150-£300 a year, and four district representatives £78-£104 and commission, or £120-£180), an advertising assistant (£100-£120), three specialists in power, lighting and signs, and heating and cooking, respectively at £120-£250 a year, a show-room attendant (£100-£150), and a clerk (£80), all working directly under the sales manager.

As commission for the district representatives, Mr. Cramb suggested 3½d. per 35-watt lamp, 2s. 6d. per B.H.P. in motors, and *pro rata* for heating and cooking apparatus. Each man should make an average of thirty calls per day, and a record should be kept of the number of calls per order for each man—in one case this works out at nine. The advertising assistant's salary is based upon literature and advertisements being arranged through the Joint Publicity Committee. The total cost of rent, rates, wages, advertisements, literature, and all other expenses of the commercial department are chargeable against working costs, in undertakings run on these lines, and the expenditure for commercial development under these conditions should be in the neighbourhood of 2 to 3 per cent. of the annual revenue.

When sales and installation departments are carried on, Mr. Cramb continued, the expenditure on sales, installation, hire, &c., should be covered by profits on this work, but the remaining expenditure, including publicity, should be charged to working expenses as in the former case. The suggested staff for a large town with a sales and installation department comprises a sales manager at £400 a year; an assistant manager at £200; four "experts" as before, but with separate experts for "lighting" and "signs"; a "business-getting representative" with a show-room assistant under him at £100 a year or £85 and commission; and five outside canvassers at £100 plus commission; construction and maintenance and dispatch departments under a construction superintendent at £200-£250 a year; a staff of four typists for the whole correspondence; and a publicity man at £120-£150 a year, with two assistants at 40s. and 10s. a week. The canvassers are to take orders both for electric supply and for the carrying out the work, and consumers generally prefer to have the whole business dealt with by one party. The experts will only be required in large undertakings, in others the manager or assistant undertaking the supervision of special work. The bonus, it is proposed, should be paid on net sales, disconnections being debited. On sales 2½ per cent. up to £450 turnover per annum, 5 per cent. between £450 and £750, and 7½ per cent. over £750. On hire and hire-purchases and maintenance schemes, the bonus suggested is 2½ per cent. on amount paid each quarter. On heating, cooking, and other special applications, 7½ to 10 per cent. Bonus on connections: Lighting, 2s. 6d. per kw. up to 5 kw. in excess 1s.; heating and power, 1s. 6d. per kw. up to 5 kw. in excess 1s.; cooking, 2s. 6d. per kw. up to 2 kw. in excess 1s. The bonus paid is less than in the previous case, as canvassers get a bonus on sales also.

The author next considered the charges that should be made to the convassers on hire and hire-purchase agreements. For hire he advocated a gross profit rental of 30 per cent., made up as follows:—Redemption of capital, 15 per cent.; interest, 5 per cent.; repairs and maintenance, 5 per cent.; contingencies and other charges, 5 per cent. The rental to include inspection and maintenance, but the hirer to be charged for any breakdowns not due to fair wear and tear, and fire insurance. For hire-purchase (two to five years) a profit of 15 per cent. over the list price of the motor should be taken, or, alternatively, 25 per cent. of cost paid in advance and the remainder in eight quarterly instalments. Arc lamps are hired at inclusive prices, and in one case the charge is £8 4s. per annum up to 800 hours' use per annum, payments to be made in advance, 2½d. per lamp per hour being charged for excess use. Hour meters are installed at small rental. Electric vacuum cleaners, hired, including delivery, at a rental of 7s. 6d. to 10s. per day, should have a fair demand. Sales should be strictly maintained at list prices except to the trade. Curves showing turnover, expenditure, and rate of profit are recommended, and similar curves applied to each canvasser.

The Paper next dealt with the arrangement of showrooms, and recommended that the collection of accounts should be made from these premises, consumers having to walk through the showrooms to reach the cashier. The author recommended the holding of exhibitions at intervals, the out-of-pocket expenses in connection with which should not exceed £50 to £100 if the exhibition does not pay its own way. Advertisements are recommended in the local Press, "backed up by chatty paragraphs on new apparatus or work carried out," and in church magazines; posters on hoardings, "which should be full of human interest and of artistic merit"; showcards distributed in contractors' windows; artistic calendars distributed to tradesmen; tramcar advertisements; and illuminated signs, "perhaps the most effective of all if properly thought out." In addition, Mr. Cramb advocates circular letters and pamphlets, and puts the expenditure for advertising and publicity literature in a medium size undertaking at only 0·3 to 0·5 per cent. of revenue.

The author then referred to the recently formed Joint Publicity Committee, representing company and municipal electric supply interests, which should save the time of the staffs of the various undertakings, as they will be able to purchase suitable literature from the committee; moreover, owing to the "literature" and posters being turned out in large quantities, a saving in cost will be made. This committee may, at a later date, act as a registry for the commercial staffs of the undertakings.

The Paper next described in some detail a card system in connection with the business-getting department. Among Mr. Cramb's other recommendations were that a close watch should be kept on new premises being erected, and that it is important to obtain early notice of premises let. Complaints should be received in a "sympathetic" manner. The sales manager should be kept in immediate touch with disconnection notices and reduced accounts. A list of unused services should be kept, and these should receive occasional calls. Considerable increase in lighting revenue can be obtained by two or three year hire-purchase of installations, and, if financially sound, certain hiring schemes will also assist. Quite 50 per cent. of small power users can only be obtained by a proper hiring or hire-purchase scheme. Certain small lines of heating and cooking apparatus, such as electric irons, should be vigorously pushed; these should be placed on 14 to 30 days' trial, and 60 per cent. to 80 per cent. should be sold. An electric iron should produce a revenue of 15s. to 25s. per annum. Electric cooking is retarded more by the initial cost of the apparatus than by the cost of current, and a progressive scheme of hiring out is necessary.

A few lines in the Paper were devoted to the attitude of the local contractors: "Attempts at a more active business development of the supply undertaking has been accompanied by hostility from the contractors. There are two alternatives for the future, either co-operative arrangements between the contractors and the supply authority, or a vigorously conducted sales department by the latter. The author is of opinion that the sales department would bring a more rapid increase of business, and must be the final solution of the problem, as already proved by the experience of the gas companies, but the former schemes being properly supported might produce useful results. If a co-operative arrangement can be effected, the supply undertaking should insist on seeing that, as far as their powers will carry them, good installation work is done and a fair price obtained. The canvassers should have a schedule of prices for estimating. Consideration of each other's interests must be shown. The supply by combining requirements and buying the best apparatus in large quantities would obtain the goods at a minimum cost, thus enabling fair profit to be made by the contractor, who could be supplied at almost cost price, and he would not have to carry a large amount of stock. Where the supply departments go in for installation work they should confine themselves to small orders, or where competition renders it advisable to displace rival apparatus. The difficulty of attempting co-operation, however, seems mainly to be due to trade jealousy amongst the various contractors in any particular district."

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NOTES ON THE COMMERCIAL PROGRESS OF ELECTRICITY UNDERTAKINGS.

By H. COLLINGS BISHOP.
(Chief Electrical Engineer, Newport, Mon.)

The following are the main points of Mr. Collings Bishop's Paper :—

At the present time no town need suffer from the want of advertising matter, as plenty can be obtained free from the various manufacturers if one is prepared to push their goods, and there is more than one company from which a supply of such literature can be bought. The author is of opinion, however, that the correct way to deal with the problem is to make up your own advertising matter to suit your special requirements.

The author has spent a good many years in America, but has not returned with the American idea of advertising, which necessitates dumping a postcard or letter on your breakfast plate every day until, from sheer exhaustion, you succumb and give an order. Introducing specialities is another matter, and can very well be done in the first instance by circular, to be followed by a call showing the article you want to introduce. When that article is likely to be suitable, such, for instance, as an iron, it should be left for a week's free trial. Nine times out of ten this will result in a sale.

It is no good writing to a man worth £2,000 a year suggesting, say, the purchase of electric radiators at 5s. a quarter, or to ask an artisan to buy cooking apparatus costing £30 or £40.

Canvassing is the most important of all the departments connected with the commercial development of electrical undertakings. Payment by commission should not, in the author's opinion, be indulged in. It leads to the temptation to get work whether the prospective consumer is financially sound or not, and dissatisfaction on the part of the canvasser if the customer is rejected. If a commission is necessary to make a man look after your interests get rid of him; he is no good to you.

Two or three years ago the Newport Corporation appointed a combined canvasser and illuminating engineer, and the appointment has been an unqualified success, not only in the way of obtaining new consumers, but in satisfying those who grumble. He has also been able to cover practically the whole of his salary by the casual sale, during his rounds, of lamps, irons, radiators, &c. The canvasser reports daily to the chief the result of the previous day's work, and generally discusses the work in hand. Close co-operation between the chief and the canvasser enables the man to give a customer a decisive reply without keeping him waiting whilst the matter is referred to the office. Where the canvasser has difficulty in persuading a man to decide, good is often done if the manager takes the trouble to see the individual himself; in the larger jobs the manager has to do a great deal of the negotiating himself.

There is no doubt that, were the field free, the electrical undertakings are in an excellent position for dealing with all the necessary installation work for their own consumers, and a good percentage of electricity users prefer that all repair and installation work should be carried out by the undertaking. Newport, which possesses full powers for dealing with all work connected with the undertaking, has so far rested content with carrying out such work as has been directly thrust in its way and in carrying out work under the hire or hire-purchase systems. The general run of work has been left to the contractor. The number of consumers who now send direct to the electricity department is, however, growing rapidly.

The properly trained and conscientious contractor has little to fear, but the man who becomes an expert in a night must, in the interest of the whole industry, go. A great deal of harm is also being done by some of the large plumbers and ironmongers, who often put on an inexperienced man as electrical foreman and leave the whole department to him.

To give one example: A small job of arc-light wiring was sublet to a local firm. The total run consisted of about 80 yards of cable. It was afterwards discovered that there were 21 joints (there were no branches), not a single one of which was either cleaned or soldered, and no attempt had been made to properly insulate the copper, save by a small quantity of sticky tape, bought for about 9d. per lb.

The author has yet to find the consumer who discards electric power once he has started, except due to failure in business or other like cause. It is necessary to run the hire department upon business lines. Ten per cent. to cover interest and all other charges, based upon the cost price, is bound to end in a loss to the department. In Newport there has been no difficulty in obtaining 20 per cent. return on the cost price.

It may be of interest to know the rates obtained in Newport for the hire of various sizes of motors. The figures given include a starter, switch and fuses, and wiring up to a run of 50 ft.

H.-P.	£	s.	d.	H.-P.	£	s.	d.	H.-P.	£	s.	d.
1 ...	2	17	6	10 ...	7	5	0	85 ..	18	0	0
2 ...	3	10	0	15 ...	9	15	0	40 ...	19	0	0
3½ ...	4	0	0	20 ..	11	10	0	45 ...	21	0	0
5½ ...	4	15	0	25 ...	13	0	0	50 ...	23	0	0
7½ ..	6	7	6	30 ...	16	0	0				

At the present time 283 arc lamps are on hire from the Newport Corporation. The whole of these lamps are maintained by the Corporation for an inclusive fee per hour (in use) for current and carbons. In addition to these there are 55 lamps owned by consumers, but maintained by the Corporation at a given sum per annum.

The rates charged in Newport are as follows :—

One 360-watt alternating lamp, 2d. per hour.

One 400-watt alternating lamp with metal core carbons, 2½d. per hour.

Two 400-watt alternating lamps with metal core carbons, 5d. per hour.

Four direct-current metal core carbon 400-watt lamps, 10d. per hour.

The above rates are for yellow carbons.

The rates charged for the hire of the lamps are as follows :—

One alternating lamp and transformer, £2 8s. per annum.

Two alternating-current lamps, £4 3s. per annum.

Four direct-current lamps, £6 18s. per annum.

The business done in the hire-purchase department has been fairly good, without unduly pushing it; if a consumer is prepared to buy outright he is left to the contractor. On the other hand, hire-purchase is popular, even amongst those who are able to pay outright, for the reason that they like to have the maintenance in the hands of the Corporation. The basis of charge is generally as follows, say for a five years' agreement :— Payments per quarter : one-twentieth part of the capital; 5 per cent. interest on capital not repaid; 5 or 10 per cent. on total capital for maintenance.

So many Corporations undertake installation work themselves that it is questionable if they are the right ones to do inspection of work that may be done by a competitor.

At Newport the charge for ordinary lighting is 4½d. per unit up to 1,500 units per quarter, and then 3½d. per unit. On a guarantee of 10,000 units per annum a net charge of 3½d. per unit is made for the whole quantity. Power users have special lighting rates that vary from the maximum down to a nett charge of 1d. per unit if sufficient power units are used. The power rates are first a general scale of 2d. per unit, falling as low as 1d. according to quantity; for a guaranteed 20 per cent. load factor, 1d., or with a guaranteed use of 100,000 units per annum, 1d. per unit.; by two-rate meter, 3d. per unit during the restricted hours and 1d. per unit during other hours; heating, 1¼d. per unit net.

Gas competition does not exist to nearly the same extent that it did a few years ago. There is no doubt that the advent of the flame arc and the metallic filament lamp has put quite a different complexion on matters. Where the competition really does exist is with the small consumer, who, at the present time, uses gas, oil, or candles. The competition in street lighting is dead. The advent of the flame arc for main streets and the high candle power metallic lamp for side street lighting has put the necessary finishing touch of superiority. One is able now to attack successfully that stronghold of the gas company, heating, and the gradual increased consumption in heating units that is being made each year is bound to tell in time.

In Newport considerable success has been obtained with prepayment meters, and 50 to 60 have been put out during the past seven or eight months. For the very small consumer, however, whose demand does not exceed two or three lights, the revenue allowed in the charge made is not sufficient to make a sufficient return on the cost of the meter, and the author now puts forward for consideration a scheme for the inclusive rental of wiring and energy, somewhat similar to that of the Fixed Price Light Co. (see ELECTRICAL ENGINEERING, Jan. 20, 1910, p. 39).

Briefly the scheme is :—To charge a weekly rental for current and hire of fittings; to use a cheap form of surface wiring; a variable weekly rental according to the time of the year; an arrangement by which all rooms can be wired and a varying rate charged according to the number of lamps it is desired to have power to light up at the same time; and a locking holder to minimise the theft of lamps.

The charges are based upon the following rates :—Charge for energy, 4½d. per unit; capital cost for wiring (without lamps), 10s. per point; capital cost for each service, 20s.; capital cost of the instrument to prevent the use of more lights at a time than are paid for, 15s.; collection charges, 1d. per house per week; annual allowance per lamp for renewals, 2s.

The average number of burning hours per annum taken is, for one point installed, 1,000 hours per annum; for two to six points installed and two lights permitted at a time, 1,300 lamp-hours per annum; for three, four, or five lights installed and three lights permitted, 1,500 lamp-hours per annum; for four lights installed and four lights permitted, 1,700 lamp-hours per annum; for five lights installed and five lights permitted, 1,900 lamp-hours per annum; for six lights installed and six permitted, 2,000 hours per annum.

The charges work out to from 7d. per week in winter and 4d in summer for one lamp, to 1s. per week in winter and 10d. in summer for six lamps permitted.

It is estimated that 100 consumers divided among the various classes will produce a revenue of £184 per annum, and that on the assumption that the 5,330 units consumed by them cost 0·75d. per unit to generate, and after allowing for interest and

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repayment on installation costs, services, and the proportion of plant and mains required (basis maximum demand 5·6 kw.), collection expenses and cost of lamps, £16; limiting apparatus, &c., £15; with a further allowance of 20 per cent. in extra units for waste, the net profit will be £56.

During the past three years the number of new consumers obtained at Newport has been 710, and the equivalent in 30-watt lamps, 74,800. The total revenue from sales and wiring (mostly hire-purchase), £8,101, and the total horse-power of motors connected has increased from 1,080 to 2,450.

The annual revenue now obtained by Newport for goods or maintenance of apparatus supplied under the powers required for the purposes of commercial development are as follows:—Annual receipts for motors on hire, £328; annual receipts for the hire of arc lamps, £461; annual receipts on hire-purchase account, £1,047; annual receipts for the maintenance of arc lamps, £380. Total capital involved, £8,800.

DISCUSSION.

Mr. A. H. SEABROOK (Chief Electrical Engineer, Marylebone) said he found it easy to get from 40 to 50 per cent. profit on his sales and installation department, and, this being so, no wiring contractor could have great cause for complaint as to undue competition. The period for hire-purchase should not exceed two years, unless there were very strong guarantees from the consumer. In this case, he would regard 25 per cent. paid in advance as a necessity, and not an alternative, as suggested by Mr. Cramb. He thoroughly agreed that sales should be strictly on a cash basis, except to the trade. On the question of circular letters, there was no doubt that a specially typed letter in every case was much more effective, but many engineers and managers disliked them because of the laborious task of signing each one. The remark had been made that morning that electricity was in its infancy, and the more he went into this question of commercial management, the more it was impressed upon him that we are in our infancy with regard to systems of charging and business-getting generally. For instance, although electricity supply had been going on in Marylebone for 25 years, less than 40 per cent. of the premises had services in, and not half of these were using electricity exclusively even for lighting. His opinion on the payment of canvassers was that they should be paid a small salary up to £2 a week, plus a commission. This was the only way in which to get the best work out of a class of men over whom it was very difficult to have any control. With regard to the basis of a hiring scheme, 10 per cent. return was insufficient. Such a scheme which he had introduced had been a total failure. His present return was between 50 per cent. and 60 per cent., and it was quite easy to get this. He assured Mr. Collings Bishop that gas competition did exist, in London, at any rate, where both public and private lighting was most vigorously competed for. The gas company arranged its prices in a very artful way, the annual charge including maintenance, and it was impossible to get at the price of the gas. In one case the gas company had gone so far as to assist the consumer in the cost of his electric motor to supply his compressing arrangements. He did not think that electrical undertakings would ever get at small property until a scheme were devised which abolished meters, and he instanced some one-, two-, and three-room tenement-houses in which the cost of the wiring was £150 and the cost of the meters £300.

Alderman J. W. CROWTHER (Sheffield) said that the experience of Sheffield was that periodical exhibitions were of greater value than permanent showrooms, and were less expensive. He was opposed to newspaper advertising, as no results had been traced to this in Sheffield. A large number of electric furnaces were now being erected in Sheffield, and supply was given at prices ranging from 0·6d. per unit to 1d. per unit. His committee were in a curious position, for after having paid £8,000 for the goodwill alone of the installation business of the old company in Sheffield, they had had a writ issued against them at the instance of the local wiring contractor, and it was still hanging over their heads. He agreed with paying canvassers salaries, and regarded the bonus system as mischievous. That there was need for even more commercial development in Sheffield was shown by the threat of the gas company to reduce their price to 11d. per 1,000 ft. The position in regard to this in Sheffield was that it was necessary to make the gas for the sake of the by-products, which produced more revenue than the actual sales of the gas, and even if they could not sell any gas at all they would still make it and blow it out into the atmosphere.

Mr. C. H. WORDINGHAM (Electrical Engineer-in-Chief to the Admiralty) thought Mr. Cramb rather overdid specialisation when he suggested a separate official for lighting, heating, and power, and imagined the feelings of a hairdresser who wanted 20 lamps, a radiator, and a motor to drive his hairdressing machinery. Surely a good all-round man could be procured who would carry through all classes of work. On the question of advertising, he objected to what he termed the Ally Sloper style of pretty pictures. Consumers wished to be told facts in a straightforward way, and electricity supply managers might perhaps do a great deal of good if they adopted the same style as the innocent articles in the newspapers which disinterestedly told how cheap gas was. We were not nearly so wily as the gas people. He also suggested keeping in touch with house agents in order to keep records of properties which were being let. Mr. Wordingham next championed the cause of the wiring contractor, who, he said, was the best canvasser of the central station. He did not think anything should be done to "get his back up"; in fact, it was unfair to poach upon his preserves at all. The wiring contractor was not treated, in the Papers, as he should have been. He also recommended that central station engineers should be allowed to undertake consulting work within their own area, rather than leave prospective consumers in the hands of wiring contractors for advice. Mr. Collings Bishop's advice, that a man should be paid a good salary, should be written in letters of gold in every committee room in the kingdom.

Mr. W. A. VIGNOLES (Chief Electrical Engineer, Grimsby) pointed out the possibility of a successful canvasser earning a larger salary than the manager of the undertaking if Mr. Cramb's scale of commission were adopted. The cost of the staff, under Mr. Cramb's scheme, would be about £2,000 per annum, which was out of the question for the average undertaking. He urged the Publicity Committee in London to bear in mind, in preparing their literature, that the provincial undertakings were not in exactly the same position as the London ones, and they ought to keep in touch with provincial engineers as to what their requirements are. He had been very successful in putting his canvassers on to particular trades, dealing with one at a time. A butcher, for instance, quickly adopted electric light if he was informed that the butcher opposite had done so. He did not think they ought to look for direct results from newspaper advertising, and looked forward to a universal scheme of newspaper advertising in the daily papers, on some joint basis. A great educational work could be carried out in this way. He had found a consumers' guide, in which was given particulars of lamps, wiring, &c., a great help—a kind of book of the words which was believed in by the consumers. He thought 20 per cent. on the cost price of motors hired out was too high, and further, consumers who had their motors five years ago would have cause to grumble now that the price of motors had gone down, as the amount they had to pay was very much more than that paid by present consumers.

Councillor D. LIVINGSTONE (Hull) urged electrical engineers to turn their attention to the smaller property as the most likely outlet for increased consumption.

Mr. F. AYTON (Chief Electrical Engineer, Ipswich) suggested a radical departure in methods of canvassing, viz., the employment of ladies. It was his intention to train some lady canvassers, who, he thought, would be better able to talk to the lady of the house than a man. At Ipswich they did everything they possibly could for the consumer, and did not consider the wiring contractor at all. A contractor desired to get in the largest number of lamps, and he advised the most expensive apparatus, which was all against the interest of the undertaking, because the consumer told his neighbours how expensive electricity was. The Ipswich sales department last year had a turnover of £3,043 for actual work done for the consumer, in addition to £500 for wiring. The cost of the staff was £300 per annum, which worked out at 1¾d. per cent. on the total revenue, or 10 per cent. on the installation department revenue. They did not carry out work under cost. With the best class of materials, the cost of wiring per lamp point was 8s. 9d. actual cost, and with establishment charges 9s. 8d. They charged 13s. 6d., but this did not include fittings. They tried to persuade every consumer to have a better method of illumination. Contractors, speaking generally, did not interest themselves in illumination; all they wanted were as many lamps and as many fittings as possible. He had in one case put in an improved system of lighting, with ceiling fittings, &c., and offered to take it out in three months if the consumer did not like it. But it was still in use. He could not understand why corporations owning tramway systems did not make use of their tramcar windows for advertising the electricity undertakings. Such methods as these, together with street lighting, made people think electrically, and that was going to do an enormous amount of good. He also adopted the plan of sending a man out with fans on hot days, and the other day he sold six fans in this way.

Mr. MARK RUDDLE (Chief Electrical Engineer, Dublin) remarked that it was of little use suggesting methods of developing electricity supply when so many corporations were debarred by law from adopting them. They ought to make a big effort to see that powers to undertake wiring and fitting were granted to every electric supply authority.

Mr. E. E. HOADLEY (Chief Electrical Engineer, Maidstone) spoke on the same point. It was not a question of municipal trading, but one purely of business. All authorities, municipal or company, should have these powers. A direction in which little progress had yet been made was in illuminated facia boards.

Mr. F. M. LONG (Chief Electrical Engineer, Norwich) said advertising was not so essential as the provision of attractive schemes to put before consumers. One which had been successful in Norwich was the system of charging on the rateable value of the house and one penny per unit. This enabled any class of apparatus to be used. He had also a scheme for selling metal filament lamps by quarterly payments which had been successful. The hiring of arc lamps had also been very successful in Norwich, the charge now being £5 per annum and 1d.

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per unit. In this way he had 400 lamps on hire, and about 125 lanterns with metal filament lamps. He did not think Mr. Bishop had allowed a sufficient number of units in his scheme for a fixed price.

Mr. A. C. CRAMB, in reply, said his scheme for a publicity department was arranged for a large undertaking, and could be modified for smaller ones. With regard to a scheme of universal advertising, it was the intention of the Joint Committee to initiate one, if all the undertakings in the country contributed their share of the cost. With regard to Mr. Wordingham's remarks concerning wiring contractors, he said that every engineer in the country would co-operate with the contractors if the latter would only concentrate their attention on the business. The present position seemed rather to be that the central station managers should sell the apparatus and the contractors should take the discount. He was entirely in favour of lady canvassers. On the question of wiring powers he asked if the wiring contractors were fair to the municipalities in regard to the Electricity Supply Act last year. It seemed absurd that in England there could be two undertakings side by side, one having authority to do wiring and the other being forbidden by law to do it.

Mr. H. COLLINGS BISHOP also briefly replied. He said his remark as to gas competition was to infer that it was not so great now, relatively, as it had been in the past. He thought it was best to be diplomatic with the wiring contractor. There was no good in throwing him over altogether. But the contractor did not go far enough, and they would have to take up the work in which he was lagging. Therefore, with every respect to the contractor, it was necessary for the undertakings to push the sales and hiring departments. The contractor did not worry much about auxiliary apparatus. In Newport, although the contractor had had the field to himself for years, heating and cooking apparatus were almost entirely absent until the electricity department took the question up. The rate of 20 per cent. on the cost of motors was fixed when the cost of motors was high, and it had not been altered. Tramcar windows were very difficult to get, as there was always a demand for them for advertising purposes. In answer to a question by Mr. Furness, Chief Electrical Engineer at Blackpool, Mr. Bishop said his fixed price light scheme contemplated running one service to supply a row of houses. He also proposed the use of current limiters as a means of reducing the waste.

After the conclusion of the discussion of these papers on Tuesday morning, the members and visitors were entertained at luncheon in the City Chambers, when a very large company were present.

In proposing the toast of the Association, the Lord Provost said that the best proof of the success of the Association was to be found in the fact that the charges for electrical energy for lighting and power purposes in all the principal towns were now sufficiently low to enable municipal supply undertakings to connect up all large works to their mains. Mr. W. W. Lackie, in reply, pointed out that when the Association met in Glasgow in 1901, the membership was 160. To-day it was 450, whilst the capital invested in municipal supply undertakings had increased from £19,000,000 to £42,000,000, or, including tramways, £84,000,000.

Visits were subsequently made to the Springburn sub-station of the Electricity Department, the Pinkston power house of the Tramways Department, and the Port Dundas Electricity Works.

There was a reception and conversazione at the City Chambers in the evening.

EXHAUST STEAM TURBINES AND CONDENSING PLANT AT THE McDONALD ROAD STATION, EDINBURGH.

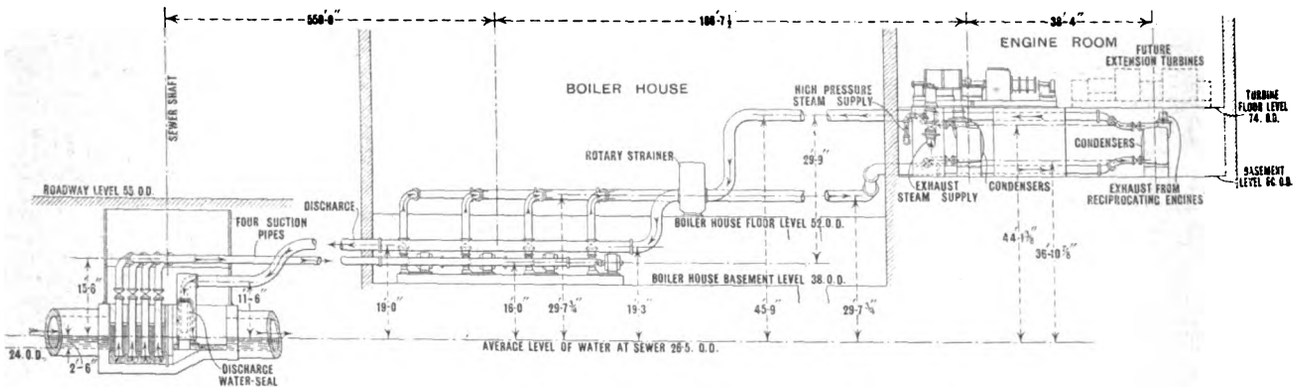
By F. A. NEWINGTON.

(*Chief Electrical Engineer, Edinburgh.*)

The average flow of the water of Leith main sewer is about 750,000 gallons per hour, and as there were certain objections to the use of cooling towers and difficulties in obtaining a supply of water otherwise, it was decided to utilise this for condensing purposes, so that the required extensions of plant could take the form of exhaust steam turbines. The general arrangement of the plant is shown in the figure.

The sewer is 6 ft. 6 in. inside in diameter, and 22 ft. below the level of the road. A shaft, 26 ft. in diameter, formed of cast-iron segments bolted together, was sunk down until the top of the sewer was reached and a ring of brickwork, of the same diameter as the cast-iron shaft, was continued downwards for about another 9 ft., that is, to the bottom of the sewer. Four suction pipes, each 18 in. in diameter, and one discharge pipe, 26 in. in diameter, are laid from the shaft to the station. Straining screens are fixed in the shaft just in front of the suction pit. The end of the discharge pipe in the sewer is water sealed, so that a syphon action is maintained. Four 14-in. motor-driven centrifugal circulating pumps, each with a capacity of 182,400 gallons per hour, are placed in the basement of the boiler-house, each pump having a separate suction pipe from the shaft. The pumps deliver into a common pipe 26 in. in diameter, to which is connected a Bailey & Jackson rotary strainer. From this the circulating water passes through the four condensers back through the rotary strainer, and then is returned to the sewer. On account of the pipes forming a closed system, the average head against which the pumps work is 15 lbs. Two air extracting pumps have been provided; one extracts the air on the suction side of the pumps, the other the air on the delivery side. By this means the syphon action is maintained, and the pressure at the highest point of the pipe system averages about 20 in. of vacuum.

Four surface condensers of the Contraflo type are used, each



GENERAL ARRANGEMENT OF PIPEWORK, CONDENSING PLANT, AND EXHAUST STEAM TURBINES.

having a cooling surface of 3,750 sq. ft. The air pumps are of the Edwards type, with three-throw cranks. The feed water force pump is also driven off the same shaft. One line of each air pump was altered so that it now delivers the condensed steam to the force pump, the other two lines working dry. The air pumps are driven by motors geared through Renold chains.

The straining arrangements in the shaft consist of three iron grids, each 5 ft. high and 3 ft. 6 in. wide, with vertical bars spaced ⅜ in. apart. These are kept clean by scrapers automatically worked by a small motor, but a certain amount of scraping by hand is necessary at the time of top load.

Mr. Newington then proceeded to describe the Bailey & Jackson rotary strainer, particulars of which were given in ELECTRICAL ENGINEERING, June 9th, page 370.

The most interesting point about these strainers was the way in which the discharge water washes off from the grids everything that has been deposited on them on the delivery side, and carries it back to the sewer. In connection with their working, he remarked that there was considerable leakage of water from the inlet chamber to the outlet chamber, which increased the power required for pumping. The temperature of the sewer water ranges from 60° to 70° F., and as it is prohibited to return the water to the sewer above 90° F., the quantity of circulating water required per pound of steam condensed is large.

At present only two exhaust steam turbo-generators have been installed, but there is sufficient steam from the reciprocating engines for two more exhaust turbines. The turbines are of the Rateau type, running at 1,250 r.p.m. The guaranteed output of each set is 1,200 kw., with 45,600 lbs. of steam per hour at a pressure at the inlet to the turbine not exceeding 14·7 lbs. per sq. in. absolute, and at the exhaust 1·3 lbs. absolute.

The exhaust steam from two of the 780-kw. reciprocating sets is sufficient to give an output of 1,200 kw. from one of

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the turbo-generators. Live steam is also available through reducing valves.

The dynamos were built by Brown Boveri & Co. They are four-pole machines, and are separately excited by a small dynamo at the end of the shaft. Copper brushes are in use on one machine. The commutator of the other machine has been altered to give increased ventilation, and carbon brushes are fitted. There was some little trouble at first with commutation, but this has been overcome, and both machines are now running well, especially the one fitted with carbon brushes. This commutator keeps very cool, being only 42° F. above the temperature of the air after a six hours' full-load run. Each commutator works with a pressure of about 22 volts per bar.

Automatic atmospheric valves are placed in the exhaust pipes between the reciprocating engines and the turbines. They are balanced to open at about 3 lbs. above atmospheric pressure, so they are always nearly in equilibrium. Those now in use have a special dash pot which admits air freely on the upward movement of the valve, but by means of a non-return valve only allows it to escape very slowly when the valve is closing.

Oil separators of the Blake type between the engines and the turbines extract the greater part of the oil. The feed water is further treated by the Davis Perrett electrical process of oil separation.

There is not the least difficulty in running the turbo-generators in parallel with the other dynamos. The old dynamos are shunt-wound, and the turbo-generators compound-wound. The whole regulation is done by the switchboard attendant by means of the shunt resistances. The only point to be careful about is to see that steam is not escaping past the atmospheric valves, which would mean waste. In order to prevent this, indicators have been fitted just above the atmospheric valves, and directly any steam passes the valve an electric circuit is closed which rings a bell on the switchboard. The switchboard attendant then puts more load on to the turbine and so reduces the pressure of the steam in the exhaust pipe.

The capital cost of the condensing plant, which is sufficient to deal with the steam from reciprocating and exhaust turbines of 11,000 kw., was £13,800, or 5·7d. per kw.

The working costs per unit generated since the plant was installed have shown savings (by comparing figures of 1908 and 1910) of 33·4 per cent. for fuel; 50 per cent. for oil and stores; and 78 per cent. for water; the total works costs are now 0·281d. as compared with 0·398d.

In conclusion, Mr. Newington says:—"Some engineers seem to think that exhaust steam turbines are only a passing fashion and will disappear in a few years, but in stations with existing reciprocating engines, either exhaust steam or mixed-pressure turbines seem the most suitable for extensions, as the combination of reciprocating engine and turbine is as economical as high-pressure turbines, and obviates all necessity of scrapping the old sets until these are worn out."

The discussion of this and Mr. Bremner's Paper, both of which were read yesterday, will be reported in our next issue.

DISPUTE re MUNICIPAL WIRING AT LEICESTER

AN extremely important case was opened before Mr. Justice Neville in the High Court of Justice on Monday. The case is "Attorney-General (at the relation of John Charles Utley) *v.* Leicester Corporation," and it is an endeavour made by the local wiring contractors to prevent the Corporation from wiring houses and from selling and hiring out electric light fittings, motors, &c. The Corporation work under a Provisional Order obtained in 1890, and have no Special Act with wiring clauses similar to those owned by other Corporations.

The plaintiffs claim that the Leicester Corporation have carried on, and still carry on, the business of installing, selling, and repairing electric light, cables, wires, and fittings, electric bells, dynamos, and motors. It is alleged that installations are erected, and that such material is sold, not only to their own consumers, but also in connection with houses and buildings of non-consumers, and even outside the borough.

Mr. FELIX CASSEL, K.C., in opening the case for the plaintiffs, contended that Section 10 of the Electric Lighting Act of 1882, which authorises a supply authority "generally to do all such acts and things as may be necessary and incidental to such supply," did not empower the Corporation to do the work complained of. He referred to the Special Acts of other Local Authorities who had obtained powers to do wiring work, and to sell and hire motors and fittings, and pointed out that these Local Authorities had not relied upon Section 10 of the Electric Lighting Act of 1882 to give these powers, but had embodied clauses in their Special Acts, in which these powers were specifically granted. Mr. Danckwerts, K.C., objected that Mr. Cassel could not cite clauses in Private Acts in order to construe clauses in the General Act, but the judge decided that Mr. Cassel might be heard on this point, and Mr. Cassel thereupon read the clause in the Marylebone Electric Lighting Act which authorises the Marylebone Borough Council to do house-wiring, selling, and hiring of motors and fittings, &c.

The first witness for the plaintiffs was Mr. TAYLOR, whose premises are situated on the Leicester Borough boundary. He stated that for his gardens and stable, in which there were no electric fittings, he paid rates to the Corporation, but for the house he paid rates to the Parish of Oakby. The electrical installation in his house had been erected by the Corporation, and he enumerated some of the fittings which were supplied.

The next witness was Mr. TWEEDIE SMITH, of the firm of Turner & Co., who acts as honorary secretary to the Electrical Contractors' Association. He stated that he had examined the electric lighting fittings stock book and other books of the Leicester Corporation, and had found that the Corporation dealt in large quantities of motors and fittings, and also bells and batteries, and such things as shaving pots, foot-warmers, hair-driers, electric signs, cigar-lighters, "magic mirrors," omelette pans, and had found in their stock book also entries of an "extra lid for omelette pan" and "a sewing machine complete with motor." He had found large sums allocated in the books to wages for work done in carrying out installations. Among other things he had found an account against Messrs. Smith, Faire & Co. for £515 14s. 1d. for the erection by the Leicester Corporation of an installation for generating electricity in competition with themselves. He was proceeding to state that an examination of the ledgers had shown that, in spite of the figures in the Corporation's public accounts, its installation business was carried out at a loss, but the judge interrupted him and said that if the Corporation had statutary power to do what they were doing it did not matter whether they made a loss or not. Witness described the showrooms occupied by the gas and electricity department, in which the stock was exhibited, as it would be by an electrical contractor, and the showroom had the appearance of an ordinary shop. There was nothing to indicate that the fittings would be sold only to firms supplied by electricity.

In cross-examination, Mr. DANCKWERTS suggested that the stock of telephone and bell material was for the Corporation's own public building, but Mr. Smith replied that there would be then no reason to have them in the showroom. Mr. Smith admitted that the Corporation might have a large number of public buildings for which such goods would be required, but he stated that he had taken out a list of goods supplied to other departments by the Electricity Department (supplied at 33⅓ per cent. profit), but this was not sufficient to account for the large stock of material. He admitted that the workhouse, although technically under a different authority to the Leicester Corporation, might be maintained by the same ratepayers. During the course of Mr. Tweedie Smith's examination, large scale plans of the Borough were examined by the witness, the judge, and council on both sides to ascertain whether certain houses were only or partly within or entirely outside the borough boundary.

Mr. I. J. FOX was next called, and stated in reply to Mr. M. N. Drucquer, on behalf of the plaintiffs, that his residence, Manor House, was outside the Borough of Leicester, and that he pays rent to the Middleton Union in respect of it, and not to the Corporation of Leicester. In December, 1904, his house had been installed with electric light by the Corporation, and he produced the account which he had paid for it. Since 1904 all the repairs to his installation had been done by the Corporation, and any additional fittings that might have been obtained were obtained from the Corporation. In cross-examination by Mr. Danckwerts he said that he was still a consumer, and did not wish to cease to be one, and was supplied also with gas and water by the Leicester Corporation.

Mr. R. I. CRAWFORD, Managing Clerk to Messrs. Turner & Co., solicitors for the plaintiffs, gave an account of a visit by him to the Corporation showrooms at Leicester, and stated how he had bought a lamp for 1s. at the showrooms, and was not asked by the assistant whether he was a ratepayer or not. He also asked for a Leclanché battery, but the assistant said there were none in stock, but offered to procure one.

Mr. JOHN CHARLES UTLEY, at whose suit this action is brought, said that he was sorry to say that he was a ratepayer to the Leicester Corporation. In cross-examination by Mr. Danckwerts he said that his business was that of an electrical engineer, and he did wiring work and erected lightning conductors. He paid rates in respect of two premises of rateable value of about £20 and £11 respectively, and his turnover last year was about £1,200. He was finding a portion of the money for this action, but when asked how much, he said he had not got the bill in yet. Mr. Danckwerts produced an advertisement from a local paper which stated that Mr. Utley was contractor to the Leicester Corporation. Mr. Utley admitted that this was so but said that it was not for wiring but for lightning conductors.

On the Court resuming on Tuesday, the first witness was a youth, who stated that he had purchased some electrical material at the Corporation showroom. In cross-examination it appeared that he was in the employ of a local electrical contractor, by whom he had been sent to the showroom for this purpose, and

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it was elicited that the contractor was a consumer on the Corporation mains.

After evidence had been given by Mr. Squires, honorary solicitor to the Leicester branch of the Electrical Contractors' Association, Mr. S H. Webb, an electrical engineer and contractor at Leicester (and chairman of the Leicester branch of the Electrical Contractors' Association), said that he had, at the time, seen the Corporation carrying out the electric wiring of Messrs. Smith, Faire & Co.'s installation, the private electric plant previously referred to, which is a suction-gas plant.

Mr. WATHES also gave evidence to the effect that he had been engaged in work on Messrs. Smith, Faire & Co.'s premises, and had seen the electric wires being fitted by the Corporation.

Mr. LEONARD G. TATE, Secretary of the Electrical Contractors' Association (Incorporated), said he had been electrical engineer and contractor since 1892, and explained to the judge the method of connecting up the mains and services, and the position of the main fuses, main switch, meter, &c. He said that installation business was recognised as a separate business, and the supply of electrical energy as a business by itself. He was cross-examined by Mr. Danckwerts as to whether the Electrical Contractors' Association was bearing the cost of the present action. He explained that individual members of the Association, as contractors, had promised to provide funds for the present case. He also said that the biggest gas companies in the United Kingdom, including the Gas Light & Coke Co., were sub-letting installation work to contractors. Asked by Mr. Danckwerts whether a large number of Corporations were not carrying out wiring work themselves, he said that there were about a dozen Corporations who were doing it, and about forty who had powers.

Mr. W. R. RAWLINGS, an electrical contractor and also on the Wiring Rules Committee of the Institution of Electrical Engineers, explained further the arrangement of the connections between the service cable and the consumer's installation. He stated that he had been in practice for twenty years, and that the installation business was recognised as a separate and distinct business to that of supplying electrical energy. Asked in cross-examination by Mr. Danckwerts if the cut-outs were inserted on the consumer's premises for the purpose of safety, he said that this was so.

This closed the case for the plaintiffs.

Mr. DRUCQUER then addressed the Court on behalf of the plaintiffs. He contended that the Corporation were restricted to the wiring which was necessary in order that the consumers might obtain a supply, and that a distinction was made throughout the Provisional Order as to what the supply authority should do and the consumer should do. He pointed out that a number of clauses in the Electric Lighting Acts were copied from the clauses of the Gas Works Act of 1847, but that Section 13 of this latter Act was deliberately omitted, a section which gave express powers to the undertakers to supply the consumer with pipes, burners, meters, and lamps, and to repair them.

Mr. DANCKWERTS then opened the case for the defence, and expressed the view that the words "necessary and incidental" in Section 10 of the Electric Lighting Act of 1882 quoted above should read "necessary *or* incidental." He gave precedents in which it had been held that "and" could be read as "or" in Acts of Parliament if the context proved that this was the correct sense, and argued that, as what is necessary cannot be incidental, and what is merely incidental cannot be deemed necessary, the words "necessary and incidental" obviously meant "necessary or incidental." In his view Section 10 gave power to wire houses and supply fittings to consumers, as these were incidental to the supply of electricity. Dealing with the alleged sales by the Corporation, he said that, to begin with, the Corporation had not supplied anybody with telephones or tele phone wire. The stock of these was for use for their own purposes in their own buildings. In the case of bells, these were not supplied unless they were to be operated by means of electricity supplied by the Corporation, and he did not pretend that they were entitled to supply them in any other case. It had happened, however, that, when they were wiring houses, the owners sometimes had wanted the bells and telephones to be fitted by the Corporation workmen also, and it had been done "as a favour." Eighteen months ago, however, Mr. Alfred Colson, who was engineer and manager to the Gas and Electricity Department, had given orders that this should be stopped. The circumstances in connection with Messrs. Smith, Faire & Co.'s installation were as follows: At the time that the firm wanted electricity, the Corporation were not yet in a position to supply them from their mains. They, therefore, wired the consumers' premises for connecting provisionally to the consumers' own dynamo with the idea of their being ultimately transferred to the Corporation mains. Referring to the other premises alleged to be outside the Corporation area, Mr. Danckwerts stated that with one exception these premises were partly in and partly outside the area.

Mr. JAMES SWINBURNE, F.R.S., was then examined as the first witness for the defence, and explained the principles of the electric circuit. In reply to questions, he said that electricity was supplied at a certain pressure, and the lamps had to be suitable for this pressure. He was asked to explain the different effects of a leak in the case of gas and electricity, and pointed out that whereas a leakage of gas in consumers' premises did not affect the gas company, as the gas leaking away merely passed through the consumers' meters and the leakage did not affect other consumers, a leak in the consumers' installation, on the other hand, was prejudicial to the supply undertaker as it might affect the supply to the whole system. It was, therefore, advantageous to supply undertakers to know that the electrical wiring and fittings should be well done, as, of course, they would be enabled to do if they had supplied them themselves. In cross-examination by Mr. Cassel, Mr. Swinburne admitted that there was a Board of Trade regulation which, in such a case, would protect the supply undertaker, as they could refuse to supply if the wiring were not well done. He was also questioned as to drop of pressure in the installation, and agreed with Mr. Cassel that the Board of Trade regulations provided that the pressure, which had to be kept constant, should be tested at the consumers' terminals, and that the undertakers were not responsible for drop of pressure within the consumers' installation.

This concluded the proceedings on Tuesday. The case for the defence was resumed yesterday (Wednesday), and was still proceeding when we went to press.

ANNUAL MEETING OF THE ELECTRICAL CONTRACTORS' ASSOCIATION

THE Electrical Contractors' Association (Incorporated) could hardly have had finer weather for their visit to the northern capital on Monday and Tuesday. Needless to say, many members took the opportunity of spending the week-end in Edinburgh or its vicinity, whilst the London party combined pleasure with business in travelling by sea. Business commenced at an early hour on Monday, when the Central Board met at the Caledonian Station Hotel, Edinburgh. This meeting was followed immediately by the annual general meeting, which lasted till 6 p.m., so that, with a brief interval for lunch, the combined meetings lasted all day.

Mr. Harland Bowden's election to the presidency for the forthcoming year evoked universal approval. A resolution was passed making Past Presidents *ex officio* members of the Central Board for one year after their year of office, the object being to secure continuity of policy.

A great deal of time was occupied in the discussion of the various oppositions to municipal trading schemes which the Association has in hand. In view of the fact that the Leicester Corporation case was actually before the court at the time the meeting was being held, it was decided that no further reports should be issued before that case was decided.

The representatives of the various sections reported in detail upon the work done in their respective districts, and all showed encouraging signs of progress. Mr. Martin (Scottish Section) was able to report that not a single subscription was in arrear, and he spoke for some time about the steps which were being taken to prevent manufacturers advertising as their own work done by contractors. For the Northern Section, Mr. Shaw told of the enthusiasm that was being thrown into the propagandist work, modestly making little of his own share. For the Midland Section the most important matter brought up by Mr. Brown was the arrangement arrived at with the Borough Engineer, by which (subject to the authority of the Central Board) the Association would guarantee the proper carrying out of all work placed in the hands of its members. Mr. Brown presented agreements which the Hon. Solicitor to the Section had prepared with a view to carrying out this arrangement, and asked for the authority of the Board to proceed. A long discussion ensued, and it was generally agreed as being most desirable that the Association as a whole should guarantee the work of its members. The difficulty of putting this into effect without incurring financial risk for the completion of unfinished contracts in the event of the failure of a member, was pointed out. Mr. Marryat considered that the proposal resolved itself simply into a question of insurance, for which those members guaranteed should be willing to pay a premium, and that from the collection of these premiums a fund might be constituted from which losses could be paid. It was finally resolved to refer the whole question to a committee for consideration and report, and this committee was duly elected.

The Treasurer was able to report a considerable reduction in the deficit on the Central Board accounts, as compared with last year, and further pointed out that, if the balance in hand with the various branches were taken into account, there was no deficit at all. The balance-sheet and auditors' report were submitted and adopted. A motion to enable the Central Board to collect subscriptions direct from the members instead of through the medium of the branch and section was negatived.

The most important matter brought before the general meeting was contained in a most able address by Mr. W. R. Rawlings (London), in which he advocated an amalgamation of interests, such as are now represented by the various organisations of the consulting engineers, station engineers, manufac-

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turers, cable makers, and the E.C.A. He referred by way of illustration to the extraordinary success of the Society of Motor Car Manufacturers and Traders, in which all branches of the trade are represented, with the result that conditions of unsatisfactory trading, such as exist in the electrical industry, are unknown, and the society has a bank balance of £33,000, after making a most liberal expenditure in many directions conducive to the welfare of the industry as a whole. Mr. Rawlings's address was received with enthusiasm, and a committee was at once formed to see what steps could be taken to bring the scheme into being.

The annual dinner was held at the same hotel in the evening, when the company was joined by Mr. Gibson, President of the Surveyors' Association; Mr. Berry, President of the National Electrical Manufacturers' Association; and other visitors. The retiring President, Mr. William Finlay, who, it will be remembered, has been obliged under doctor's orders to abandon all business for some time past, was nevertheless able to take the chair for the first half of the evening.

The dinner was excellent, and the haggis proved a great success. Mr. Gibson proposed "The Association," referring to the excellent effect upon a trade which always results from the getting together of its members; it was "better for the man who pays, better for the man who squares the work up, and better for the contractor," that such a body as the E.C.A. should exist and prosper. Mr. Harland Bowden, in his reply, referred to the work done during the day, and to the promising outlook for the future.

Mr. Wright (Glasgow) proposed the health of "The Manufacturers and Kindred Associations" in felicitous terms, "fully believing and hoping," he said, "that by this time next year there will be no kindred associations, because all will be united into one harmonious whole." Mr. Berry (Manufacturers' Association) replied in a most witty speech, and congratulated the Association upon the many virtues and graces of its new President.

Tuesday was occupied by the Scottish Section entertaining the visitors.

LOCAL NOTES

ACTON: *The Electricity Undertaking.*—At the meeting of the Council on Friday it was decided to appoint a deputation to interview the Metropolitan Electric Supply Co., with a view to making the best terms possible with regard to the electricity undertaking. An amendment that notice be given to the company to terminate the present agreement was defeated.

ARGENTINE: *Tube Railways.*—The plans submitted by Messrs. Otto Franke & Co. relative to the construction of an underground electric railway, which will run from the border of the Riachuelo, by way of the Avenida Vélez Sársfield, Entre Ríos and Callao to the Retiro station, and through the Calle Brasil to the Plaza Constitución, thence effecting a connection with the lines at the Buenos Aires and La Plata harbours, have been approved.

BATH: *Electricity Accounts.*—The electricity accounts for last year show a deficit of about £1,400. This is attributed to decreased revenue caused by the use of metal filament lamps.

BELFAST: *Electricity Accounts.*—The Electricity Department for the year to March 31st shows a net profit of £11,040, of which £5,000 is to be handed over to relief of rates.

BLACKBURN: *Electricity Accounts.*—The accounts for last year show a profit of £1,388, after meeting capital charges and transferring £2,000 to depreciation. The number of units generated was 4,535,680, an increase of 111,413 over the previous year.

BOURNEMOUTH: *Conduit System to be Abandoned.*—At the meeting of the Corporation last week, the report of the tramways manager in favour of abandoning the conduit system in Bournemouth was adopted. The approval of the Board of Trade will be necessary before the change can be effected.

BURY: *Electricity Accounts.*—The annual report shows a slight decrease in the consumption of lighting, but a considerable increase for heating and power. The generating costs have been reduced by 12 per cent. from last year's figure of 0·577d. The final surplus was £3,569. Considerable saving in wages has been obtained since the adoption of automatic voltage regulation.

Tramway Accounts.—The tramway accounts for last year show a net profit of £2,635, of which £2,500 has been carried to reserve and depreciation.

CARLISLE: *Extension of Electric Lighting Area.*—The Corporation are applying for a Provisional Order, extending the area for electric supply.

COLCHESTER: *Electricity Accounts.*—There was a net profit of £414 upon the electricity undertaking for last year, against £247 in the previous year. The sum of £200 has been transferred to relief of rates, and £214 added to depreciation fund.

CROYDON: *Tramway Accounts.*—The accounts for the past year show a surplus of £7,005, which has been carried to reserve and renewals account.

DOVER: *Extension of Supply.*—The Council has decided to extend their mains to Alkham at a cost of £250, provided that sufficient consumers can be found to meet the capital charges.

DUDLEY: *Electricity Accounts.*—There was a deficit of £600 on the electricity undertaking last year. The chief factor in this loss has been an increase in the sum necessary for repayment of loans.

DUNDEE: *New Electrical Laboratory.*—The new Peters Laboratory of Electrical Engineering will be opened in October.

EASTBOURNE: *Electricity Accounts.*—There was a net profit of £2,200 upon the electricity undertaking for last year, which is an improvement of £262 compared with the previous year. The number of units sold for power purposes increased by 14 per cent., and there are now 117 motors installed, aggregating 311 h.p. No less than 74 of these motors are on hire for the Corporation. In his report, Mr. J. K. Brydges, the Borough Electrical Engineer, states that the increasing use of the showroom and inquiry office has produced excellent results, especially as regards connections to the mains in Hamnden Park. The total costs for the year were 1·92d., against 1·98d. in the previous twelve months.

EAST HAM: *Electricity Supply.*—Wanstead Urban District Council have written stating that they cannot see their way to give permission to the East Ham Council to supply electricity under Section 6 of the Electric Lighting Act, 1909, to premises belonging to the West Ham Guardians situated within Wanstead District. The Town Clerk of East Ham is to take the necessary steps to obtain the consent of the Board of Trade to a supply of current being given to the premises named.

FINCHLEY: *Electricity Accounts.*—After meeting capital charges the electricity accounts for last year show a net profit of £577, which is to be carried forward.

FROME: *Transfer of Electricity Works.*—The Council have passed a resolution in favour of transferring the Electricity Works to Messrs. Edmundson's Electricity Corporation.

KING'S LYNN: *Electricity Accounts.*—The electricity accounts for last year show a net profit of £858. The committee recommend that £200 be carried to meters account, and the remainder carried forward.

LEIGH: *Electricity Accounts.*—The accounts of the Electricity Department for last year show a net profit of £112, against £350 in the previous year. The output increased by 5·2 per cent., which is considered satisfactory in view of the very unsettled state of trade during the past twelve months.

LINCOLN: *Electricity and Tramway Accounts.*—The accounts of the electricity undertaking for the past year show a net profit of £2,503. On the tramways, there was a loss of £44.

MIRFIELD: *Increased Charges for Supply.*—A recommendation of a special sub-committee that the price of electricity be increased from 4½d. to 6d. per unit for lighting, in view of the general use of metal filament lamps, has been agreed to by the Council.

LONDON: *Woolwich.*—The Borough Council have given permission to the West Ham Corporation to supply electricity to the Port of London Authority in the North Woolwich area on condition of a payment of £40 to Woolwich.

MARYLEBONE: *Wiring.*—The General Purposes Committee report having considered an estimate from the Electricity Department for the maintenance of the Town Hall electrical installation. The Committee has decided to have the work done on the basis of cost price, plus 10 per cent. for supervision. The Public Health Committee have accepted an estimate of £50 from the Electricity Department for re-wiring and overhauling the electric light installations at four conveniences, and also for re-wiring and overhauling the installation at the mortuary.

MARKET HARBOROUGH: *Electric Lighting.*—The Council's electric lighting Provisional Order expires this month, and the Board of Trade have intimated that they will not be prepared to grant an extension of time.

NORTHAMPTON: *Tramway Extension.*—The proposal of the Tramways Committee to extend tramways to Farcotton has been adopted by the Corporation. Parliamentary powers have yet to be obtained.

NORTH BERWICK: *Electric Supply.*—Messrs. Crompton & Co. have submitted an electric supply scheme to the Council which is now under discussion. The Council are offered the option of purchasing the undertaking at the end of twelve years.

ROSYTH: *Fire at the Power Station.*—A serious fire broke out at the Rosyth Naval Base on Saturday, and the contractors' power station, which contains generating plant driven by suction gas producers, was practically destroyed. Damage was done to the extent of some thousands of pounds, and the progress of the work will be seriously interrupted.

SOUTH AFRICA: *Power Scheme.*—It is stated that a proposal by Messrs. Harper Bros. & Co. for the establishment of a power station on the Kroonstad coal mines is under consideration. Power is to be transmitted to Kimberley, Koffyfontein,

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Jagersfontein, Bloemfontein, and Kroonstad for mining and other general purposes.

SWEDEN: *New Water Power Scheme.*—The proposal to establish an electric power station at the Porjus waterfall and electrification of the State frontier railway in the north of Sweden has been agreed to by the Government. The estimated cost of the scheme is £1,194,500.

WARRINGTON: *Electricity Accounts.*—There was a net profit of £1,691 on the working of the electricity undertaking for last year, against a loss of £943 in the previous year. After writing off various small sums, a balance of £938 has been placed to reserve fund, which now amounts to £9,099.

The total works costs, not including capital charges, work out at 0·656d. per unit sold, as against 0·774d. for the previous year.

Tramway Accounts.—The net profit on the tramways undertaking last year was £2,750, compared with £2,370 in the previous year. The sum of £1,000 has been transferred to relief of rates, and the balance placed to reserve fund, which now stands at £8,437.

WEYMOUTH: *Electricity Accounts.*—The cost of coal per unit for the year was reduced from 0·60d. per unit to 0·145d.

WOLVERHAMPTON: *Tramway Accounts.*—After meeting capital charges, the tramway accounts for last year allow of £3,855 being transferred to renewals, and £1,037 to reserve. There has been some reduction in traffic receipts due to adverse weather, and the operating expenses were 6·423d. per car mile, an increase of 0·049d. over the previous year. This is attributed mainly to extra repairs on the permanent way and the Lorrain equipment.

WORCESTER: *Water Power Plant.*—Mr. C. M. Shaw, the Borough Electrical Engineer, has been granted permission to visit America to inspect water-power systems. Mr. Shaw will pay his own expenses.

YORK: *Completion of Tramways.*—Two new sections of the Corporation tramways were opened on Thursday. These complete the system, although some work has yet to be done upon one of the bridges.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BATLEY.—The Council require a battery and automatic reversible traction booster, and one battery charging booster. Particulars from the Borough Electrical Engineer, and tenders by the 28th inst.

BELFAST.—The Harbour Commissioners require a steam generating set. Particulars from the Harbour Engineer, and tenders by the 22nd inst.

CHATHAM.—Application is to be made to the Local Government Board for a loan of £3,500 for extension of mains and services.

CLACTON.—The Council require 440 yards of armoured twin 7/18 V.B. cable.

COVENTRY.—A Local Government Board inquiry has been held concerning a loan of £54,200 for electrical extensions.

CROMPTON.—The District Council invite tenders for electrical plant at their new sewage works. Particulars from Messrs. J. P. Wilkinson & Son, 301 Cathedral Street, Manchester, and tenders to the Clerk by June 30th.

DEWSBURY.—The Electricity Committee have decided to instal a mixed pressure turbine, the cost of which will be defrayed out of revenue.

HEREFORD.—A Local Government Board inquiry was made last week in respect of a loan of £3,000 for electric lighting purposes.

LEITH.—Extensions to the generating plant are contemplated. The Electricity Committee are undecided whether to instal a reciprocating engine or turbine.

LONDON: *Fulham.*—Alterations to sub-stations to meet the requirements of the regulations under the Factory and Workshop Act, &c., are to be carried out at a total cost of £823.

NEWPORT (Mon.).—An inquiry was held on Thursday concerning a loan of £31,255 for electrical extensions. This application is the result of the Corporation acting upon the main suggestion put forward in the report of Mr. C. P. Sparks, who recently investigated the undertaking, and suggested a centralisation of the generating plant.

NUNEATON.—A Local Government Board inquiry has been held concerning a loan of £4,804, for electric lighting purposes.

ROME.—Tenders are required for the supply of three-phase cable, insulators, generating and sub-station plant, and line material, by the Commissione Consultative dei Tramvia Elettrici Municipali, Piazza S.S. Apostoli, 49.

ST. ANNE'S-ON-SEA.—An enquiry has been held into an application for a loan of £3,000 for extensions at the electricity works.

ST. HELENS.—An inquiry was held last week concerning a loan of £10,230 for extensions to the electricity undertaking. These extensions have been rendered necessary by the increase in the demand for power purposes.

SHEFFIELD.—An inquiry was held last week concerning a loan of £78,207 for extensions at the Neepsend power station. It is proposed to duplicate the Neepsend plant. Owing to the illness of Mr. S. E. Fedden, engineer and manager of the electricity undertaking, his evidence was taken at his home. The present capacity of the plant is 11,000 kw., and the maximum demand last winter was 6,980 kw. During the coming winter the demand is expected to reach 8,500 kw.

Mains are to be extended at an estimated cost of £490.

STRETFORD.—Mains are to be extended to supply current to 140 houses and some shops off Chester Road and Warwick Road, Old Trafford.

TONBRIDGE.—The Council require a Lancashire boiler, an extension to economiser, and pipe work. Particulars from the Electrical Engineer, and tenders by July 1st.

WALSALL.—Mains are to be extended along Green Lane, Birchills, at a cost of £65.

WARRINGTON.—An inquiry was held last week concerning a loan of £7,420 for extensions at the Electricity Works.

WEST BROMWICH.—Extensions to the generating and distributing plant at a cost of £11,386 are contemplated.

WEDNESBURY.—The sanction of the Local Government has been obtained for a loan of £2,858 for extensions. Application is to be made for a further loan of £4,600 for a gas-driven generating set.

Miscellaneous

BIRMINGHAM.—The Electricity Department invite tenders by June 30th for general stores, including electrical accessories. Particulars from the City Electrical Engineer and Manager.

CHILE.—Tenders are being invited for the conversion to electric traction of the sections of the Chilian State railways from Valparaiso to Santiago and Los Andes, and will be received at the Ministerio de Obras Publicas up to July 15th.

ITALY.—Tenders are invited by the Commissione Consultative dei Tramvia Elettrici Municipali, Piazza S.S. Apostoli, 49, Rome, for the supply of 50,000 metres of three-phase cable, 30,000 insulators, supplies for the equipment of generating and transformer stations, alternators, transformers, water turbines, &c., and about 4,000 insulators to withstand 30,000 volts. No date is given for the receipt of tenders, which, it is stated, are open to international competition.

MANCHESTER.—The Electricity Department require meters, service cables, motors, and motor-starters. Particulars from the Secretary, Electricity Department, Town Hall, and tenders by June 22nd.

MOROCCO.—It is stated that tenders are to be invited for the installation of both telephone equipments and electric light services in various towns.

NOTTINGHAM.—The Tramways Committee require 400 tons of steel rails of British standard section No. 4. Particulars from the City Engineer, and tenders by July 4th.

RAWTENSTALL.—The Corporation invite tenders for the erection of a tramway along Burnley Road East. Particulars from the Borough Engineer and Borough Electrical Engineer, and tenders by July 1st.

SHEFFIELD.—The tramway track, in a portion of Attercliffe Road, is to be relaid at an estimated cost of £4,700. Points and crossings are required at the Shoreham Street depôt.

TURKEY.—Tenders are invited by the Ministère Impérial Ottoman des Travaux Publics, Constantinople, up to November 10th next, for a tramway scheme for Constantinople. A copy of the specification (in French) may be seen at 73 Basinghall Street, London.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

S.W.—Extensions of South-Western Polytechnic, Chelsea (£14,000), for the Governors.

S.E.—New Cross Branch Library, Deptford (£4,500). Builder, F. J. Gorham, Point Hill, Greenwich.

Bioscope Theatre, Eric Street, Mile End Road, E., for C. D. Cox.

Conversion of buildings into rink, rear of Spray Street, Plumstead. Architects, Church, Quick & Whincop, William Street, Woolwich.

Small hall, Newington Public Baths (£175). Builders, John Marsland & Son, York Street, Walworth, S.E.

E.C.—Markets, Charterhouse Street (£17,185). Builders, E. C. & J. Keay, Ltd., 47 Victoria Street, S.W.

PROVINCES.

BARROW-IN-FURNESS. — Woodwork centre (£2,347). Builder, H Britton, Barrow.

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BEXHILL.—School (£5,000). Secretary, T. Wilson, Education Committee, Bexhill Town Council.

CREWE.—Convent and school, Nantwich Road (£6,134). Architect, Hy. T. Sandy, Stafford. Builder, C. W. Davenport, Warrington.

CROYDON.—Additions, Borough Hospital (£9,831). Builder, Thos. Wm. Moss, Rayleigh.

EASTBOURNE.—Extensions, motor-bus depôt, Roselands (£3,305). Builder, F. W. Allcock, Eastbourne.

EAST GRINSTEAD.—Council offices (£5,000). W. E. Woollam, surveyor, East Grinstead Urban District Council.

HORNSEY.—The Education Committee has decided to invite tenders for the electric lighting of the Stroud Green School.

HULL.—Library. H. Hirst, City Architect, Hull.

ILFORD.—"Homes of Rest," South Park (£1,245). Architect, A. C. Russell, 13 Basinghall Street, E.C.

KINGSTOWN.—Library (£4,000). Surveyor, Kingstown Urban District Council.

LEIGH-ON-SEA.—Infectious Diseases Hospital. J. W. Leversedge, architect.

LOCHMABEN.—Addition, public school (£1,400). Architect, J. Gladstone, Lockerbie.

RAMSEY.—Police station and court (£2,498). Builders, Thackray & Co., Huntingdon.

READING.—Additions, workhouse (£6,770). W. Roland Howell, architect, Reading. Builder, McC. E. Fitt, 118 Oxford Road.

SOUTHAMPTON.—School, French Street. C. L. Crowther, engineer, High Street.

SWANSEA.—Club premises (£5,500). Builder, G. Davies, Paxton Yard, Oystermouth Road.

TORQUAY.—Municipal buildings (£28,869). Builders, R. Wilkins & Sons, Bristol.

WALSALL.—Sub-station, Darwell Street (£1,150). Builders, J. & F. Wootton.

Alterations and extensions, Birchills Tramway Depôt (£2,000). Tramways Manager, Walsall.

WEDNESBURY.—Schools, Holyhead Road (£15,385). J. Summershill & J. O. G. Jellyman, Ltd., builders.

WESTON-SUPER-MARE.—Adaptation of premises, Anstree Gardens, into a working men's club. Builder, C. Addicott, Locking Road.

TENDERS RECEIVED AND ACCEPTED

BLACKPOOL.—The tender of the British Thomson-Houston Co., Ltd., for high-tension switchgear at the new electricity sub-station at South Shore has been accepted.

CROYDON.—The Town Council has accepted the tender of Johnson & Phillips, Ltd., at £349, for electric lighting, call bells, &c., for the hospital extension.

DUBLIN.—The Corporation has accepted the tender of Messrs. Fletcher and Phillipson, Dublin (£1,273) for the electric lighting of the new Technical School, Bolton Street, Dublin. Eight other tenders were received, ranging up to £2,368.

DUNDEE.—The tender of a local contractor has been accepted at £130 for wiring the new part of the public baths.

EASTBOURNE.—Tenders for a twelve months' supply of electricity meters have been received from the following:—The Electrical Co., Ltd., Siemens Bros.' Dynamo Works Co., Ltd., British Thomson-Houston Co., Ltd., the British Westinghouse Co., Ltd. (accepted), Bat Meter Co., Ltd., Aron Electricity Meter, Ltd., Ferranti, Ltd.

EDMONTON.—The following tenders for an electric light and power installation at the Edmonton Union have been accepted:—Electric motors and accessories for laundry equipment, Messrs. G. Harland, Bowden & Co., £240 (E.C.C. motors); electric lift motors and fan, Messrs. R. Waygood & Co., Ltd., £293.

LLANDUDNO.—The contract for replating the storage battery has been placed with the Chloride Electrical Storage Co., Ltd.

LONDON: *London County Council.*—The tender of Messrs. Hurst, Nelson & Co., for 39 double-deck car bodies and 40 trucks for £14,040 and £4,980 respectively has been accepted.

NUNEATON.—The tender of Messrs. Callender's Cable & Construction Co., for cable at £144, has been accepted.

SHEFFIELD.—The Council have accepted the tender of the Electric Supply Department, at £45, for a 10 h.p. motor and wiring at the Baths. The Electric Supply Department is also to wire the new lending library in Surrey Street, and provide lamps and fittings at an estimated cost of £81.

SOUTHAMPTON.—The tender of the Electric Construction Co., Ltd., for the supply of a 300 kw. motor-alternator, has been accepted (£598); the tender for a 300 kw. two-phase alternator has been referred to the Borough Electrical Engineer to report upon; the tender of Messrs. Dick, Kerr & Co., for a generator with Cole, Marchant & Morley engine and condensing plant, has been accepted (£8,131); and that of Messrs. Babcock & Wilcox for a water-tube boiler (£1,590).

WALSALL.—The Town Council has accepted the tender of F. & J. Wootton, at £1,150, for erecting a sub-station in Darwall Street.

WEST HAM.—The Council have accepted the tender of Messrs. Babcock & Wilcox for water-tube boilers with superheater and mechanical stoker (£1,650), and the second alternative tender of the British Westinghouse Co. (£1,835) for condensing plant.

OSRAM·LAMPS

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Western Telegraph Co.: a third quarterly interim dividend of 3s. per share, free of tax, for the year to June 30th, 1910, has been declared.—Sao Paulo Tramway, Light & Power Co.: a quarterly dividend of 2½ per cent. has been declared.

Havana Electric Railway Co.—3 per cent. on the ordinary shares.

Provincial Tramways Co., interim dividend 8d. per share, payable 27th inst. India Rubber, Gutta Percha Telegraph Works Co., interim dividend 2½ per cent., payable July 1st.

Aron Electricity Meter, Ltd., 9 per cent. on the preference shares, making 12 per cent. for the year. Canadian General Electric Co., 1¾ per cent. for the three months ending June 30th. Notting Hill Electric Lighting Co., 3 per cent. and a bonus of 1½ per cent., payable July 1st.

COMPANIES STRUCK OFF REGISTER.—The names of the following companies have been struck off the register:—Booston Accumulator Syndicate, Birmingham Electrobus Co., Electric Canal Haulage Co., Lancashire and Yorkshire Electrobus Co., Liverpool Electrobus Co., Manchester Electrobus Co., Nottingham Electrobus Co., Nottingham Gas and Electric Fittings Co., Provincial Electrobus Co., Scottish Electrobus Co., and Tramways Development Co.

CITY OF BIRMINGHAM TRAMWAYS CO.—At a special meeting last Thursday a resolution that £4 per share be paid to the holders of fully paid ordinary shares by way of reduction of capital was confirmed.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. per ton (last week, £59 to £59 5s.).

AGENCY.—The Kramax Manufacturing Co., 12 Cambridge Lane, Glasgow, inform us that they are no longer represented by the Electric Lamp Lock Co., as selling agents for their "Elleo" invisible lamp lock. All orders and inquiries, therefore, should now be addressed direct.

We are informed that Mr. E. C. Seear (16 and 17 Devonshire Square, E.C.) has been appointed sole agent for the United Kingdom for the F. W. Bosch Co., of Lüdensheid, manufacturers of electrical apparatus, in succession to Mr. A. Branckmann. Mr. Seear was formerly manager of Mr. Branckmann's electrical department.

INDUSTRIAL SITES.—A pamphlet has been issued by the Great Central Railway Co., calling attention to the advantages of North-East Lincolnshire as an industrial centre, offering favourable opportunities for the establishment of successful enterprises. The completion of the Company's new dock at Immingham has greatly added to the resources of that portion of England, and firms contemplating the erection of new works in the provinces would do well not to overlook this district.

EHRHARDT & SEHMER GAS ENGINES.—Mr. R. B. Slacke, a director of the Key Engineering Co., Ltd., has joined the staff of Messrs. Galloways, Limited. It will be remembered that Messrs. Galloways are now manufacturing the Ehrhardt & Sehmer gas engine at their works at Manchester. The Key Engineering Co. will continue to act as agents for the Ehrhardt & Sehmer gas engine, and will be prepared, as hitherto, to quote alternatively for these engines made at either the English or German works.

DISSOLUTIONS OF PARTNERSHIP.—Messrs. J. Cecil McFerran & F. O. Rooper, electrical engineers, 26 Victoria Street, London, have dissolved partnership.

The partnership between E. Downer and J. M. Connare (Connare, Downer & Co., electricians, 110 High Street, Watford) has been dissolved by an order of the County Court of Hertfordshire. Creditors are to submit their claims before June 25th to H. M. Turner, Court House, King Street, Watford.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—A meeting of creditors of the Typewriting Telegraph Corporation, Ltd., will be held at 72 Bishopsgate Street, London, today (Thursday), at 12 noon.

J. P. Donlevy, consulting electrician, 125 Tulse Hill, London, S.W., has been adjudicated bankrupt. The public examination will be held on July 14th, at 11 a.m., at Bankruptcy Buildings, Carey Street, London.

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A first and final dividend of 4½d. in the £1 is to be paid in the bankruptcy of J. G. Cunnington, electrical engineer and contractor, 7 Great Newport Street, London. The dividend will be paid on and after June 14th at 28 King Street, Cheapside.

The last day for receiving proofs in the bankruptcy of J. Platt and R. Bleasdale, electrical engineers, Victoria Square, Bolton, is June 28th. Mr. Harold Mather, 10 Acresfield, Bolton, is the trustee.

J. A. Frederick, electrician, 258 Hungerford Road, Crewe, has been adjudicated bankrupt. The public examination will be held at 11.15 a.m. on July 22nd at the Court House, Edleston Road, Crewe.

FOSTER ARC LAMP & ENGINEERING CO.—The company have informed us that they have just heard that a very large consignment of metal filament lamps sent abroad has been received without a single lamp broken. They have introduced a train lighting lamp specially constructed to withstand vibration.

APPOINTMENTS AND PERSONAL NOTES

Mr. Henry M. Sayers has been appointed Resident Engineer in Santos, Brazil, to the City of Santos Improvements Co., Ltd., and sailed to take up his new position on Friday, June 10th, by the R.M.S.P. Co.'s s.s. "Amazon." Mr. Sayers will have in his charge the water supply, electric light and power supply, electric and mule tramways, and the steam railway undertakings owned and operated by the City of Santos Improvements Co.

Mr. F. T. Olding, traffic superintendent on the Bournemouth Corporation tramways, has resigned, having obtained an appointment in Queensland. A successor has been advertised for, and fifty applications have been received. The salary is £175, rising to £200 per annum.

An assistant engineer is required by the Watford Council at a salary of £120 per annum, rising by £10 every two years to £170 per annum. Applications by June 20th to the chief electrical engineer.

Walsall Town Council has appointed Mr. S. Whitehouse substation superintendent to the electricity undertaking, at £2 per week, rising by annual increments to £2 10s.

Mr. R. E. Middleton has been re-appointed Lecturer in Municipal Engineering at University College, London, for the session 1910-11.

Applications are invited for the position of Secretary in the Birmingham Corporation Electricity Supply Department. (See an advertisement on another page.)

COMPANIES' MEETINGS AND REPORTS

BIRMINGHAM & MIDLAND TRAMWAYS CO.—The net profit for 1909, after meeting debenture interest and preference dividends, amounted to £4,524, and a dividend of 1¼ per cent. is recommended on the ordinary shares. The company has been granted a lease of the Dudley tramways for 30 years, and an arbitrator has been appointed to determine the price which the company should pay the Corporation, during the first five years of the lease, for electrical energy. In order to meet the increasing demands from power and lighting consumers, an additional 1,000 kw. generating set has been installed, whilst a 2,000 kw. turbo-generating set is under construction.

BRITISH ELECTRIC TRACTION CO.—The profit for 1909, after reserving £12,500 for depreciation of undertakings worked by the Company, &c., and transferring £10,398 (profit on sales of investments), to reserve, is £150,760, including the amount brought forward. After meeting debenture interest and a dividend of 3s. per share on the preference shares, and transferring £15,000 to general reserve, there is a balance of £14,067, which is carried forward. The full dividend on the 6 per cent. cumulative preference shares is now paid up to June 30th, 1908. The reserve fund now stands at £633,582, whilst to meet depreciation the associated companies have made various reserves, which amount to £1,175,997. After referring to the restricted scope for tramway enterprise in this country, the report mentions that the directors have recently met with some success in their endeavours to secure participations in electrical enterprises abroad, and they are giving their attention to several other promising schemes.

R. WAYGOOD & CO.—The report for the year ended March 31st gives the available balance, including £3,159 brought forward, as £23,755. After deductions for directors' fees and preference dividends, writing £1,090 to experimental work, and placing £1,000 to reserve, a dividend at the rate of 7 per cent. is recommended, making, with the interim dividend, 6 per cent. for the year. £2,665 is carried forward.

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CORRESPONDENCE

HIGH-PRESSURE SWITCHGEAR.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—With reference to the highly interesting and instructive review of the development of high-pressure switchgear in this country, given by Mr. H. W. Clothier recently at Newcastle, and reprinted in your issue of the 9th inst., I would like to remind Mr. Clothier in the interest of historical accuracy that the oil switches installed at Bankside in 1894 were not the first of their class. So far back as 1891 Mr. G. W. Partridge designed switches of this type, the first of which were made and put into use on the L. E. S. Co.'s system in 1892. As far as I know, these were the first oil switches constructed for commercial use on high-pressure alternating-current systems.

Arising out of Mr. Clothier's remarks on the present position of the oil circuit-breaker, one is inclined to wonder whether finality has really been reached in this direction. The oil circuit-breaker undoubtedly constitutes to-day a highly important factor in the successful operation of large power plants; in fact, it is not too much to say that without it such supply undertakings as that of the Newcastle Co. could not be commercially exploited. But it appears likely that the time is coming when, due to the great increase in the size of power stations and of generating units, it may be necessary to look at the problem of machine and feeder protection from another point of view. On the one hand, the direct and indirect capital expenditure on switchgear becomes a matter of increasing importance as soon as a power station capacity of 50,000 kw. has been passed; on the other hand, as soon as we are called upon to deal with undertakings having double and treble this plant capacity, it is doubtful whether we can rely *solely* upon the oil circuit-breaker—or upon any circuit-breaker—to deal satisfactorily with the enormous surges of energy that may arise from time to time.

As far as this country is concerned, it is likely to be many years before even our largest undertakings (with one or two exceptions) will call for plant capacities exceeding 100,000 kw., but in other countries station outputs corresponding to this are already rapidly approaching realisation, and the size of the generating unit now in demand for such undertakings is continually increasing. A broad survey of the largest electric power plants in the different countries (but excluding the U.S.A.) shows that the size of the generating unit called for is rapidly increasing; roughly speaking, in 1904 it was 3,000 kw.; in 1906, 5,000 kw.; in 1908, 7,500 kw.; and to-day it is 10,000–12,000 kw. Further, due to the characteristics of turbine-driven stations, to considerations of capital cost, and to the large developments which are in sight in connection with electrochemical and electrometallurgical work, it is highly probable that in five years' time the demand will be for units of 20,000 kw., and even larger. And when it is considered that, whether such plants are placed in one or several stations, parallel operation throughout is an economic necessity, that the *momentary* short-circuit current of turbo-generators of present-day design is usually twenty to thirty times the full-load current, and that circumstances may arise in which a station full of such machines may be pouring current through a short circuit which has to be cleared instantaneously, the question arises: What will be the cost of circuit-breakers and the buildings to contain them capable of dealing with such terribly severe conditions? And, again, can we be sure, no matter how much we spend on protective devices, that the continuity of the supply will be preserved under these conditions?

Careful study of this question indicates that the capital cost of such protective gear (and the buildings for it), which will with reasonable certainty afford the same degree of security to the class of generating station referred to above as is readily obtainable at the present time with a station of 20,000–30,000 kw. capacity, will turn out to be prohibitive. And it cannot be doubted that the attainment of the essential degree of security at moderate cost for the case of these very large power stations of the near future will prove to be a very difficult matter.

It is possible that the solution will be found to lie in the adoption (or partial adoption) of a type of generator that will have different characteristics from those of the present-day synchronous machine, rather than in further improvements to oil circuit-breakers. Thus, if it was not for its high exciting current and inability to carry a wattless current, the asynchronous generator might well come into consideration in this connection, for, running in parallel with synchronous units, it ceases to generate under short circuit, which in reality is what is wanted. Although at present this type of machine is nearly uncommercial (at any rate, in large sizes), it may be that it will undergo development before long—perhaps on the lines indicated by Heyland in 1903. If the disadvantages at present inherent to this type of generator could be even partially eliminated, its sphere of usefulness would be greatly extended, and the use of such machines would furnish, at any rate, a partial solution to the problem referred to above.

A question in connection with high-pressure protective devices which was not touched upon by Mr. Clothier in his Paper (perhaps because it does not often arise in an acute form in this country) is that of providing really effective means for taking care of the pressure surges which arise from a change of circuit conditions. Such surges, as is well known, can easily attain destructive dimensions on these very large high-pressure systems, and although by the use of electrolytic and other forms of arresters they can be taken care of to a certain extent, finality is far from having been reached in this direction.

Yours faithfully,

Caxton House, Westminster, S.W., June 13th, 1910. A. C. EBORALL.

OSRAM LAMP WORKS, LTD., *v.* G. M. BODDY & CO.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Reference has been made in the Press to the pending litigation between ourselves and the Osram Lamp Works, Ltd.

In the interests of the trade generally we are writing to request you to insert this letter in your next issue, inviting anyone attacked to put themselves at once into communication with our solicitor, Mr. Jonathan E. Harris, of 95 Leadenhall Street, E.C., who is defending the action on our behalf with the approval of the Messrs. Philips Metallic Glow Lamp Works, Ltd.

15 Gray's Inn Road, W.C., June 13th, 1910. Yours obediently, G. M. BODDY & Co.

Electric Driving of Reversing Rolling Mills.—An application was made in the Appeal Court on Saturday by the Donnersmarckhütte Oberschlesische Eisen- und Kohlenwerke Akt. Ges. of Zabcze, Germany, for leave to appeal against the judgment of Mr. Justice Parker in March, which decided that the Ilgner patent for electrically driving reversing rolling mills, is invalid. The Electric Construction Co. were alleged to have infringed this patent in a plant erected by them at the works of Sir Alfred Hickman, Ltd. The time for giving notice of appeal expired on May 28th, but it was not given until May 30th. Mr. Bonsfield strongly opposed the application, on the ground that the whole action had been unduly delayed from the start. It was first commenced 2½ years ago, and all through the plaintiffs had been as dilatory as possible. Should the application now be allowed, he asked that there should be no further question of damages or injunction in regard to the Hickman installation. He had no objection to the validity of the patent being fought out. The Court allowed the application, and as the notice to appeal had already been made, no terms were put upon the plaintiffs.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published June 9th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

11,242/09. **Wireless Telegraphy.** A. W. SHARMAN. This patent covers the master switch for controlling the receiving and transmitting circuits in wireless telegraph stations, referred to in the description of the Helsby system in ELECTRICAL ENGINEERING, May 26th, p. 342. Five claims, four figures.

12,139/09. **Tramway Controller.** W. E. IRELAND. Cases have occurred in which the reversing drum of one controller has not been left in its "off" position, with the result that when operating from the other end of the car, the electromagnetic brakes have failed to act on account of the connections being affected by the other controller. To avoid this, additional contacts are provided on the reversing drums so that any displacement from the "off" position will close a pilot circuit and warn the driver by an audible or visible signal. Two claims, three figures.

12,146/09. **Cable Expansion Joint.** C. VERNIER. To obviate troubles due to expansion of cables or subsidence of the ground in which they are laid, expansion joints are provided at suitable intervals. The alignment of the cable is maintained by one or more sliding sleeves, while the joint is bridged by symmetrically arranged, flexible, braided conductors. Five claims, nine figures.

14,790/09. **Interlocked Switch Cover.** C. H. PEARSON. To prevent the cover of an iron-clad switch from being removed when the switch is closed, a roller or pin projecting from the switch-handle rides over a projecting rib cast on the cover. When the switch is opened, the pin is clear of the projection, and the cover can be lifted. One claim, two figures.

15,193/09. **Metal Filaments.** SOCIÉTÉ FRANÇAISE D'INCANDESCENCE PAR LE GAZ (SYSTÈM AUER). Filaments of vanadium, niobium, or titanium are prepared by reduction from the oxides of these metals. The filaments are squirted from a paste of the oxides mixed with powdered metal and lamp black, and, after being heated to make them conduct, are raised to a red heat in a suitable atmosphere to decarbonise them. Finally, the decarbonised filaments are reduced at a white heat (about 1,800° C.) in an atmosphere of hydrogen and ammonia to the metallic state. The decarbonising and the final reduction can be performed in one treatment by the addition of a small percentage of an oxidising gas to the hydrogen and ammonia. One claim.

17,106/09. **Railless Traction System.** E. M. MUNRO and THE RAILLESS ELECTRIC TRACTION CO., LTD. A crossing or junction for the three-wire overhead system described in ELECTRICAL ENGINEERING, Vol. V., p. 855, comprises a movable switch or "gate," which joins up the sections of overhead conductors at places where two lines meet or cross. The overhead conductors cross at different levels, and the "gate" is removed automatically to allow the trolley head to pass without breaking the continuity of the central negative conductor. Three claims, six figures.

18,808/09. **Strengthening Tungsten Filaments.** C. H. WEBER. In order to render tungsten filaments less brittle, a small percentage of tellurium (a brittle metal vaporising at 1,400° C.) is added to the tungsten mixture before squirting. After the usual baking process, the filaments are heated in a reducing atmosphere at a red heat for a considerable time in order that the tellurium may melt and alloy with the tungsten. Finally, the filament is raised to a bright red heat, and most of the tellurium is vaporised. About 0·05 per cent. tellurium is present in the finished filament, however, and this is about the amount which gives the toughest alloy. Selenium can be used instead of tellurium. Two other processes for obtaining the required alloy are described in the specification. It is stated that blackening is not accelerated, as the tellurium is retained by the filament, and the carbon content of such filaments is less than that of ordinary tungsten filaments. Seven claims.

26,845/09. **Electric Furnaces.** A. HELFENSTEIN. A series of arc furnaces are constructed side by side with the upper electrodes suspended in the upper shafts, and a long solid conducting structure at the base forming a common lower electrode. The working hearths are independent. Two claims, four figures.

Opposition to Grant of Patents

19,847/08. **Metal Filament Lamps.** GLÜHLAMPENWERK ANKER-GES. This patent, relating to the use of phospham for preventing blackening, has been refused as the result of opposition on the part of the "Z" Electric Lamp Manufacturing Co., Ltd. Further particulars will be found on page 390 of this issue.

11,060/09. **Arc Furnace for Treating Gases.** G. W. JOHNSON (*Chemische Fabrik Griesheim-Elektron*). Opposition has been entered to the grant of this patent. It is for a furnace in which a long horizontal arc is drawn out, the gases being blown down on to the arc at a sharp angle from a series of slits arranged above it in the manner of louvres. The gases are thus supplied all along the arc, and owing to the pressure of the gas jets the arc is kept horizontal in spite of the great length.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: LONSDALE BROS., LTD. [Insulating material] 13,693/09; LAVY [Telephone insulators] 19,834/09; MONNIER [Distributing box for multiple core cables] 23,937/09.

Dynamos, Motors and Transformers: BRITISH THOMSON-HOUSTON CO. and KINGWELL [Motor control] 12,047/09; DEUTSCHE ELEKTRO-SPARLICHT GES. [Transformers] 17,761/09.

Electric Ignition: BROOKS and ALSTON. 15,803/09.

Incandescent Lamps: JAHODA [Metal filaments] 15,496/09.

Switchgear, Fuses and Fittings: HAMILTON [Combined section-insulator and switch for trolley wires] 12,442/09; WEEKES [Switch fuses] 12,585/09; DAMEY [Lamp lock] 21,109/09; BOULT (*Felten & Guilleaume Lahmeyerwerke A.-G.*) [Control gear for electrically-driven machine tools] 27,026/09; SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*) [Cartridge fuses] 29,087/09; LUNDBERG [Switches] 3,927/10.

Telephony and Telegraphy: SHARMAN [Production of harmonics in oscillations for selective wireless telegraphy] 12,790/09; TATTERSALL [Telephone mouthpieces] 16,520/09; AITKEN and BRITISH INSULATED & HELSBY CABLES, LTD. [Telephone switching apparatus] 2,057/10; GOTTSCHALK [Telephone transmitters] 4,446/10; JUILLAC [Wireless antennæ mast] 7,082/10.

Traction: COLEMAN [Signalling] 12,795/08; HAMILTON [Section insulator] 12,442/09; CARBONI and TIRONI [Signalling] 22,866/09.

Miscellaneous: COWIE [Mariner's compass] 11,940/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Propulsion of ships] 19,872/09; MASCHINENFABRIK OERLIKON [Electro-hydraulic press] 24,784/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution Systems, &c.: NEW [Transformer system] 8,563/10.

Dynamos, &c.: GARCIN, 11,356/10.

Electric Ignition: R. BOSCH [Magnetos] 6,653/10.

Electrometallurgy, &c.: KAISER [Production of Nitrogen oxides] 12,229/10; AKTIEBOLAGET ELEKTROMETALL [Electric smelting furnaces] 12,430/10.

Instruments, &c.: COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIALS D'USINES À GAZ [Recording galvanometers] 6,782/10.

Telegraphy, &c.: FESSENDEN [Wireless signalling] 11,903/10; DROOP [Telephone relays] 12,408/10.

Traction: BUTLER & ROCKMAN [Suspension railway] 12,124-5/10.

Miscellaneous: ALLGEMEINE ELEKTRICITÄTS GES. [Air compressors] 12,338/10.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: J. STEVENSON [Lowering gear] 4,390/03.

Dynamos, &c.: B. G. LAMME [Single-phase commutator motors] 27,705/04.

Switchgear, &c.: H. H. LEIGH (*F. J. Sprague*) [Control of lift motors] 4,549/98; H. LEITNER AND R. N. LUCAS [Automatic reversing switch for train-lighting dynamos] 4,732/03; G. SPERRYN AND W. H. WOOD [Tumbler switch] 4,451/04; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Control of electric hoists and overhead runways] 3,919/05.

Telephony, &c.: T. SLOPER AND J. H. PARSONS [Intercommunication telephone system] 4,793/02.

Traction: P. HALLOT [Brakes] 4,664/04; A. E. TANNER AND E. A. CLAREMONT [Automatic signalling] 4,164/05.

Miscellaneous: J. HOGARTH [Electrical treatment of flour and other foodstuffs] 4,695/97; H. J. DOWSING [Radiant heat baths] 4,736/97; J. BARR AND R. ANDERSON [Electrically-driven reciprocating saw] 4,709/03; C. D. ABEL (*Siemens and Halske A.-G.*) [Springs, &c., of alloys of tantalum] 3,691-1A/05; R. LOMAX [Automatic electrically-driven stoker] 3,867/05; MAY-OATWAY FIRE APPLIANCES, LTD. [Fire alarm] 4,073/05.

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ELECTRICAL ENGINEERING

No. 182 [Vol. VI., No. 25] THURSDAY, JUNE 23, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Latest Time for Receiving
Letters for Insertion, *Tuesday first post.*
Small Advertisements and Official Announcements, *Wednesday first post.*
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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

A portrait and biography of Mr. John Christie, who has been elected President of the Incorporated Municipal Electrical Association for the coming year, appear on page 407.

A motor generator for meter testing is described on page 407.

Some pyrometers having several interesting features have been introduced. Various patterns are supplied to suit different conditions and with different ranges. An alarm device, and an instrument for taking a continuous record of one or more pyrometers are described. (Page 408.)

Mr. Justice Neville delivered judgment on Monday in the action in which the wiring contractors of Leicester are endeavouring to obtain an injunction to restrain the Leicester Corporation from carrying out electric wiring and selling electric fittings. He held that the Corporation were not entitled to wire premises and sell fittings, and granted the injunction asked for, subject to an appeal, which must be set down within three weeks. (Page 407.)

A submarine telegraph cable 3,144 miles in length, and said to be the second longest in the world, has been opened for service between Ascension and Buenos Ayres. (Page 410.)

We give a few details of the central car repairing depot of the L.C.C. tramways, which was recently visited by the Society of Engineers. (Page 377.)

We conclude our Report of the Proceedings at the I.M.E.A. meeting last week. On Wednesday Mr. F. A. Newington described the exhaust steam turbines and the special condensing plant using sewage effluent as circulating water at the McDonald Road Station, Edinburgh. This Paper, an abstract of which was given in our last issue, was discussed, together with one by Mr. Ashton Bremner, describing the mixed pressure turbo-generator at Burslem. More than one speaker in the discussion questioned whether better ultimate economy could not often be obtained by the entire replacement of old by new plant rather than by the addition of exhaust steam turbines, and Mr. Shawfield went so far as to say that even the capital cost would be less. Mention was also made of the ways in which early commutator troubles on continuous-current turbo-generators had been overcome.—On Thursday there were two discussions. The first of these was on the advantages of Continuous Records of Costs and of Steam Consumption, and was opened by Mr. G. Wilkinson, who insisted particularly on the undesirability of feeding into the economisers at too high a temperature, and explained that he obtained greater efficiency by returning the condensed water from the steam traps, &c., direct to the boiler instead of taking it to the feed tank. Mr. Shawfield, who followed, gave an instance to show the practical value of continuous tests. He was not in favour of returning the condensed water direct to the boiler, as he preferred to measure it, and thus obtain an indication as to

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defects in the lagging or arrangement of the steam pipes. He had, however, not had good experience with CO_2 recorders. Mr. Ayton, Mr. Wordingham, and Mr. Ruddle all thought that there was danger of the taking of records in stations being overdone. Mr. Ayton's experience with CO_2 recorders coincided with that of Mr. Shawfield, and he explained the probable cause of the trouble and the remedy he was trying. He also described the methods he used to prevent air leakages into the furnaces and flues, a point which had also been raised by Mr. Wilkinson. Mr. Newington described some tests he had made on the moisture in coal; Mr. Lea related some interesting experiences which had led him to evolve his water recorder, and complained that plant-running was not taught at engineering colleges; and, finally, Mr. Rowland expressed a high opinion of the CO_2 recorder, which instrument, he said, had led to economies at Stretford.—The next discussion was on Cheapening the Costs of Mains and Services, which was opened by Mr. S. J. Watson and Mr. Ayton. In this some valuable figures were given as to the cost of service connections. In Glasgow they average £4 6s. 6d., but a few years ago they were actually £7. Some speakers explained how they had been successful in reducing the cost of services; an extended use of looping in was also advocated, and one suggested that it would be worth while in some cases to lay the services at the same time as the mains.—At the annual meeting, on Friday, Mr. J. Christie, Chief Electrical Engineer to the Brighton Corporation, was elected President for the coming year, with Messrs. Wilkinson (Harrogate) and Shawfield (Wolverhampton) as senior and junior Vice-Presidents respectively. The annual report of the Council did not raise any contentious points, but a discussion followed upon the desirability of municipalities throughout the country having powers to wire premises and hire out apparatus. Eventually a recommendation was passed that the Council should consider what steps can be taken to promote a Bill for this purpose. Among other matters discussed were a new method of electing Members of Council, the establishment of a Central Information Bureau, and the appointment of Special Committees at the annual conventions to discuss points of limited interest. Mr. C. H. Wordingham has been elected an honorary member of the Association. (Pages 411-419.)

AMONG the specifications published by the Patent Office on Thursday last was one by W. G. Hamilton for a combined section insulator and switch for trolley wires, to obviate the necessity for switch-boxes and cables other than the feeders.—An ignition coil, in which the magnetic flux is reversed by reversing the direction of the current flow in the primary, is described by B. Brooks and F. H. Alston.—The British Thomson-Houston Co. have protected a system of electrical propulsion for ships, in which low-pressure low-speed turbines on the propeller shafts assist the electro motors at high speeds. The low-pressure turbines are driven by exhaust steam from the turbo-alternator sets supplying the motors.—A method of control for heavy planing machines, in which the motor is slowed down electrically before reversing, is described by the Felten Guilleaume-Lahmeyerwerke A.G.—A patent by S. Johnston for wiring fittings is opposed.—T. A. Carver has applied for an extension of the life of two patents relating to electrically-controlled jacquards for looms. (Page 418.)

A COMPACT switch for regulating the brilliancy of incandescent lamps or for controlling fans and other motor-driven apparatus is described. (Page 420.)

THE Board of Trade have refused the Lancashire Electric Power Co. permission to supply electrical energy in Radcliffe in competition with the Council. At the same time they express the opinion that the Council is not affording facilities for a cheap supply, and urges them to take the necessary steps to do so. (Page 421.)

THE report of Mr. G. S. Ram, H.M. Electrical Inspector of Factories, for the year 1909, shows that out of 447 accidents in electricity works, 90 were due to electrical causes, and that of these only four were fatal. In fifty cases the accidents were caused by men cleaning or working near exposed H.-T. conductors. Mr. Ram makes some comments with regard to the interlocking of isolating switches in H.-T. stations, two accidents having been caused by opening these on load. Of 257 electrical accidents in factories, only eight were fatal. Many were due to the use of cheap switchgear and insufficiently protected flexible wires. (Page 421.)

THE adoption of trolley omnibuses is under consideration at Cardiff and Lowestoft.—The Bradford Tramway accounts show a net profit of £32,365 for the past year.—The Fleetwood Borough Electrical Engineer has been instructed to prepare estimates of the cost of superseding gas for street lighting.—Mr. C. H. Yeaman, of Hanley, has been recommended for the post of Electrical Engineer to the new County Borough of Stoke-on-Trent.—The estimated surplus on the L.C.C. tramways for 1910–11 is £244,182 after meeting capital charges. (Page 422.)

FURTHER plant is to be installed at Hampstead at an estimated cost of £6,600; Manchester Corporation require three-phase transformers and high- and low-tension switchgear; an electric lighting plant is required in the neighbourhood of Dublin. Loans are contemplated as follows: Gillingham (£3,500), Pembroke (£8,000), Portsmouth (£24,000), Rawtenstall (£11,000), Rochdale (£13,941). (Page 423.)

THE Aron Meter Co.'s accounts for last year show a net sum available of £27,667. In addition to the full dividend on the 6 per cent. preference shares, a further 9 per cent. is paid on account of arrears.—At the annual meeting of the British Electric Traction Co., last week, Sir Charles Rivers Wilson stated that there were indications of improvement in the immediate future. The profit on the last year's working of Marconi's Wireless Telegraph Co. was £11,432. (Page 424.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JUNE 23RD.

National Telephone Co.

7 for 7.30 p.m. Staff dinner at Trocadero Restaurant.

FRIDAY, JUNE 24TH.

Physical Society.

Visit to the National Physical Laboratory.

SATURDAY, JUNE 25TH.

Institution of Mining Electrical Engineers.

3.30 p.m. Notts and Derbyshire Branch. At University College, Nottingham. "The Adaptation of the Cascade Induction Motor for Mine and Quarry Work," by M. J. Williams-Ellis.

3.30 p.m. South Wales Branch. Visit to Treforest Power Station of the South Wales Electrical Power Distribution Co.

TUESDAY, JUNE 28TH.

Institution of Electrical Engineers.

9-11.30 p.m. Conversazione at Natural History Museum, Cromwell Road, London, S.W.

Telegraph Traffic and Movements of Cable Ships.—On the 15th inst. the cable between Gibraltar and Tangier was restored, while on the 18th inst. the cable between Souakim and Djedda was again working.—The c.s. *Minia*, of the Anglo-American Telegraph Co., which left port on April 26th, returned to Halifax, N.S., on May 3rd.—The Commercial Cable Co. has had considerable trouble with one of their short sections, the work occupying the c.s. *Mackay-Bennett* some considerable time. The vessel had to put into port once or twice, and finally finished the work on the 31st ult. It is also understood that some gear was lost.—The repairing steamer of the French Cable Co. did not leave port during the past month.—The *Robert C. Clowry*, of the Western Union Telegraph Co., is at Canso, where she arrived from the United States.—The c.s. *Colonia*, of the Telegraph Construction & Maintenance Co., has been employed on the laying of the new section between Weston-super-Mare and Waterville, for the Commercial Cable Co.

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THE NEW I.M.E.A. PRESIDENT

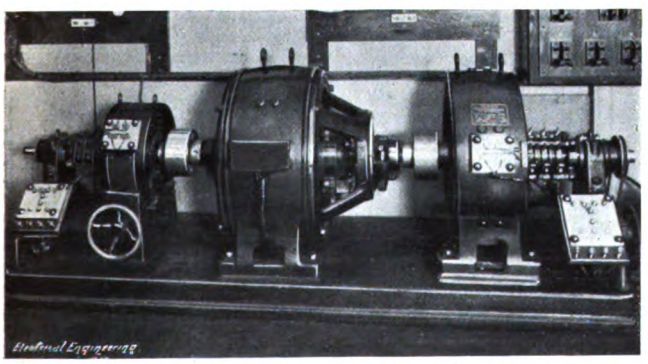
MR. JOHN CHRISTIE, who has just been elected President of the Incorporated Municipal Electrical Association, is Engineer and Manager of the Brighton Corporation Electricity Works. He will be forty-two years of age next month, and is a native of Glasgow. His apprenticeship and early experience was as a marine engineer, and he started his electrical work at Messrs. Crompton's Works at Chelmsford. His first municipal job was as Second Engineer to the St. Pancras Electricity Works, in which situation he was for about a year, and, after a few months in the testing department of Messrs. Siemens Bros. & Co. at Woolwich, he proceeded to Glasgow as Second Engineer at the Corporation Electricity Works. Early in 1894 he was appointed Chief Electrical Engineer at the Londonderry Corporation Electricity Works, which at that time only supplied public lighting. He remained there for four years, and in 1898 he returned to Glasgow as Power-house Superintendent under Mr. W. A. Chamen, who was then City Electrical Engineer. He remained there 2½ years; but his work was not confined to the charge of the generating station, as he also assisted Mr. Chamen in superintending the installation of the plant at the Port Dundas Power Station, which was under erection during that period. In the summer of 1900 he was appointed Engineer and Manager to the Brighton Corporation Electricity Works when Mr. Arthur Wright retired from the position of Chief Engineer and started his practice as Consulting Engineer, retaining his association with the Corporation in that capacity. The Brighton electricity undertaking was then a far smaller one than it is now, but in June, 1906, the present new turbine power station at Southwick was opened by Mr. John Burns, and Mr. Christie has been responsible for its running and management. The success which he has achieved in the reorganisation of the electric supply in Brighton since the starting-up of the new works is well shown by the fact that last year there was a net profit of £6,251, largely due to the development of a large power load.



For many years Mr. Christie has taken the keenest interest in the affairs of the Incorporated Municipal Electrical Association, and although, owing to his retiring disposition, he has never been prevailed upon to read a Paper and has seldom spoken in discussions, yet his work upon the Council and the committees has been invaluable, and he is one of the most popular members of the Association.

A MOTOR-GENERATOR FOR METER TESTING

ONE of the latest additions to the electrical engineering laboratories at the Manchester School of Technology is a small motor-generator set for testing meters and carrying out experimental work. This set, which was manufactured by the British Westinghouse & Manufacturing Co., Ltd. (Trafford Park, Manchester), is illustrated in the accompanying figure. It consists of three machines rigidly coupled together on a combined bedplate, and is driven by a 13-h.p. D.-C. shunt-wound motor, suitable for operating on a 400-volt circuit. This motor is of the variable-speed type, and capable of running between speeds of 500 to 1,700 r.p.m., giving its rated output throughout this range.



MOTOR-GENERATOR SET FOR METER TESTING.

Two generators of the revolving-armature type are arranged one on each side of the motor. These have ratings of 1 to 5 kw. respectively, three-phase, 25 to 85 cycles, 100 to 340 volts at 500 to 1,700 r.p.m. Each machine is designed to give a sine-wave, and is fitted with six slip rings. The motor is fitted with a terminal board arranged for connecting the field coils in parallel, as they may occasionally have to be excited from a lower voltage than 400. The 1-kw. generator has its yoke machined on the outside, and fitted into a circular seat on the bedplate, and is arranged with a worm-gear for rotating the field, which enables this machine to be given a displacement of as much as 200 electrical degrees with respect to the 5-kw. generator. A gradual variation of phase adjustment is obtainable by this means while the set is running. This is necessary, as the phase has to be adjusted for each variation in current output, on account of the varying lag with a varying current in the armature. By this arrangement one is able to get from maximum lagging to maximum leading current. Terminals are also provided for making easy and rapid connection with the external circuit. Great care has been taken in specially balancing the set to avoid vibration and disturbance of the standardising instruments where the set is run. The engineering staff are carrying out a number of very interesting and valuable experiments on the effect of wave-form, &c., on the indications of induction type meters, in which this set is employed.

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INDICATING AND RECORDING PYROMETERS

SOME new indicating and recording pyrometers, the manufacture of Messrs. Keiser & Schmidt, of Berlin, are being introduced into this country by Mr. H. I. Lewenz (6 Trinity Square, London, E.C.). These instruments have many new features of especial interest, and great accuracy and reliability is claimed for them. For temperatures up to 600° C., two thermo-couples in series of copper and constantan, or of iron and constantan (the latter have been found to retain their accuracy longer), are enclosed in a glass tube protected by a steel tube. A pyrometer of this type, suitable for recording or measuring the temperature of superheat in steam plant, is illustrated in Fig. 1. This pattern, but generally with a longer tube, is also used in chemical and gas works. The couples are connected to a millivoltmeter, calibrated to read in degrees Centigrade, or if necessary to a recording instrument. In order to obviate the error which occurs when the temperature of the cold junction (*i.e.*, the connection at the head of the pyrometer) is not at the same temperature as it was when the instrument was calibrated, a special compensating cable is employed. This contains four conductors of special metals; two connect one pole of each thermo-couple to the millivoltmeter, while the other two, connected to the other two poles of the couples, are joined together at their other ends, thus removing the cold junction to a place of comparatively constant temperature.



Fig. 1.—PYROMETER FOR SUPERHEATERS.

Pyrometers for steel and iron works, porcelain, glass, and pottery works, &c., for measuring the temperature of flue gases, or for use in electric furnaces where the temperature is not higher than 1,600° C., are constructed with couples of platinum and an alloy of platinum with 10 per cent. of rhodium. Great care is taken to ensure that the metals are pure in order to obtain high accuracy. The couples are either hung without any covering in the furnace or are enclosed in porcelain tubes. For glass works the couples are enclosed in a fireclay tube. Where the temperature does not exceed 1,200° C., the couples are placed in a double porcelain tube, protected by a steel covering. If the pyrometer is to be kept permanently at a high temperature, steel cannot be used, and a fireclay tube is employed.

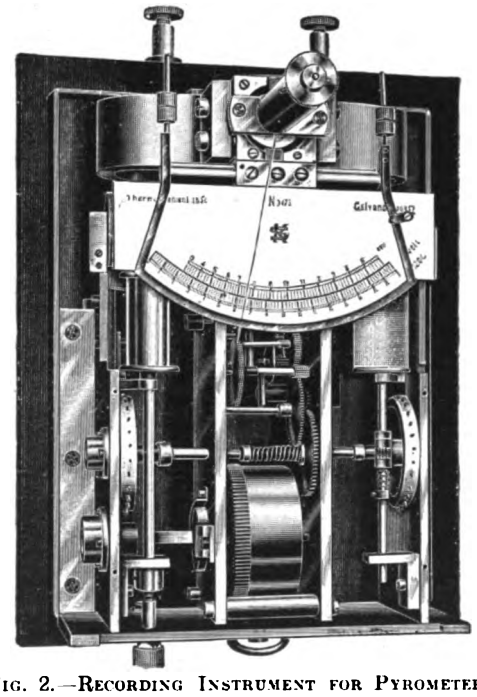


FIG. 2.—RECORDING INSTRUMENT FOR PYROMETERS.

Various patterns of indicating instruments are provided, including wall and portable patterns, and desk instruments for laboratory and workshop use. The laboratory instruments have steel filar suspension, and the workshop patterns jewelled suspension. A multiple-way switch can be employed where several pyrometers are connected to one indicating instrument. When it is desired to give a warning when the temperature exceeds a certain limit, a contact is placed at that point on the scale, and when the needle reaches this point, a relay circuit is closed and a bell or lamp indicates the fact. A disadvantage of this arrangement was that on lowering the temperature, the needle still remained in contact owing to "stiction." The following ingenious device prevents this. An auxiliary thermo-couple is placed in series with the millivoltmeter, but electrically opposed to the pyrometer thermo-couples, and is enclosed in a heating coil placed in series with the bell or lamp. When the bell or lamp operates, the coil heats up the couple and a powerful reverse current is sent through the millivoltmeter. This causes the needle to break contact. If the temperature of the pyrometer is not immediately reduced, intermittent signals will be given at intervals of about 30 seconds, as the needle will return to the contact directly the heating coil cools down.

A recording instrument for use with pyrometers of both classes is illustrated in Fig. 2. It consists of an eight-day clockwork with toothed wheels which unroll a strip of paper perforated at its edges. The teeth enter the perforations and prevent cornering. An ink ribbon travels across the paper strip. The needle of the instrument has a blunt point, and this is brought down at regular intervals on to the ink ribbon, by means of a stirrup operated by the clockwork, thus marking the paper. The electrical movement has a steel filar suspension. Where two or more curves are to be plotted by one instrument, the different pyrometers are connected to the instrument successively by means of a commutator, which also inserts suitable resistances, so as to displace the zeros of the various curves, preventing their overlapping.

These instruments can also be used for measuring and recording low temperatures down to 200° C. below zero; the iron-constantan couples are always used for this purpose. Finally, it may be mentioned that special pyrometers are constructed for measuring the temperature of the superheated steam of locomotives where superheat is employed. The Prussian State railways authorities have just completed a 15,000 mile test on one of these instruments, with satisfactory results.

The "Z" Metal Filament Lamp Patent.—In the Appeal Court on Saturday, a motion was made by the "Z" Electric Lamp Co. with reference to the forthcoming hearing of the appeal against Mr. Justice Parker's decision that Messrs. Marples, Leach & Co. (now Adnil Electric Co.) have infringed the "Z" Company's patent covering the use of phospham in metal filament lamps. The "Z" Company applied for security for the costs of the appeal, and Messrs. Marples, Leach & Co. were ordered to pay £200 into court within ten days in respect of these.

Photo-telegraphy.—We are informed that Mr. T. Thorne Baker has carried out some successful experiments with his system of photo-telegraphy between Boston and New York, and that tests will be made in September next with apparatus especially designed for the purpose between Chicago and New York. If these tests are successful, we understand that permanent stations will be set up in these cities for the purpose of transmission of news photographs for the *New York American*, which publishes in both Chicago and New York. Attempts will also be made to transmit photographs and drawings between San Francisco and New York, but the line disturbances in such long-distance work render accurate transmission very difficult.

American Light Railways Statistics.—The report of the U.S. Census Bureau on street railways, compiled from the census taken in 1907 shows that the total length of track for light railways, including all electrically-operated interban railways, and electric, horse, and steam tramways, was 34,403 miles in 1907, as against 22,577 in 1902, an increase for the whole of the United States of 52·4 per cent. Of this, 34,059 miles, or 99 per cent., was worked electrically. The total number of passenger cars in use was 83,641, and the number of passengers carried over 9½ billion. Some 830 power stations were in operation, with a total capacity of over 1,700,000 kw. The technical portion of the report, prepared by Mr. T. C. Martin, contains detail particulars and illustrations of the engineering equipment of various systems.

Burglar Alarm.—At the invitation of Mr. S. Lichtenfeld (300 Regent Street, London), we recently inspected a burglar alarm which he has patented. Spring contacts are placed under mats and carpets in suitable positions, and these are connected to a common relay across the lighting mains in series with a lamp. When a contact is made, the relay operates to release a clockwork mechanism which turns a rotary switch. This switch is placed in additional wires in the lighting circuit, so that it causes certain lamps of the house to light up independently of the local switches. Further, the lamps cannot be switched off except by returning the rotary switch to the original position. During the day, the relay circuit is broken by means of a special switch. Besides lighting the lamps, alarms can be sounded and warning signs outside the building illuminated to attract the police. The arrangement for switching on the lamps of the ordinary lighting circuit independently of the local switches is distinctly novel, but will entail further complications in the wiring. The advisability of having contacts under the carpets at the lighting pressure is questionable, however well they may be insulated, and there seems to be no reason why a battery would not be equally effective.

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MUNICIPAL WIRING AT LEICESTER DECLARED ILLEGAL

IN our last issue we reported the first part of an important case that is being heard by Mr. Justice Neville in the Chancery Division of the High Court of Justice. The case started on Monday last week, and our previous report dealt with the first two days' proceedings. Judgment has now been given, and an injunction has been granted to restrain the Leicester Corporation, who work under a Provisional Order, from carrying out electric wiring and selling electric fittings, &c. During the first two days of the hearing, evidence of considerable interest was given, including proof of the sale of an electric lamp to a non-ratepayer, and the wiring of a private electrical installation outside the borough boundary. The Corporation contended that they were entitled to wire consumers' premises and to supply consumers with fittings under Section 10 of the Electric Lighting Act of 1882, which empowers them to "do all such acts and things as may be necessary and incidental to" the supply of electrical energy.

On resuming on Wednesday, evidence was called for the defence.

Mr. J. J. P. Barker said that he had had charge of the Corporation's Electrical Fittings Department for the last seven or eight years, and had been in the Corporation's employment for 36 years, having previously been in the Gas Fittings Department. During this time they had done wiring for people who did not take their supply from the Corporation, but it was a long time ago, and very seldom. Although they did not make a speciality of bell wiring, this had been done also at the same time as they did the electric light wiring, or when they had been called in for repair work. Now, however, they no longer carried out bell wiring, and when people asked for this class of work to be done, they referred them to a contractor. In reply to further questions he said that they had never put up any telephones or telephone wires, but the Corporation employees did the telephone work in the Corporation's buildings. In reply to some questions on the quality of work done, he stated that he had known cases in which consumers' fittings and wires were not perfect, and it was very important in his opinion that they should be perfect. If there was any failure of supply, the consumers would go to the Corporation.

In cross-examination the witness was first asked as to the appearance of the showroom, and said that it had a window like a shop window, and admitted that the fittings, &c., which were displayed in the showroom, included shaving brushes and "magic mirrors." He stated that the Corporation did not sell either cells for electric bells or the materials for charging them, and when invoices relating to this class of material were shown him he said that they might have done it in a few instances, but he knew nothing about it. They had put in electric fittings for Messrs. Smith, Faire & Co. for the amount of about £500 about fifteen years ago in the hope that some day this firm would take their supply from the Corporation, but they had not done so yet, and still ran their own installation. He said it had not been their practice to do anything on the premises of people not taking supply from the Corporation unless express permission or instructions were given by the late Mr. Colson.

Mr. Felix Cassel, K.C., for the plaintiffs, then replied on the whole case.

During the course of Mr. Cassel's speech, Mr. Justice Neville said that the word "supply" was used both in the Gas Acts and the Electric Lighting Acts, but, whereas in the former case the supply was deemed to terminate at the burner, and the company had the option of supplying the fittings, in the latter case the Acts did not refer to the fittings at all.

Mr. Cassel said that there was a further distinction between the Gas Acts and Electric Lighting Acts: in the former no mention was made of the consumers' terminals, whereas in the Electric Lighting Acts the supply was defined as being a supply to the consumers' terminals. Under the Electric Lighting Acts, the undertaker had no power to charge for anything except supply and for the meters. Finally, he submitted that even if the Judge should hold that the Corporation had power to do wiring on consumers' premises, they were not entitled to sell such things as motors, cooking utensils, shaving pots, and things of that sort.

The Judge said that if the wiring and fittings were "incidental" to the supply, these things would be also.

Mr. Cassel contended, however, that what the Corporation was doing was really keeping an ordinary shop, and that this was no part of their undertaking.

At the conclusion of Mr. Cassel's arguments, the Judge intimated that he would reserve judgment.

In delivering judgment on Monday, Mr. Justice Neville first expressed the opinion that the plaintiff had proved his allegations. The Corporation had claimed the right to supply wires and fittings under the powers of the Electric Lighting Act of 1882, and their Provisional Order. Section 10 of the Act of 1882 authorised the undertakers to do all such acts and things as might be necessary and incidental to the supply of electricity, and it seemed to him that there was a clear distinction between "supply" and "use." Section 18 of the Act of 1882 expressly negatived the right of the undertakers to prescribe any lamp, or to interfere with the use of electricity by consumers, and incidentally he mentioned that the analogy which had been made between the Acts relating to gas and those relating to electricity failed, for the Gas Works Clauses Act gave gas undertakings the right to prescribe burners. Section 18 of the Electric Lighting Act of 1882 plainly discriminated between the supply of electricity and its use, and gave the undertakers no authority with regard to the latter. The Corporation's Provisional Order interpreted "consumers' terminals" as meaning "the ends of the electric lines situate upon any consumer's premises, and belonging to him, at which the supply of energy is delivered from the service lines." The undertakers had power to charge for the supply of energy, and for meters and fittings, but for furnishing and laying lines they had no power to charge, except in special cases. By Clause 21 of the Provisional Order, however, they were bound to give a supply of energy on demand, and if the wiring of the house and the provision of fittings was part of the supply, they would be compelled to do it without remuneration, and he thought there was force in the argument of the plaintiff that this could not have been intended by the legislature. **In his opinion, "supply," within the meaning of the Act and Order was completed at the consumer's terminals. The installation of electricity and the provision of fittings was a separate business incidental to the use, but not to the supply of, energy. He thought the Corporation had misinterpreted their powers, and had been carrying on a business in excess of them.** The Electric Lighting Act of 1909 did not throw any light upon the meaning of "supply" in the Act of 1882. Section 16 of the Act of 1909 not having reference to any power given by the Act of 1882. The plaintiff was, therefore, entitled to the injunction asked for, and defendants must pay the costs of the action.

On the application of Mr. Danckwerts, K.C., a stay was granted, provided notice of appeal was given within three weeks.

Erratum:—By a clerical error, in our report last week, Mr. Tweedy Smith was referred to as Honorary Secretary of the Electrical Contractors' Association, instead of Honorary Solicitor to the Electrical Contractors' Association.

Induction Motor Design.—In a paper by R. E. Hellmund, published in Vol. 27 of the *Transactions* of the American Institute of Electrical Engineers (1908), the author described some graphical methods for the study of the main field in induction motors. A Paper by the same author describing similar methods for investigation of the zigzag and slot leakage fluxes and their effects has been accepted by the Council of the Institution of Electrical Engineers (London) for publication in the *Journal*. In an appendix to the Paper, the author gives a number of formulæ and curves deduced by the methods described, from which the values of the various leakages for any given motor can be estimated. An expression for the end-connection leakage is given, though, as the author points out, the exact calculation of this is almost impossible. The expression deduced for the total leakage is stated to have given results agreeing very closely with those found from test.

Magnetic Balance.—At a recent meeting of the Physical Society, a Paper describing the magnetic balance of MM. Curie and C. Cheneveau was read by Mr. A. C. Jolley. This balance is intended for the determination of the coefficient of specific magnetisation, susceptibility, and permeability of feebly paramagnetic and diamagnetic bodies. The body is suspended from one arm of a torsion balance, which measures the force exerted on the body when it is placed in the field of a permanent magnet. The balance is formed by a horizontal rod suspended by a fine platinum wire, and carrying at one end a hook, and at the other end a copper sector. The latter moves between the poles of an auxiliary magnet, and thus provides efficient damping. A second arm is provided upon which may be placed counterweights. The suspension carries a mirror, and the movements are read on a scale. A large circular permanent magnet is mounted so that the vertical gap may be made to describe a semicircle of radius equal to the length of the torsion arm. Experiments have been performed with various metals and alloys. Mr. Jolley mentioned that the balance would be useful for making sure that the metals used for making certain instruments were quite non-magnetic. It also indicated the presence of very slight impurities in copper better than a chemical test. Wood and ebonite had been found to be very magnetic, but the results were variable owing to the effects of tooling.

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A NEW SUBMARINE CABLE

ON June 3rd a new cable was opened to service between Ascension and Buenos Ayres. This cable, which is the second longest in the world, was laid recently by the c.s. *Colonia*, of the Western Telegraph Co., Ltd., who have carried out all the engineering work connected with the laying of the cable. The total length of the cable is 3,144 miles, comprising one mile of heavy shore end, 188 miles of intermediate shore end, 78 miles of intermediate, and 2,877 miles of deep sea cable. The conductor weighs 700 lbs. and the insulation 360 lbs. per nautical mile. A maximum depth of 3,220 fathoms is reached. The underground land-line extensions consist of air-space and paper-insulated cables laid in conduits, and are 1·7 miles and 41 miles in length at Ascension and Buenos Ayres respectively. We are indebted to Mr. W. Judd for the above information.

CENTRAL CAR REPAIR DEPOT OF THE L.C.C. TRAMWAYS

A VISIT was paid recently by some members of the Society of Engineers to the central car repair depôt of the L.C.C. Tramways at Charlton, by kind invitation of Mr. A. L. C. Fell, chief officer of tramways.

The site of the depôt is at Woolwich Road, Charlton, on the south bank of the Thames, and is nearly seven acres in extent; rather more than one-half being at the present time occupied by buildings, while extension works are in progress.

The smiths' shop, 130 ft. by 34 ft., contains two 5 cwt. electrically-driven Massey pneumatic power hammers, a forging machine, a 10 cwt. drop hammer, one 6 ft. by 2 ft. 3 in. forging and annealing furnace, and 13 smiths' hearths. The machine shop, 143 ft. by 43 ft., is fitted with modern milling, slotting, screwing and drilling machines and lathes, and contains a 3-ton overhead travelling crane (3 motor type). In the wheel shop is a 150-ton wheel press, a tyre hearth, and special tyre-boring mills and tyre-turning lathes; while the truck-overhauling shop, 195 ft. long by 46 ft. wide, contains two 5-ton overhead travelling cranes, and has accommodation for 28 pairs of trucks. Other departments include the traverser-way, inspection shop, paint shop, tool room, small gallery (containing lathes, drilling machines, and small tools), large gallery (comprising the offices, testing room, plough shop, motor shop, controller shop, and other equipment), and the advertisement plant, which is a steam-heated drying apparatus for paper-slip advertisements.

There are ample stores, including the tool stores, having 1,270 bins, the finished part stores with 1,750 bins, and the general stores with 6,720 bins. The power supply is by three-phase high-tension current from Greenwich Generating Station to the transformer room, where it is transformed down to low-tension current at 220 volts, and distributed to sectional distribution fuse-boxes in the works.

The heavy tools are motor driven, while the ordinary and light tools are grouped and driven by motors. With the exception of traverse motors, all the motors are short-circuited rotor three-phase type. Lighting is effected by flame arcs throughout the smiths' shop, machine shop, truck shop, and galleries, and by incandescent lamps between car-ways in the paint and inspection shops.

Accumulator Cars on the Prussian State Railways.—A large number of these cars are now running on various sections of the Prussian State railways, and thirty-three further cars have been ordered this year. The design of the cars now in use was described in ELECTRICAL ENGINEERING, Vol. IV., p. 522. The new cars, of which eleven are now under construction by the Felten & Guilleaume-Lahmeyerwerke A.-G., will be slightly different. As before, they are double cars with the two units coupled back to back. Each unit will have three axles, however, instead of two, as it was found that the weight per axle was formerly too high. With three axles per unit, the weight per axle is less than 6 tons. The extra axles are to be placed at each end and under the accumulator tanks, where the greatest weight is. Further, all the new cars will be provided with electric, as well as compressed-air, brakes, whereas of the original cars only those by the F. & G.-L. A.-G. were so fitted. Applying both brakes simultaneously, these cars have been stopped from a speed of 35 miles per hour in a distance of only 115 yards. A third modification consists in the use of a time-element device in connection with the button on the driving handle. Should the driver release the button accidentally, the current will be cut off and the brake applied only after a few seconds. This will avoid the slowing down of the car due to accidental release, but will still ensure safety in the event of illness of the driver.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

MOTOR STARTERS.—A leaflet from George Ellisson (Victoria Works, 17 and 18 Warstone Lane, Birmingham), describes a series of fully enclosed face plate pattern star-delta starters for three-phase squirrel cage induction motors. These are constructed so that it is impossible to attain the running position without passing through the starting position; also the spring centre and retaining hook (provided even in the plain type) prevent the starter remaining in the starting position unless held there by the operator. They can be fitted with no-voltage and overload releases.

FANS.—We have received from the Electrical Co., Ltd. (122 Charing Cross Road, London, W.C.), a price list of this season's fans. Besides the usual patterns, shaft fans, oscillating bases, and speed regulators are listed.

FANS.—A new catalogue issued by the Electric & Ordnance Accessories Co., Ltd. (Aston, Birmingham), covers a number of types of small ventilating fans for desk, wall, ceiling, and porthole use. The cost of running a 12 in. Universal D.-C. fan for ten hours is stated to be less than 1½d. with current at 3d. per unit. Some particularly neat D.-C. ceiling fans for ships' saloons and railway carriages are listed.

TELEGRAPH AND TELEPHONE APPARATUS.—A new illustrated pamphlet issued by the British Insulated & Helsby Cables, Ltd. (Prescot, Lancashire) as a supplement to the firm's telegraph and telephone catalogues, gives prices and particulars of several pieces of telegraphic apparatus, including the Vyle polarised sounder, Mansbridge's self-sealing condensers, complete Simplex and Quadruplex telegraphic equipments, and several pieces of telephone apparatus. These latter include a new design of magneto table telephone, telephone cable heads, pole boxes, and testing pillars for underground cables.

FANS AND BLOWERS.—Messrs. Atkinson Bros. (Aire Place, Kirkstall Road, Leeds) have issued a new list covering various patterns of electrically-driven box-blade fans and blowers.

*Readers desiring copies of **catalogues** or pamphlets should apply to the firms in question, referring to the notice in "**Electrical Engineering.**"*

ELECTRICALLY-DRIVEN MACHINE TOOLS.—Two leaflets from Messrs. Atkinson Bros. (Aire Place, Kirkstall Road, Leeds) describe various patterns of self-contained electrically-driven sensitive drills and polishers. A hack saw, driven by a ⅓ h.p. motor, is also illustrated.

ELECTRIC DRIVING OF TEXTILE MACHINERY.—A pamphlet from the A.E.G. Electrical Co., Ltd. (121 Charing Cross Road, London, W.C.), deals with the application of electric drive to cotton spinning mills and weaving factories. A brief outline of the A.E.G. system of individual drive is given, together with a number of illustrations depicting the methods of meeting the requirements of the different classes of machinery.

Wireless Telegraph Detectors.—A Paper "On an Oscillation Detector Actuated Solely by Resistance-temperature Variations" was read before a recent meeting of the Physical Society by Dr. W. H. Eccles. Experiments were described in support of the author's hypothesis that in detectors constituted of a loose contact, the energy of the oscillatory current through the contact is transformed into heat at the contact and warms the matter there sufficiently to change its electrical resistance, and, consequently, the steady current through the indicating instrument. A detector of the so-called "crystal rectifier" type was used, from which, however, the possibility of thermoelectric effects had been eliminated. This detector consisted of a loose contact between two pieces of galena—a substance which according to the author's theory ought, by virtue of its large negative coefficient of change of resistance with temperature, to be a very efficient detector of electrical vibrations. The experimental curves obtained were, the steady current curve, the sensitiveness curve, and the power curve. The first has steadily applied E.M.F. as abscissæ, and current through the detector circuit as ordinates, and rises slowly at first, then quickly, and then slowly again; but if the circuit be arranged to have but little resistance other than that at the contact, the curve may possess a negative gradient at the point of inflexion. The sensitiveness curve has the E.M.F. applied to the detector as abscissæ, and the power passed to the indicating instrument as ordinates, the intensity of the electrical vibrations being of fixed amount. It is a curve which rises to a maximum near the point of greatest slope of the former curve, and thereafter descends slowly. The power curve has the power supplied to the detector in the form of electrical oscillations as abscissæ, with the power passed by the detector to the indicating instrument as ordinates, the steady E.M.F. applied to the detector being the best value. This curve is a straight line. The properties of this "crystal rectifier" are therefore just such as are logically deducible from the fundamental fact that the contact possesses a negative resistance-temperature coefficient.

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FIFTEENTH ANNUAL CONVENTION OF THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION

ON Wednesday last week, the second day of the Convention, the members proceeded to Edinburgh in the morning, where a meeting was held at the Free Gardeners' Hall. The Rt. Hon. the Lord Provost of Edinburgh welcomed the Association, and in the course of a short speech, questioned the wisdom of continual changes in the conveners and chairmen of electricity committees. He hoped a policy of longer continuity of office would be adopted in the interests of the undertakings.

EXHAUST AND MIXED-PRESSURE TURBINES, AND CONDENSING PLANT.

A Paper by Mr. F. A. Newington describing the exhaust steam turbines and condensing plant at his McDonald Road Station, Edinburgh—in which sewage affluent is used as circulating water—was first read. This Paper was published, in slightly abbreviated form, in our last issue. Mr. Ashton Bremner (Chief Electrical Engineer, Burslem) followed with a Paper on "Extensions to Existing Electricity Supply Station by Means of Mixed-Pressure Turbines":—

At the beginning of his Paper, the author pointed out that it should always be the endeavour of an engineer when called upon to design and afterwards to manage a central station, to make sure that whilst copper in the mains is most liberally provided, the generating plant be installed of such capacity that even in the early days the plant will be efficient, and later, the same plant may be economically run on light loads such as at certain times will obtain, and further that extension may be easily and economically made. He outlined the gradual growth of the demand at Burslem, which led to his advising in 1908 that the extensions should take the form of a 600-kw. Belliss-Siemens mixed-pressure turbo-generator, so designed that it could be used either as auxiliary power on exhaust steam or as stand-by plant on live steam. The original sets were run non-condensing, and the whole of the exhaust steam could be utilised in the turbine to produce additional power without increasing the cost of coal and water.

A study of Fig. 2 will show that the turbine develops approximately the same power as the sets which supply it with steam. Fig. 1 shows the general lay-out and arrangement of the mixed-pressure turbine plant at Burslem. The reciprocating sets can be run either non-condensing or in connection with the turbine or the turbine can be run as a separate unit. The result of tests of the steam consumption per kw.-hour under different conditions and varying loads are given in Fig. 3. From figures given by a firm of turbine builders as a guide to the power obtainable from the exhaust steam of reciprocating engines, it may be taken that, with the engine producing 500 kw. running compound non-condensing with steam at the

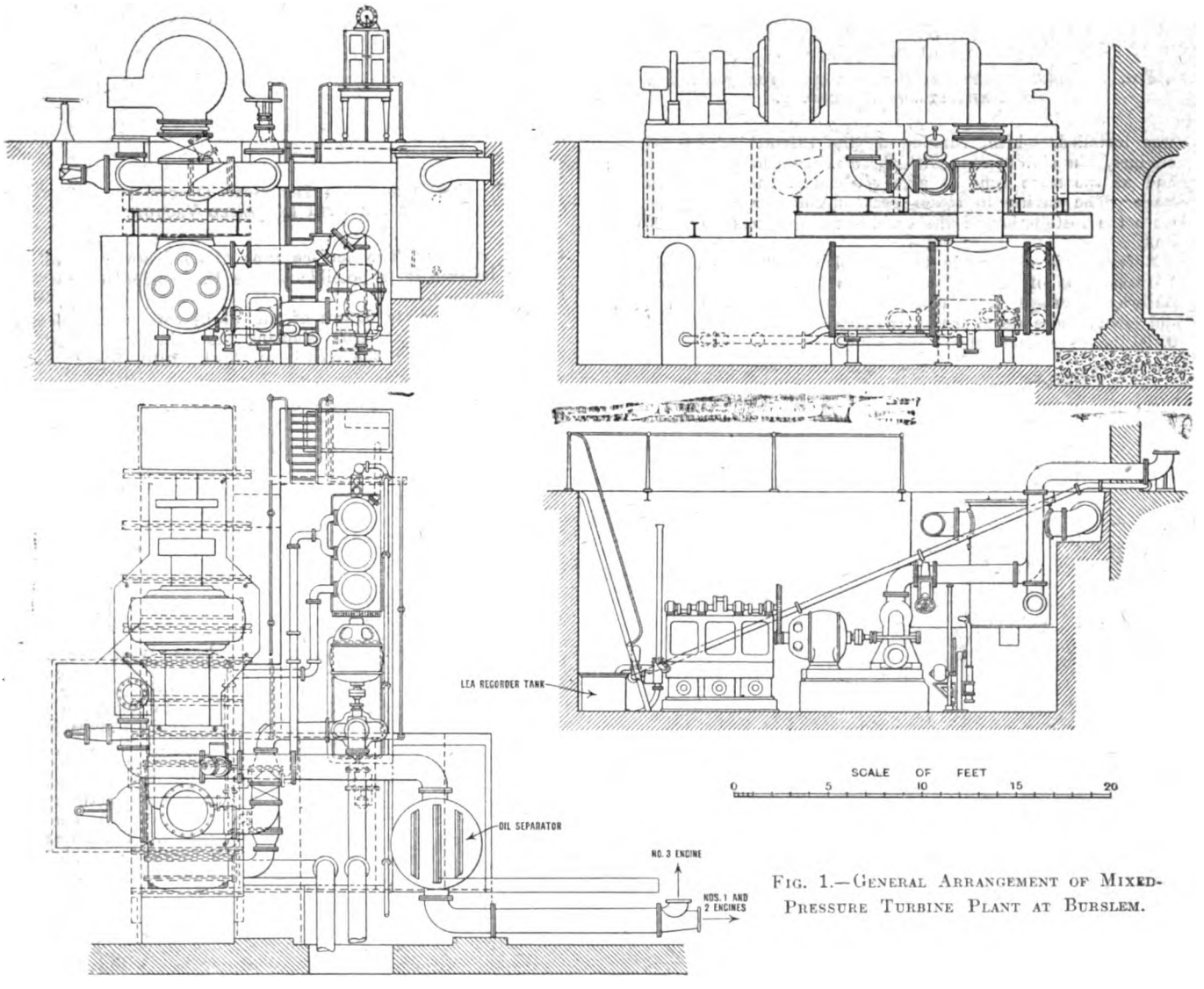


FIG. 1.—GENERAL ARRANGEMENT OF MIXED-PRESSURE TURBINE PLANT AT BURSLEM.

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stop valve at a pressure of 160 lbs. per sq. in., the exhaust turbine will produce an additional 375 kw., less, say 5 per cent. required to drive the condensing plant.

The Paper also referred to the results of the working economies of the power-house plant of a large engine builder's works, equipped with one 300-kw. and one 400-kw. triple-expansion engine running with a steam pressure of 160 lbs., and vacuum of 26 in., the steam being superheated from 50° to 150° F. At the beginning of 1908 an exhaust pressure turbine

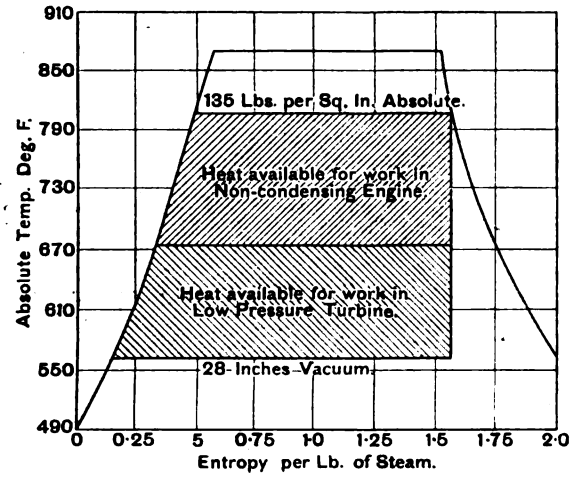


FIG. 2.—ENTROPY-TEMPERATURE DIAGRAM FOR ENGINE AND EXHAUST STEAM TURBINE.

was installed, which, running on the exhaust of one of the engines, was able to cope with the maximum load of the station and at the same time to give economical running on lighter loads. The saving in steam consumption per unit generated since the installation of the turbine ranged from 19 to 26 per cent.

Reference is also made to a turbine of the Westinghouse-Parsons type of 368-kw. capacity installed at the Gloucester Railway Carriage & Wagon Co.'s works, fitted with high- and low-pressure steam chests, the latter capable of dealing with 9,000 lbs. of exhaust steam per hour, and from which 210 kw.

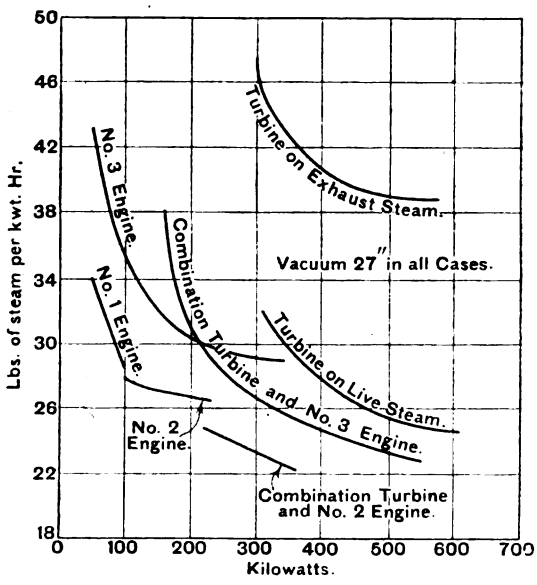


FIG. 3.—STEAM CONSUMPTIONS UNDER VARIOUS CONDITIONS.

is obtained, the rest of the load being carried on high-pressure steam. In this turbine the governing is effected by giving the low-pressure governor valve a lead over the high-pressure, so that the full quantity of exhaust steam is always used before high-pressure steam is admitted.

The following is a short description of the mixed-pressure Belliss turbine installed at Burslem electricity works. The turbine is of the drum type. The rotor is a short forged steel drum supported by two forged steel discs, mounted on a shaft which goes right through the rotor. The blades are of strip brass; each is aligned and held quite individually secure. The fixed blades are inserted in groups, in windows in steel blade rings, and are entirely protected from damage. The bearings are lubricated with water-cooled oil at a pressure of 30 lbs. to 40 lbs. per sq. in.; the oil pump is double acting and valveless. There is a flexible coupling between turbine and generator shafts. Governor throttle valves on both live and exhaust steam supplies, are operated by a powerful and sensitive oil relay, which is in turn operated by a governor of the same type as on the "Belliss" engines. Emergency valves are provided for both h.p. and l.p. steam, which operate at prescribed overspeed.

In order that a mixed-pressure turbine may run to the best advantage a high vacuum is necessary. The condensing plant is therefore a very important feature of the equipment. Fig. 4 shows the increase in output from exhaust turbine with in-

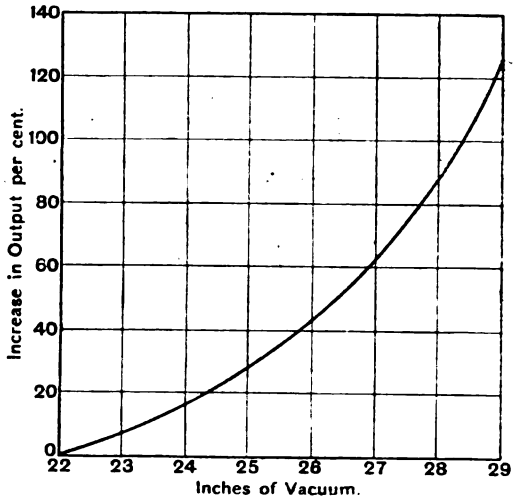


FIG. 4.—CURVE SHOWING INCREASED OUTPUT FROM EXHAUST TURBINE WITH INCREASED VACUUM.

creased vacuum. The surface type of condenser was selected mainly because it is possible to use the condensed steam for boiler purposes.

The following are figures of the works costs at Burslem for the month of April, 1909, showing the gain due to installing the turbine during the month of April, 1910, based on coal at 7s. 3d. per ton:—

Pence per Unit Generated.

	Without turbine.	With turbine.
Coal	0·244	0·184
Water	0·071	0·028
Total ...	0·315	0·212

The saving is thus 32 per cent.

Mr. Newington's and Mr. Bremner's Papers were discussed together:—

Mr. I. V. ROBINSON (Messrs. Richardsons, Westgarth & Co.) remarked with regard to the general proposition of using exhaust steam turbines that they were being considered for many stations where it really was not advisable to put them down, such as when the existing reciprocating engines were getting near the end of their useful life. There were, however, many cases in which they could be used with great success, and McDonald Road was one of them. His firm had recently brought out a new type of air-pump, called a kinetic ejector, worked by a combination of steam and a water jet, somewhat similar to that used in the vacuum augmenter. There was then a small water spray which condensed the steam which was added, and the uncondensed vapours were carried forward by means of a straight line water jet. The water used in the spray and the jet was circulated by a small centrifugal pump. This combination of spray and jet was maintained in a circular sump of cast iron about 3 ft. in diameter and 4 ft. 6 in. high. Condensed steam water from the condenser was withdrawn by a two-stage centrifugal pump. One advantage of this type was that the latent heat of the steam which had been used in the primary jet for withdrawing air from the condenser was not required for the circulating water, but was given up to the water in the steam which was used for hot-well purposes. This had the effect of giving a hot-well temperature ten or fifteen degrees above the temperature corresponding to the vacuum. The pumps were all rotary and were driven by a small steam turbine or motor, which, if desired, could drive the main circulating pump also.

Mr. C. H. WORDINGHAM (Electrical Engineer-in-Chief to the Admiralty) asked if Mr. Newington had found any trouble from

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corrosion, because it would appear that a number of paper mills discharge into the sewer, and there was no doubt a good deal of bleach which he should think must attack the condenser tubes. Again, was there any trouble with the foul nature of the water affecting the health of the station staff? The necessity for scraping by hand during time of full load might be a very serious disadvantage. With regard to Mr. Bremner's preliminary remarks, he thought the first designers of stations often came in for a good deal of criticism which they did not deserve. People often remarked on the smallness of the plant, but the critics forgot that if the plant had not been put in on a small scale to begin with, the station would not have paid its way in the early days and no extension would have been wanted. On the general question of installing exhaust steam turbines in reciprocating engine stations, attention should be paid not only to the possible economy, but to the practical operation of the station. These turbines practically doubled the switchboard, and gave what might be an inconvenient thing to run when they had to put on two units instead of only one at a time.

Mr. S. Z. DE FERRANTI had found a good many prospective users of exhaust steam turbines who did not realise to the proper extent the value of the exhaust steam that they were going to deal with. As a matter of fact, it was most important to utilise exhaust steam to quite the best advantage. They could not get more exhaust steam without having a greater capital expenditure and increasing the whole undertaking. He would like to suggest that specifications should be so drawn that it was worth while designing turbines to get the best possible value out of the steam. It was possible to get very much higher economies than those ordinarily obtained in everyday practice, but this usually involved building turbines of a larger size, much more ample exhaust pipes, bigger casings, higher velocities on the blades, much more carefully designed blades and structures all tending to greater capital costs. Exhaust steam turbines generally were an excellent makeshift at the present time. He did not follow Mr. Newington to the full by saying that a combination of this kind was as good as a new turbine. It was not finality; it was a financial process of bridging over the present position. This was largely brought about by the difficulty of putting aside for scrapping existing plant and having the difficulty of dealing with the matter in the accounts. The only solution appeared to be that the contractor might take a price for increasing the total output of a station to a certain number of kilowatts, and be allowed to do it in whatever way he liked. He could then sell the plant for scrap iron, but the Corporation would have a new plant at a less price per kilowatt and absolutely up-to-date with the latest practice in generating costs. He had no doubt, however, that in the majority of cases at present, it was quite the best thing to instal these exhaust steam turbines, and to leave to some later date a more complete reorganisation of the generating stations.

Mr. C. E. C. SHAWFIELD (Chief Electrical Engineer, Wolverhampton) was inclined to think that Mr. Newington would have obtained better financial results if he had scrapped his reciprocating engines and put down high-pressure turbines direct. In the first place, there would have been a distinct saving in capital expenditure. Also, the economy of working to be obtained with a live steam turbine was distinctly greater than with the combination. He gathered that the average steam consumption per unit generated with the exhaust steam turbines was 22·2 lbs., including stand-by losses, probably about 19 lbs. per actual unit generated. With a high-pressure turbine with similar vacuum the figure would not be more than 17 lbs. Further, it would only require half the size of condenser, and the total costs, including water, would be considerably less. In his own station he had had three 500-kw. reciprocating sets, to which he had thought of fitting exhaust steam turbines. When he had the whole scheme complete, however, he found that if he put down a 2,000-kw. live steam turbine, he got a much lower capital expenditure and a much lower running cost.

Mr. T. W. BLOXAM (Chief Electrical Engineer, Belfast) had some similar sets to those described in the Paper. His own 2,000-kw. sets were originally fitted with copper brushes, but these required so much daily trimming and attention that the cost of maintenance was excessive. Carbon brushes were substituted, but there was difficulty in getting each brush to take its proper share of the current. The result was the burning away of the carbon in patches, which aggravated the trouble. If additional load was put on, the temperature rise of the commutator became greater than the provision for expansion could deal with, and distortion of the commutator took place producing an out of balance fatal to running at even quarter-load. The makers now suggested re-construction of the commutators, with flexible end rings instead of the original method of a sliding cone, and making effective provision for ventilation inside the commutator. He wished Mr. Newington had said whether he considered separate exciters or self-excitation the best. There seemed to be some doubt as to which had the greater advantage. With regard to the facilities for clearing the strainers on the suction side of the circulating pumps, they had a tidal river in Belfast, and a great deal of rubbish floated down and caused trouble by blocking the strainers. A good way of clearing these was to hold up the retentive valve after the station was shut down at night, and discharge one or other of the pumps backwards through the particular pump whose strainer they wished to clear. It seemed to be quite sufficiently effective if done once or twice a week to keep the strainers of each pump in rotation clear of any accumulation.

Mr. R. BIRKETT (Southend) did not think it was much use applying exhaust steam turbines in power stations with very poor load factors. They would only be required for half an hour a day, and this would surely not pay for the plant. He had some difficulty in getting clean water at Southend, and had gone into the question of using the sewage. The difficulty was to make the sewage water keep pace with the demand on the station. He had thought of condensing by air, and had adopted a Ledward condenser, which always maintained a 25-in. vacuum. He questioned whether any plant could beat his efficiency of 23 lbs. per kw., especially with a load factor of 16 per cent. With his air condenser he connected small branch pipes to each layer of main pipes the whole length of the condenser, and on each of these he put a valve, which was regulated so that it did not matter what the load on the station was he always got a constant vacuum. There was previously a certain condenser with cooling tower capable of dealing with 30,000 lbs. per hour. The present plant was capable of dealing with 60,000 lbs. per hour, and the whole of it was run at a less cost than it took formerly to run the fan for the cooling tower.

Mr. S. L. PEARCE (Chief Electrical Engineer, Manchester) did not question the possibility of using exhaust steam turbines, but thought they all should have a very clear idea of the principles underlying their use. The work got out of steam was proportional to the heat given out by the steam, and, looked at from that point of view, an exhaust steam turbine was a piece of apparatus that did not give up the greatest proportion possible. Having regard to the range over which they were getting the greatest amount of heat units from the steam, it was at once clearly apparent that a good vacuum was the first consideration, and unless a good vacuum could be obtained, the use of exhaust steam turbines was practically out of the question. From a well-known curve he saw that for an increase in the vacuum from 27 in. to 28in., there was a percentage increase in the available heat units of practically 20 per cent. It was, however, very easy indeed to expend more capital in endeavouring to get a good vacuum than would really repay them in the end. He thought that Mr. Newington's remark that exhaust steam turbines or mixed pressure turbines were the most suitable for extensions was rather too sweeping, and required some qualification. It was erroneous to say that an exhaust steam turbine, coupled to a first-class triple expansion engine, would enable that engine to do its work more economically than when working as an ordinary condensing engine. Some of them might be familiar with a Paper read in the early part of this year by Mr. Stott before the American Institute of Mechanical Engineers, in which he gave a description of the plant of the Interborough Rapid Transit Company in New York. Mr. Stott coupled a 5,000-kw. vertical exhaust steam turbine to a 7,500-kw. alternating-current set of the Manhattan type. Mr. Stott's figures looked attractive, but he believed this was mainly due to the abundance of cold water from 50 to 55 degrees, and to the particular cylinder ratios of the engines in use. When planning extensions at Manchester, he had carefully considered whether he should put in an exhaust turbine on the Wallsend Slipway Company's engines, but after going into the matter carefully, he could not show a saving of more than ¼ lb. to ½ lb. in the steam consumption as compared with a high-pressure turbine.

Mr. H. FARADAY PROCTOR (Chief Electrical Engineer, Bristol), referring to Mr. Ferranti's suggestion of scrapping existing plant, said he would prefer keeping the reciprocating engines as a standby pure and simple. It was a question of capital expenditure upon buildings rather than upon machinery, or at any rate upon the turbines. If their buildings were inexpensive per square foot of space, they could afford to let their old and inefficient sets remain where they were at present standing and use them as standby. They must have regard to the fact that if they were inefficient their available boiler plant would have to be extended if a breakdown occurred, as it always did occur on top-load, but it was mostly a question of capital cost in respect of buildings, foundations, switchgear, and connections, rather than on the turbine itself.

Councillor D. LIVINGSTONE (Hull) asked Mr. Newington what his position would be if the supply of water from the sewer ran short. They must not forget that high vacuum meant coal. It was essential to keep the feed water going into the boiler at a good temperature, and if they could increase this, even at the expense of the vacuum, he thought it might be a good policy in the ratepayers' interests.

Mr. F. W. PURSE (Chief Electrical Engineer, Watford) referred to the fact that both authors mentioned a saving of 32 per cent. by the use of exhaust steam turbines. The comparison, however, was made between the reciprocating engines turning out a small number of units and the combination with exhaust steam turbines turning out a much larger number of units. He would have preferred to have seen the comparison made with units sold or units sent out to the mains. In the comparison in the papers, no reference was made to capital

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cost, but in order to get at the real nett saving, the costs should have been worked out after balancing up the capital charges, &c.

Mr. R. H. CAMPION (Chief Electrical Engineer, Dewsbury) said that the circumstances at Dewsbury were more or less represented by the conditions mentioned in the second paper, and he had decided to instal a mixed pressure turbine, and hoped to get something in the nature of 360 kws. out of the exhaust steam available. The advantage of the mixed pressure turbine was that with any failure of the exhaust steam, there was the high pressure side to make up on. With regard to the D.C. end of the set, they had all been waiting for years for a decent commutator, but he thought they had now got this with the radial type.

The PRESIDENT said that in the St. Andrew's Cross station there were two 1,600 kw. Willans & Robinson continuous-current turbo-sets, two of the dynamos being by Siemens and two by Brown, Boveri. The Siemens machines had carbon brushes, and the Brown, Boveri machines copper brushes, and they would be seen working satisfactorily when they visited the works on the following day.

Mr. F. A. NEWINGTON, in reply, said that he had had no trouble from corrosion of the tubes, and neither had the health authorities had any trouble. The scraping arrangements were not perfect yet, but they would probably hit upon some suitable method sooner or later. Mr. Ferranti and most of the other speakers agreed that exhaust steam turbines were not so good as scrapping the existing plant and putting down entirely new machinery. No doubt on paper the live-steam high-pressure turbine did show a better result, as far as steam consumption went, but there was this point of view in regard to scrapping plant. He was quite certain that every engineer present would have a great deal of difficulty in persuading his committee that the best thing to do was to wipe that out entirely and put down new plant. By scrapping the whole of the existing plant, the works costs might have been lower, but he was quite certain that the capital costs would have been a great deal higher. With regard to Mr. Bloxam's remarks about commutation troubles. The one dynamo which he (Mr. Newington) had referred to, had had the commutator altered and fitted with flexible plates and ventilation underneath the commutator bars, and this seemed to have got over all the trouble. The makers of direct turbine dynamos had had troubles with commutators, but they seemed now to be getting over them. As regards excitation, he could not say whether separate excitation or self-excitation was the best, but the makers would not hear of anything but separate exciters at Edinburgh, and therefore they were used. With regard to Mr. Birkett's remarks, the sewer was large enough for 10,000 kws. They realised that sooner or later they would come to the end of their tether as far as the sewer was concerned, and he was very glad to say that the Edinburgh Corporation had now seen the error of their ways, and he believed that in further extensions cooling towers would be used. The objections in the earlier days would be got over by spending several thousand pounds in ornamentation and making them look pretty.

On Thursday, the meeting was again in Glasgow. The President (Mr. Lackie) explained that the meeting that morning was somewhat in the nature of an experiment. There would be no actual Paper, but discussions upon two subjects of great interest to electrical engineers. Both would be treated in the widest possible fashion.

ADVANTAGES OF CONTINUOUS RECORDS OF COSTS AND OF STEAM CONSUMPTION.

Mr. G. WILKINSON (Chief Electrical Engineer, Harrogate), who was called, opened the discussion on this subject, and said that at Harrogate the Works Superintendent had arranged for the costs to be made up every night at 10 o'clock by the switchboard attendant; they were sent down to the office and posted in convenient places in the works. He found that the men all over the works examined these costs daily very much in the same way, and with the same interest that people looked at their morning paper. More was known about the costs from the prime mover to the switchboard terminals than from the prime mover back to the coal heap, and his remarks would have special reference to the boiler house rather than to the engine room.

There were three items which ought to have a prominent place on the records in every supply station. The first was with regard to air leakage into the flues. About eighteen months ago, when visiting one of the largest power houses in the Midlands, he had found that they were regulating the draught by the dampers in the main flues. The engineer at that works told him that they saved, due to the lessened infiltration of air into the flues, something like £500 per annum in fuel. Four or five years ago his attention was more forcibly drawn to the possibilities in this direction by the practice at a very large manufacturing works in the North of England, where the engineer had introduced a cement which had a very great affinity not only for the metal work of the boilers and economisers, but also for the brick-work, and it remained plastic for a sufficient length of time to set after the boilers had been fired and reached their maximum condition of expansion. In addition, he had carefully covered every damper slot with a cast-iron cover, so that his dampers were entirely closed, and the only infiltration that could happen was at the small close-fitting holes where the rods went through the casing to operate the dampers. This engineer told him that he had succeeded in raising the temperature of his economisers an average of 50° F., and when it was considered that 10° F. obtained in the economisers was equivalent in round figures to 1 per cent. saving in fuel, it would be seen that this was a very great accomplishment. He had followed this engineer's lead, and did a similar thing in Harrogate, and ever since then the temperature in his economisers had been from 20° to 25° higher than they were before.

The second point was that of economiser efficiency, and he wondered how many power-house engineers had made any tests as to the efficiency of their economisers. He was led to do this by experimenting to find out how much better a live steam injector was for boiler feed than a live steam feed pump exhausting to atmosphere, and he was very much astonished at the conclusion of the tests, and on their subsequent repetition, to find that the advantage was very much on the side of the feed pump, notwithstanding that its thermal efficiency is very much lower than that of an injector. Pump makers and boiler insurance companies failed to assist him in arriving at an explanation, but he got independent confirmative figures eventually from a firm who are pre-eminent in the matter of economiser practice, and who have spent lavishly in making tests upon engines and boilers. The figures they gave him, taking economisers of 280 tubes, with a Lancashire boiler having an evaporation of 1,320 gallons per hour and a flue gas temperature in their economiser in both cases of 550° F. were that, with an initial temperature in the economiser of 94° F., they got a rise of 166 thermal units per pound, and with the initial temperature of 202° F. a rise of only 122 thermal units per pound of feed-water. This meant that, by having a low temperature of 94°—and they could not go below that on account of destructive effects on the tubes—it made a difference in the efficiency of no less than 26 per cent. This meant a saving of 4·4 per cent. in fuel. He therefore suggested that it was well worth while to use a temperature in the economiser as low as possible. They should take the water directly from the air-pumps and condensers to the economiser. If it happened to be so low that they could not avoid action on the tubes, then they could raise the temperature by putting the economiser on the suction side of the pumps. When visiting the Pinkston Tramways Power Station in Glasgow that week, he took the opportunity of inquiring into the figures there. The water from the air-pumps was from 110° to 120° F., and the discharge from the steam traps was increasing that to 160° F.; it was putting on 40° which very substantially lowered the efficiency of the economiser.

The next point was condensation in the steam pipes. There was an idea in some quarters that superheat was largely a cure for condensation, but in his opinion this was a fallacy. A practice which had crept into numbers of turbine stations recently was to allow the condensed water to gravitate through the pipes and through the turbine into the condensers. Turbine makers had informed him almost unanimously that for every 1 per cent. of moisture in the steam going to the turbine there was a drop of efficiency of 2 per cent. For the long hour light load term, the condensation losses, notwithstanding high superheat, amounted to something like 2 per cent. of the steam going to the turbines, which therefore represented a drop of efficiency for the long hours of light load of 4 per cent. He had made very careful tests of condensation with high pressure steam superheated 150° to 180° F., and with pipes lagged for a depth of two inches with the best magnesia composition, and found that the amount of condensation varied from three to ten gallons of water per hour. It was astonishing how the variation corresponded very closely with the load on the station, being a minimum at full load, but there were never less than three gallons per 100 ft. of surface at light loads. It varied widely between summer and winter and between a dry day and a humid day. Investigations had shown him that where the entrainment of water from the pipes was in one place only, the water of condensation had a habit of accumulating in the pipes and coming over in a rapid rush into the turbines, and he felt convinced in his own mind that it was owing to this that numbers of strips of turbine blades had taken place. For twelve months he had been putting back the condensed water from the pipe range, &c., to the boilers at a temperature less than 10° below that of the steam itself. He worked at 140-lb. steam pressure, and lifted the water 1 ft. for a drop of less than 1° F. There were no moving parts in the apparatus, and it took the water direct from the pipes to the boilers. Mr. Wilkinson next referred to the Hopkinson-Ferranti valve. If this valve were used on high-speed engines, he said, there was a quantity of water between each valve owing to the contracted area of the valve opening. The result was that they had a hot surface on top and a cold surface below which set up racking strains and started the joints. In one Government de-

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partment they did not use these valves except on vertical pipes. He was using these valves in Harrogate, and by draining in between them he kept the water entirely out of the pipes, and was never troubled with any of the joints going. Mr. Wilkinson concluded by saying that he had had a 5 per cent. drop in the load and a 4 per cent. increase in the price of coal, but, notwithstanding this, he had effected a 10½ per cent. reduction in the cost of the units generated. He could not say that this was entirely due to his having reduced his initial feed-water temperature to the economiser by 20° to 25° F., but it was the principal economy which had been introduced during the year.

Mr. C. E. C. SHAWFIELD (Chief Electrical Engineer, Wolverhampton) said that in the electric supply industry the costs of production are subjected to more detailed comparison and analysis than those of any other, yet, as stations increased in size, it became increasingly difficult to keep a truly continuous record of cost of production, more particularly of the efficiency, or rather inefficiency, of the process of turning the coal pile into "juice." It was usual to put some form of volumetric or weighing apparatus on each boiler which dealt with a few hundredweights at a time, the amount used during the day being checked by some form of counter; but in the station containing from six to sixteen boilers, even with an automatic coal weigher on each, they were still very far from having anything like a continuous record of the amount of coal consumed per hour, and to be able to compare it with the units turned out in the corresponding period, and the difficulties were increased because the hourly consumption of coal per unit generated varied so enormously at different times of the day. It would be found that during a night-shift—from 10 p.m. to 6 a.m.—the coal used per unit would be something like double, and in some cases treble, what it was during the time of normal full load. The results he had obtained from such tests were rather paradoxical. He had actually found that during the night-shift an increase in the production of units meant a decrease in the consumption of coal. During the month of August, when his auxiliary destructor station was shut down during the night-shift, the total weight of coal burned at night was less than it had been during the previous and following months when the destructor station was running, and a series of hourly tests showed that the full output from the destructor station, when that was thrown on to the main station, cost a little less than nothing to produce. Another important matter was water consumption. It was perfectly simple to put some form of recorder on each generating set, but that was only a measurement of the actual efficiency of that particular set, and a much more useful purpose would be secured if the whole water condensation was delivered into one common recorder, so that one continuous daily chart of the whole water consumption at each moment could be obtained. Make-up feed ought also to be separately measured in order that some indication might be obtained of the constant losses of condensed water. He was not prepared to contest with Mr. Wilkinson the thermal advantages of returning any water condensed in the steam range directly to the boiler without any intermediate handling, but he thought much more useful results were to be obtained if they could collect that water and pass it through a continuous recorder, and thus know the amount of condensation going on in the steam system at any time. If it were turned back to the boiler without knowing how much it was, they had no opportunity of mending any defects in the lagging or improperly designed steam pipes. He had found CO_2 recorders by no means as reliable a guide to the efficiency of combustion as the makers would have them believe. After some years of experiment he had come to the conclusion that it is much more satisfactory to have periodical tests taken two or three times on each shift by portable apparatus than to rely on any form of automatic recorder, for he had not been able to get one which would remain entirely satisfactory for more than a week or two together. He thought there was a tendency to pay too high a regard to the extreme lowness of works costs, and that the sinking fund on the capital spent in striving after a record of low costs might sometimes be greater than the value of the coal saved.

Mr. F. AYTON (Chief Electrical Engineer, Ipswich) was in entire agreement with Mr. Shawfield in sounding a warning note that they might spend too much time trying to gain a decimal point in their works costs. He felt that they ought to attend to the other end of the scale as well, namely, the consumers' meters, for, after all, these were a sort of National Cash Register. Moreover, the delicate recording instruments would cost much in repairs and maintenance after the first two or three years. His experience of CO_2 recorders coincided with that of Mr. Shawfield. He had had in operation for six years a Krell instrument, and if it received almost daily attention reliable readings could be obtained, but this took up a great deal of time. The principal trouble was with dust getting into the tubes leading from the boiler to the instrument. The makers recommended the use of glass tubes to reduce the friction of the gases, but at every point where one glass tube was joined to the other there was a piece of rubber piping, which was a continual source of trouble because, owing to the drying action of the heated gases, and also the temperature of the boiler house, the rubber soon perished, and then air leakage took place, which, although comparatively small, was quite sufficient to upset absolutely the accuracy of the CO_2 readings. He had made considerable improvement by lapping an insulating tape over the rubber after it was put on the tubes, but some form of box should be designed in which the whole thing could be run in solid with an elastic compound. The chief fault he found with the recorder was that it did not tell them the amount of air leakage, and those engineers who were looking into the matter were surprised at the amount of air leakage which existed. This taught the lesson that they should be very particular indeed about the building of the brickwork of their flues and boiler settings. Wherever possible, glazed bricks should be used for the outside work, and he believed they repaid their initial cost. Trouble was also experienced with the cracking of brickwork in boiler settings. He now built his boiler settings with Portland cement mortar throughout. Special fire cements were expensive, and he made his own cement very cheaply. The only place in which he used fireclay on his last boiler (a dry-back marine) was just over the fire-brick lining of the combustion chamber at the back of the boiler. At this point there was a sufficient temperature to make it run as a flux, but anywhere else it crumbled away and caused air leakage. Ordinary sand was useless in making cement, because the joints went to pieces under the influence of the high temperature. He used for his cement ground fire-brick, which could be purchased from the fireclay firms at 26s. per ton in bags, and mixed it with ordinary Portland cement. Before he had finally adopted this, he made an experiment by building a wall of brickwork in the combustion chamber of his Meldrum refuse destructor, and had left it there for some weeks. Although it had been at a bright red heat the whole time, the cement joint was holding. The boiler on which this cement was used had remained airtight after three years' work, and there was not a crack anywhere in the settings. To overcome the porosity of the brickwork flues and settings, he had mixed gas tar and pitch into a hot thick liquid, and coated them with it. One of his coal trimmers went round every day looking for leaks in the flues and boiler settings; he carried a candle, and always found one or two every week. They were then stopped up with asbestos, and if they got worse they were filled up with cement mortar. Mr. Wilkinson's remarks on economisers were most interesting, but he would like to know whether any engineers had tried to improve the scrapers of economisers. A thin non-conducting layer was always left in the tubes. In this connection he referred to the drawn steel tubes of the economisers at the Horseferry Road station of the Westminster Electric Supply Corporation, which he regarded as a great improvement on account of the very much smoother surface afforded by these than by cast tubes. Another source of leakage was in the engine room, namely, from air getting through the exhaust pipes. Cast iron was slightly porous under certain conditions, and it was a very good plan to paint the exhaust pipes with some thick bodied elastic paint. With regard to keeping costs, he got out his costs for each of the three shifts, and it made some competition between the men of the different shifts. He also measured the standby coal separately, and this was a very good guide as to the efficiency of the boiler house. The cost of coal during light load hours was considerable. It cost practically nothing extra in coal to run a large number of street lamps during the night after eleven o'clock. This should enable them to put in street lighting at an extremely low price for current, and to beat gas hollow. Dampers could be greatly improved upon; most of them were not airtight, and he had found it a good plan after shutting down a boiler to go into it and pack the damper round with some asbestos rope packing.

Mr. C. H. WORDINGHAM (Chief Electrical Engineer to the Admiralty) said that central station engineers seemed always to have been meter maniacs. In a large station he could not conceive how it was possible to find time to make all these measurements, and even supposing they did, they got such an enormous mass of material that it must pass the wit of man to analyse it and to get any useful results from it. It seemed to him that a few very carefully effected tests made from time to time at long intervals would tell a great deal more than all this fearful mass of material, which is subject to a very great deal of inaccuracy. He very much mistrusted all these daily and hourly and shiftly records that so much was heard of. He felt very strongly that the fewer instruments there were of this character in stations the better chance they had of avoiding interruptions and avoiding wasting a lot of money taking records. Mr. Ayton's Diogenes with a candle was more useful than a CO_2 recorder. All this record taking reminded him of the mother whose little girl had been to a physiology class, and who wrote to the teacher, "Please do not teach Mary Ann any more about her inside. It does not do her any good, and besides it is rude." Mr. Wilkinson's method of putting water back straight to the boiler and saving all the heat was very much better than not doing it and then finding out how much heat they were wasting.

Mr. F. A. NEWINGTON (Chief Electrical Engineer, Edinburgh) spoke on the question of moisture in coal. He used small washed nuts entirely, and had found that the moisture varied from 7 per cent. to 15 per cent. or more, especially if the coal

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was not well ground. For a large proportion of small, there was a greater quantity of moisture. For some time he did not like paying 7s. or 8s. per ton for water, and had tried to get some means of daily checking the quantity of moisture. He constructed a drying chamber heated by steam from one of the much-maligned traps which had been talked about, and it was the duty of the engineer on the morning watch to take a ten-pound sample from each truck delivered each morning. This was dried for twenty-four hours at a temperature of about 220 degrees, and the moisture calculated. He specified that all above 10 per cent. would be deducted from the monthly accounts of the coal purchased. The coal owners did not like it at all, and for the twelve months during which these tests were carried out, the deductions amounted to between 3 per cent. and 4 per cent. of the total bill. The coal owners thought he was drying the coal far too much and was losing more than moisture, and he could not persuade them that this was not so. For the contract settled for the present year he found that it was not much use persisting in these tests, and therefore he asked for two prices, one, as delivered, and the other, that all above 10 per cent. of moisture should be deducted. The prices for the 10 per cent. moisture coal were from 3d. to 6d. per ton more than the other. He therefore concluded that this moisture was not worth bothering about, and that the coal merchants knew how much moisture there was and what price they could get for it. He did not think it was much use for engineers to test small samples of coal for calorific value. From one colliery the coal did not vary very much, and each colliery had its own marked advantages. He did not think that hourly records were of very much use, for the coal at any rate; the condition of the fires varied so much from time to time. Watch records of coal and water were sufficient.

Mr. MARK RUDDLE (Chief Electrical Engineer, Dublin) said that in a big station, however, working on an ordinary duty supply with a varying load from minute to minute, continuous records could not be taken, and very little could be deduced from such records as could be taken. The time expended in compiling and wading through sheets of records could be better devoted to the systematic inspection and overhauling of the plant in order to keep it in the highest state of efficiency.

Mr. JAMES LEA (Lea Recorder Company) said that his attention was first directed to recording instruments some ten or twelve years ago, when he was engaged on the Witwatersrand Mines, his last work there being to supervise the engines and boilers of a group of the Rand Proprietary Mines. At the end of every month he was supposed by the statistical department to provide figures showing the cost of every item to the fraction of a farthing. He had to hand in a record from every boiler house, of which there were twelve or more, with winding engines, pumping engines, and compressors, and he had to show how much coal had to be debited to the air compressor, to the winding engine, and to the Cornish pump. The problem was rather a difficult one, and in the absence of meters of any kind he was driven to the question of measuring instruments, mainly in connection with water. It had been suggested that the taking of such records was too much trouble and cost too much money, but he hardly agreed with this. With a 4,000 kw. or a 6,000 kw. plant, with coal at 10s. per ton, the cost for coal alone was £20 per day. There was also the expense of wages in the boiler house, and in his opinion recording meters were a very good and economical investment, whilst the cost was very trifling. With regard to running plant generally, he was astonished that at no engineering college was plant-running taught in any shape or form. They taught young men to construct boilers and engines and turbines, but the running of plant was entirely ignored. If there were a greater co-operation between boiler makers and boiler users, and turbine makers and turbine users, a better result would be got out of our boilers and engines. The average efficiency of a Lancashire boiler was about 60 per cent., and with 40 per cent. going up the chimney it would be better if boiler makers looked after their boilers after they were erected to a greater extent than at present.

Mr. R. ROWLAND (Chief Electrical Engineer, Stretford) said he would have liked to hear a little more about the defects of the Hopkinson-Ferranti valve mentioned by Mr. Wilkinson. The filtration of water in the pockets caused by the smaller diameter of the valve had been referred to. He thought the advantage of the small air gap was increased velocity, which caused a greater evaporation of the water. If this was so, there was not such a danger of water coming over in such a quantity as to cause any damage to the turbine or engine. Had Mr. Wilkinson any tests on this point? With regard to economiser temperatures, he always endeavoured to put in about 100 degrees at the inlet, and regulate it at from 300 to 350 degrees to the boilers. The best way was to work on the main dampers instead of the side flues. He agreed with the use of glazed bricks in spite of the increase of cost. Records of coal consumption could not always be relied upon, because some charge engineers might allow a less quantity and put it on to another watch, and it was very difficult to say who was correct. Tests taken at fairly long intervals seemed to be the best way. He had a very high opinion of CO_2 recorders. At Stretford there were two batteries of three boilers each, and since they put in a CO_2 recorder, they had turned out 200,000 more units per annum at less coal cost. He would also have liked to hear from Mr. Wilkinson with regard to the corrosion inside boilers, and how he overcame this. He preferred to give them a lime wash now and again and to keep them well cleaned.

The PRESIDENT, in closing the discussion, said that Mr. Wilkinson had offered to answer in the *Proceedings* a few of the points raised in the discussion, but, of course, as he had only opened the discussion and not read a Paper, he was not bound to. He then declared the subject of cheapening the cost of mains and services open for discussion.

CHEAPENING THE COST OF MAINS AND SERVICES.

A large sheet headed "Cost per Branch," and giving the various items of the cost of laying services, had been fixed conspicuously at the back of the platform, and was referred to by some of the speakers during the discussion. The items on this sheet were as follows :—

Cost per Branch.	£	s.	d.
Jointer's time		17	0
Wireman		6	5
Mason's time		6	11
Joiner's time			3
Watchman			3
Branch Box		9	6
Fuse Boxes		15	0
Cable		19	0
Compound		2	6
Mason's Material			8½
Jointer's Material			2½
Sundries		10	9
	£4	6	6

Mr. S. J. WATSON (Chief Electrical Engineer, Bury), in opening the discussion, regretted the absence through ill-health of Mr. S. E. Fedden, who had originally agreed to start the debate. During the past few years, he said, there had been very large reductions in the cost of generating plant, but the cost of mains remained practically where it was some ten or fifteen years ago, and, in fact, he found that the present prices of cables of a certain size which he used fairly largely, were some 20 per cent. more than in 1902. He was not prepared to say how much this was due to an increase of price in raw materials or whether some portion of it, at any rate, was not due to the Cable Makers' Association. The question had become of great importance, on account of the decreased revenue, due to the use of metal filament lamps. He did not think anything could be done to reduce the cost of excavating and making good, which was practically fixed, but proceeded to give some figures as to the cost of the insulation on a cable. For instance, taking 0·15 sq. in. low-tension cables, with three single cables insulated with paper and lead, or a triple concentric or three-core cable, the price would vary about not more than 3 per cent., and the cost of either of these cables was about 8s. per yard. With copper at 10½d. this meant that copper was worth 4s. 7d. per yard, and the insulation about 3s. 5d. Thus, on the total cost of the cable 42 per cent. was for insulation only. Comparing low-tension cable with high-tension cable, instead of 8s. per yard, a similar three-core cable would cost 9s. 4d., so that although the high-tension cable could transmit some 10 to 15 times as much power as the low-tension, the extra cost was only 16 per cent. With regard to the material for conductors, so far as could be seen, it would appear to be impossible to substitute aluminium for copper, as the increased size necessary for a given capacity necessitated an increased cost of insulation. He did not know of any other conductor that could be considered. A system using bare conductors underground, laid in troughing with filling was put on the market a year or two ago, but he had heard little of it since. In this country we were ahead somewhat of Americans and the Continent, for it was the universal practice here to distribute at 220 volts, while he believed that it was still common practice, even with the American Edison Company, to distribute at 110 volts. It had been suggested that we should again double the pressure and have 800 volts across the outers, but although this would be a very economical thing to do so far as economy in copper was concerned, he thought it very unlikely that the Board of Trade would sanction it. He had come to the conclusion that the only way in which the quantity of copper could be appreciably reduced was by the generation of high-pressure alternating current and transmission to sub-stations, or to transformer pillars placed above ground. The general distribution of three-phase alternating currents had, he said, not received the consideration which it deserved. Such a system was very flexible, as additional distributors could be laid, and additional transformers put in whenever necessary, thus keeping the amount of copper down. Earthing one of the conductors on the low-tension side of a transformer station deserved consideration, and, if the area in which they distributed from that station was comparatively small, the objections to this method would disappear. The question arose whether it would not be possible to get the Board of Trade regulations governing the regulation of pressure

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revised, because with metal filament lamps the effect of pressure variation was much less than with carbon filaments, and it would enable a reduction to be made in the copper. The use of overhead mains must not be overlooked. In Bury they had about a mile of aluminium overhead three-wire distributor, and the cost was about one-third to one-quarter the cost of underground work, and it had been found very satisfactory. The joints were made mechanically, and the whole line generally had been found very convenient. Reverting to three-phase distribution, he suggested transformers on the consumers' premises, supplied at 400 volts, and with a secondary pressure of, say, 50 volts. In regard to services he could not give very much information. He was located in a busy industrial town, and the question of cheap services had not required to be dealt with so very carefully as was the case in residential towns. He had, however, looked up the question of running services during the past year or two, and found that it varied from about 35s. to £11. The average cost for two years was £5 4s. He felt rather doubtful of giving this figure after seeing the table on the wall, but when he explained that the majority of these services were three-wire services, and that the average capacity of the consumers was about 25 kw., he thought they would come to the conclusion that the cost was not very excessive.

Mr. F. AYTON (Chief Electrical Engineer, Ipswich) said that unless they could lay their mains and provide services at a very much cheaper rate than in the past, the advantages afforded by the metal filament lamp would be largely counterbalanced. It was surprising to find what a small percentage the cost of the cable was of the total cost of the service. Taking a 7/20 solid two-wire service six yards long, the cost was £1 19s. 9d.; for ten yards it was £2 9s. 5d. On the armoured system it cost £2 4s. 5d. for six yards, and £2 12s. for ten yards. With 7/18 the cost on the solid system was £2 0s. 11d. for six yards, and £2 11s. for ten yards. For 7/18 armoured cable the prices were £2 6s. 4d. and £2 14s. 11d. respectively. The difference between the armoured and the solid system was solely in the cost of the service box, which he hoped to reduce considerably. They had been making all their own boxes for the solid system, but had been buying them for the armoured service. The cost of the solid system box, including fittings for a three-wire single conductor main and a two-wire service was 6s. 5d., and including compound, 7s. 10½d. The armoured boxes which they had to buy cost 13s. 8d., and these used more compound, which made the price 15s. 10d. Therefore, if they could make the armoured box at the same price as the box for the solid system there would be practically nothing to choose between the two. The armoured system had an advantage in connection with excavation, for armoured cables could be twisted about in a manner which was impossible with the solid system. He did not think they would gain very much in trying to invent a new sort of service cable. Where it would be possible to gain in connection with the cost of service work was in the fittings inside the consumers' premises. He was going to try an electrolytic meter combined with a house service, which was being put on the market by a certain firm. Mr. Watson had referred to a system of laying bare mains in troughing, and filling them in on the solid system. He had tried this, and although there were troubles at first, the makers relaid the system, and there had been no trouble since. The cost was about 70 per cent. of the cost of the ordinary solid system, and he was rather sorry that financial difficulties made the thing come to an end. With regard to overhead mains, he had some of these, and was perfectly satisfied. They gave far less trouble than underground mains, but there were only a few places where they could be used, and the Board of Trade put difficulties in the way of using them in towns.

Mr. B. SANKEY (Borough Electrical Engineer, Whitehaven) spoke with regard to the cost of services in small residential towns. He had taken out the cost of some twenty services during the past year, consisting entirely of 7/16 and 7/14 bitumen insulated cables. The average length of the service from distributor to cut-out was ten yards, and the average cost, including nothing on the consumer's premises, was £2 16s. To this had to be added the cost of cut-outs, meter and cutting the cable, which made the total cost of the service £3 6s. 7d. This was for ordinary private houses and shops. The closer they could get to the very simple services of the gas companies the nearer they would be to a cheap service. The elaboration of cut-outs, switches, meters, and all kinds of devices on the consumer's premises must add to the cost.

Mr. W. G. PICKVANCE (Chief Electrical Engineer, Wrexham) said that the expenditure of £4 or £5 on a service for a consumer with five or six lights was one for consideration as to when they would get their money back. A service laid direct in the ground was good enough where the soil was of a gravelly nature or of clay, but in most industrial towns the pathways were built up of ashes and slag, and other similar chemical products, and in such cases these services were not desirable. At Wrexham he had found odd lengths on this system which the makers had not considered it worth while to take up. On the question of cost, the depth at which a main or service should be laid came in. He had been noticing that in Edinburgh the distributors were laid about six inches or eight inches deep. It was beyond his comprehension how they managed to do this; in Wrexham some of the original mains were laid six feet deep, because the mains were not to go over the water mains, but underneath. So deep did he have to dig to look for some of his mains that he believed the local people thought he was frequently looking for coal. A depth of two feet should be quite ample. At Wrexham the average cost of laying services worked out at £2 5s. He was now using fibre troughing, with lead-covered twin-cable of 10-ampere size in some cases, and in other cases, ordinary bitumen cable. He thought that in towns like Wrexham, and in industrial towns generally, the best thing to do was to protect the cable by means of bitumen, and thereby have less trouble eventually.

Mr. C. TURNBULL (Chief Electrical Engineer, Tynemouth) said that some years ago he brought up the expression "density factor, in which he took the cost of the cable system, including sinking fund, losses in transmission, sub-station, and everything else, and divided that by the number of units. This gave the cost per unit in distribution, and his own personal opinion was that this "density factor" is probably more important than load factor. If he were laying out a new town, he would put down a system with 1,000 volts with transformers on the outside of consumers' premises, reducing down to 50 volts, and by using the outer protection of the wires as a conductor they could supply to houses extremely cheaply. It would be then possible to put down 3-phase 1,000 volts, and have a transformer for every half-dozen or dozen houses, and run wires outside houses and buildings, and have the main cut-out and transformer inside. It was impossible to run services smaller than 7/18, for mechanical reasons, although there was no need for this size for electrical purposes. He hoped, therefore, that cable makers would some day supply them with cheaper wires —possibly brass wires or a thin galvanised iron wire. He had found his early armoured cables extremely good, but now it was almost impossible to get modern makers to supply a good armoured cable well compounded over the lead. After treating cables properly with compound, they looked after ten years' use as if they had been put in yesterday, and no doubt they would have another twenty years' life. Such a cable was recently in a fire, and was perfectly good afterwards, although it had to be renewed at the terminals where it had been burnt off. The mains and pipes in the streets should be laid according to a plan. At the present time a man came along and laid a main or pipe and said, "Heaven help the next man!" He would like the Council of the Association to see if they could not produce a set of rules by which cables were laid.

Mr. F. CHARLES RAPHAEL referred to the table of cost of branch services exhibited. The cost there worked out was enormous. Incidentally, he could not understand why both a jointer and a wireman should be necessary to lay a simple service. It seemed that the cost could not be reduced unless something radical was done, and he proposed they should consider more frequently the question of laying the services at the time the mains were being laid. If they were to spend £4 6s. 6d. for each service, it was true that the cost of the mains would go up considerably, but by laying the services when the mains were laid they would not spend half this amount. If, for instance, they laid on the solid system, they would save the whole of the junction box. They could connect the service straight up to the cable and pour the whole thing in solid. The point to be remembered was that most station engineers were now connecting up entirely new districts, and were laying mains for an entirely new class of people, every one of whom they intended to be consumers. If a service was laid to such houses, the consumers would come on in a very short time. It might pay better in such cases to loop in the cable from house to house, and to have no junction box at all. He could not agree with Mr. Watson that the cost of excavation could be put entirely on one side. The cost of the cable itself could not be varied very much. It was not like a turbine or electrical machinery where invention and improvements in design could make an enormous difference to the cost. The only scope seemed to be in the use of another metal for the conductor, but, with excavating, the cost varied very considerably, and there was no doubt that it was more than it need be. A method which was used very little now was plain lead-covered, unarmoured cable laid under the side walks. If these were laid 1 ft. deep, he thought they would give very little trouble and not be liable to interruption.

Mr. W. W. LACKIE (the President) said the table which had been referred to had been put up by himself, and showed the average cost of sixty branches during the past two months. A few years ago they were costing in Glasgow £7, but they had brought this down to £4 6s. 6d. by specialising the work. With regard to Mr. Raphael's remark as to a jointer and wireman being necessary, they employed these two men because he did not think it right that the jointer who was working in the street, perhaps on a wet and muddy day, should go into a respectable house or a good shop with his dirty boots. His object in getting out the figures was to show where reductions could be made.

Mr. W. A. VIGNOLES (Chief Electrical Engineer, Grimsby) thought the voltage at which distribution was being made ought to receive consideration, as it was an important factor in the

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published June 16th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

12,047/09. **Motor Control.** BRITISH THOMSON-HOUSTON CO., LTD., and K. F. KINGWELL. Where an electrically-driven pump works a hydraulic accumulator supplying power to machine tools or other apparatus, it is usual to provide the motor with an automatic device worked by the accumulator to cut off current from the motor when the accumulator is fully restored. According to this invention, the controlling device is electrically interlocked with the apparatus taking power from the accumulator, so that the circuit-breaker is tripped only when the accumulator is fully restored and little or no power is being taken from it. The motor is thus kept running so long as power is required, and the continual stopping and restarting when the power taken is small is avoided. One claim, one figure.

12,442/09. **Combined Section Insulator and Switch.** W. G. HAMILTON. The two feeder cables connecting the trolley wire at each side of the section insulator and the feeder box containing the switches are replaced by one cable connected to the centre terminal of a double-action quick-break switch mounted on the section insulator. The switch is actuated by means of a wheel and eccentric slot, and the wheel is turned by means of a steel rope. We understand that this device has already been in use for several months on a tramway system with satisfactory results. Three claims, three figures.

15,496/09. **Metal Filaments.** R. JAHODA. Powdered tungsten is mixed with an organic binding agent and a small quantity of powdered copper or silver, or oxides or hydroxides of these metals. After squirting, the filaments are decarbonised at a high temperature in an atmosphere of hydrogen, and, although practically all the carbon is removed, the presence of the copper or silver gives the filaments the required strength, enabling them to be handled with ease. During the sintering treatment, the copper or silver is evaporated, leaving a pure tungsten filament. Two claims.

15,803/09. **Ignition Coil.** B. BROOKS and F. H. ALSTON. A wire core is provided with two primary windings wound in reverse directions, and one secondary winding. A special form of change-over switch worked by cams, or a magnetically-operated interrupter, opens the circuit of the first winding when the current has grown to its full value and closes the circuit of the second. This has the effect of suddenly reversing the field in the core, thus producing a higher induced E.M.F. in the secondary than when the primary circuit is merely broken. Nine claims, eight figures.

19,872/09. **Electrical Propulsion of Ships.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*). High-speed turbo-alternator sets supply three-phase current to induction motors, the rotors of which are mounted on the propellor shafts. On each shaft is also a low-pressure low-speed turbine. For high speeds of the ship, the turbines of the generating sets exhaust into the low-pressure turbines, and both these and the motors drive the ship. For cruising speeds, the low-pressure turbines are run in a vacuum or are disconnected from the shaft, and the ship is driven by the motors only, the turbo-sets exhausting direct into the condensers. Arrangements for pole-changing of the motor windings permit of speed variation. Six claims, eight figures.

24,784/09. **Electro-hydraulic Press.** MASCHINENFABRIK OERLIKON. This is a self-contained press for riveting, punching, and stamping, and comprises a press cylinder, a reservoir, a system of pipes always filled with liquid, and a pump driven by an electric motor. The reservoir is in the form of a cylinder open at the top, but is fitted with an air-tight float, which is pressed continuously on to the surface of the liquid by atmospheric pressure. Thus the float will keep the liquid in the reservoir even if it is tilted over, and so permits of the whole press being moved into various positions without the liquid overflowing from the reservoir. One claim, three figures.

27,026/09. **Control of Electrically-driven Machine Tools.** A. J. BOULT (*Feltes & Guilleaume-Lahmeyerwerke A.G.*). In large high-speed reversing machine tools, such as planing and mortising machines, the driving motor is reversed at the end of the travel by gradually reducing the speed of the motor by means of stops attached to the table of the machine. These stops can work switches to increase the field of the motor by short-circuiting resistances in the field circuit. The gear is arranged so that the slightest movement in the opposite direction opens all these switches, making the control of the motor when speeding up dependent on the starting gear only. Four claims, two figures.

3,927/10. **Push-button Switch.** A. P., G. C., and P. A. LUNDBERG. The switch member is moved into the "off" or the "on" position against the action of a spring by the depression of a push button, and is maintained in that position only so long as the push button is depressed. The movement provides for quick make and break at the contacts. Two claims, one figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: SIEMENS BROS. & CO., HANDCOCK, DYKES, and RAWLINGS [Sheathing of insulated conductors] 13,220/09; BEAVER and CLAREMONT [Filling joint-boxes] 20,105/09.

Dynamos, Motors, & Transformers: FORTESCUE [Transformers] 23,938/09.

Electric Ignition: BROOKS and ALSTON [Contacts] 3,247/10.

Electrometallurgy & Electrochemistry: NATHUSIUS and WESTDEUTSCHE THOMAS-PHOSPHAT-WERKE GES. [Electric furnace] 13,295/09.

Heating & Cooking: HERZFELD [Hot water and electric supply systems] 12,450/09.

Instruments & Meters: HOOKHAM [Meters] 15,458/09.

Switchgear, Fuses, & Fittings: WARDLE [Lanterns for incandescent lamps] 12,808/09; BERRY [Switches and switch-fuses] 13,442/09; EVERED and EVERED & CO. [Switches] 25,156/09; KÖRBER [Resistances] 26,929/09; WILKINSON and LAMBERT [Motor-starters] 28,476/09.

Telephony & Telegraphy: GODDARD, GROVER and THRALL [Telegraph transmitters] 27,101/09; RENDLE and CHURCHILL [Grapple for submarine cables] 5,282/10.

Traction: HOUGHTON, ALLMAN, and GRAY [Traction systems] 12,937/09; LAUDIE-WALKER and NIBLETT [Tramcar ploughs] 13,238/09; FELTEN & GUILLEAUME LAHMEYERWERKE A.-G. [Petrol-electric driving mechanism] 15,282/09.

Miscellaneous: CREWE [Driving gear for light machinery] 18,598/09; ROBILLOT [Fire and burglar alarm] 26,624/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: SIEMENS SCHUCKERTWERKE GES., 12,483/10.

Dynamos, &c.: BLÁTHY [Machines] 12,594/10.

Electric Ignition: ETABLISSEMENTS DE DION-BOUTON (SOC. ANON.) [Distributors] 10,780/10.

Electrometallurgy: HIORTH [Induction smelting furnaces] 12,214/10.

Switchgear, &c.: SIEMENS & HALSKE A.-G. [Rectifier for H.-T. currents] 5,917/10.

Miscellaneous: GODFREE [Electro-mechanical separator] 10,706/10; VON KANDO [Marine propulsion] 12,417/10; GEB. SIEMENS & CO. [Protective coating for carbon bodies] 12,425/10; BOMBORN [Centrifugal blowers] 12,768/10.

Opposition to Grant of Patent

11,773/09. **Wiring Fittings.** S. JOHNSTON. This patent is opposed. The specification describes ceiling roses, junction boxes, and other fittings, in which the connection between the main wires and the branch circuit is made without screws and without cutting the main cables, by plunger contacts pressed on to bared portions of the main cables. The latter lie in recesses in the base of the fitting.

Expiring and Expired Patents

14,345–6 of June 29th, 1896. **Electric Jacquards for Looms.** T. A. B. CARVER. These two patents expired last year due to non-payment of the renewal fee, but restoration of the patents has been applied for. If this is granted, the patents would expire in the ordinary course on Wednesday next, but application has been made to the Scottish Courts for an extension of term for a further fourteen years. The applicants are the patentee, W. Barnard, Carver Looms, Ltd., and Textile Appliances, Ltd. The decision of the courts has not yet been given. The first patent covers various improvements in jacquards in which the needles are controlled electrically, and the second covers an electrically-controlled mechanism for producing the twill as well as the pattern of the fabric.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: O. WILHELMI [Cement cable conduits] 4,944/03.

Dynamos, &c.: C. J. REED [Motor control for wide speed variations] 4,632/99; R. LUNDELL [Motor with two armature windings for series-parallel control] 7,979/99.

Electrometallurgy, &c.: O. IMRAY (*Farbwerke vorm. Meister, Lucius, & Bruning*) [Electrolytic preparation of dyes] 5,277/02.

Switchgear, &c.: R. T. D. BROUGHAM [Control gear for electric ship steering apparatus, turntables, &c.] 5,168/02; F. O. HUNT [Electric braking control of cranes and lifts] 4,497/05.

Telephony, &c.: W. T. HENLEY'S TELEGRAPH WORKS CO., and G. SUTTON [Armouring of submarine telegraph and telephone cables] 5,379/98.

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reduction in the cost of mains. During the past twelve months in Grimsby he had been laying a 7/16 three-core distributor, and it was astonishing what a long way this would go with small houses. If one of these were laid on each side of the road so as to keep the services quite short, they could get quite a lot laid along the street at a very small cost. Last year, out of 5,000 yards in stock, he actually laid 3,400 yards, and as a few years ago he was laying cables which cost 5s. 3d. per yard, and this 7/16 cable only cost 1s. 8d. per yard, it would be seen what an enormous saving there was. The cost per yard of excavation varied from 8s. 6d. per yard on one job, to about 9d. on another job. The average for the whole year was 1s. 2d. The cost of labour could be reduced by not going to work piecemeal and laying 40 or 50 yards at a time. In Grimsby, a large number of houses had a front garden about 40 ft. in length, which increased the cost of the services. The cost could be reduced by using alternating current and making one service deal with a very large number of houses, using a small transformer and running low-tension wires from house to house. The plan he had adopted, and which saved a considerable amount of money, was to take a pair of houses together and run a service into one, and when the man next door wanted supply they simply drilled a hole through the wall and looped a cable through to another service box. He had recently put in a batch of services of 36 ft. of cable with a seven-foot loop from one house to the other, and the cost came out at 32s., which was considerably less than his average for the year, namely, £3 2s. 11d. In another instance he had put in two services for fourteen semi-detached cottages, and looped from one cottage to another. The services were 42 ft. long, but as the cottages were semi-detached, they had to open the ground in running from one to the other, and consequently did not make as big a saving as they expected, but the cost was, nevertheless, brought down to 30s. per cottage.

Mr. G. WILKINSON (Chief Electrical Engineer, Harrogate) said one point had not been mentioned, and that was the piracy of electrical energy between the cut-out and the meter. If services were laid into all sorts of premises, the occupier could take what electricity he liked by driving a nail into the cable. He had got a very simple device to prevent that, namely, a bifurcating chamber on the meter, which cost 1s., and a similar one on the cut-out, and by simply using a lead-covered side-by-side cable, the pirating of electricity was absolutely prevented. They rather prided themselves in Harrogate that they could lay a service 36 ft. long suitable for a semi-detached eight-roomed house for £2 0s. 6d., one service serving the two houses, and this included current limiter and everything joined up complete for use with the pirating device.

The annual dinner of the Association was held on Thursday evening. "Glasgow and the Neighbouring Corporations" were proposed by Mr. J. Christie (Brighton) in an able speech, and Bailie Thomas Dunlop (Glasgow), and Provost McMillan (Greenock) responded. The toast of the Incorporated Municipal Electrical Association was given by Sir John Ure Primrose. Catching sight of Mr. Ferranti at one of the tables, Sir John diverted from his main theme to allude with eloquent words of appreciation to his pioneer work. The speaker said that he could remember eighteen years ago going to Deptford with Mr. Ferranti, and if immediate acceptance of his doctrine was not a possibility of those days, to-day the elemental soundness of his deductions had been amply vindicated. The name of Mr. Ferranti would ever be associated with a mission resolutely, unhesitatingly, and unflinchingly fought. This reference to Mr. Ferranti evoked great enthusiasm among the audience, and after Mr. Lackie had replied to the toast, Mr. Ferranti was loudly called upon for a speech, and briefly acknowledged the compliment paid him. The last toast, "Our Guests," was proposed by Mr. G. Wilkinson (Harrogate), and Prof. Barr responded.

THE ANNUAL GENERAL MEETING.

The Annual Meeting was held at the Institute of Engineers and Shipbuilders, at 10 a.m., on Friday, June 17th, Mr. Lackie being in the chair. The first business was the election of officers and filling the vacancies on the Council. The ballot resulted as follows:—

PRESIDENT: J. Christie (Brighton).
VICE-PRESIDENTS: G. Wilkinson (Harrogate), (senior), C. E. C. Shawfield (Wolverhampton), (junior).
PAST PRESIDENTS: H. Talbot (Nottingham), S. L. Pearce (Manchester), W. W. Lackie (Glasgow).
HON. SOLICITOR: Alderman G. Pearson (Bristol).
HON. TREASURER: J. E. Edgcome (Kingston-on-Thames).
HON. SECRETARY: H. Faraday Proctor (Bristol).
COUNCIL: R. A. Chattock* (Birmingham), A. C. Cramb (Croydon), C. Furness (Blackpool), F. M. Long (Norwich), J. H. Rider* (London), A. H. Seabrook* (Marylebone), S. J. Watson* (Bury), T. P. Wilmshurst (Derby), Alderman Bruce* (Sunderland), Councillor German* (Brighton), Alderman West* (Coventry), Alderman Sinclair (Swansea), Alderman J. P. Smith (Barrow-in-Furness), Bailie Willock (Glasgow).

New members of Council and those re-elected are marked with an asterisk. Mr. A. A. Day (Bolton), Councillor Howarth (Manchester), Mr. V. A. H. McCowen (Salford), Mr. H. Richardson (Dundee), Alderman C. West (Coventry), and Alderman Wilkinson (Luton) retired from the Council in the ordinary course, whilst a further vacancy was created by the election of Mr. C. E. C. Shawfield (Wolverhampton) as Junior Vice-President. Of the retiring members, only Alderman West (Coventry) was re-elected.

It was the general feeling of the meeting that the Convention in 1911 should be held at Brighton, and it was left in Mr. Christie's hands to make the suggestion to the Brighton Corporation.

A photograph and biographical notice of Mr. Christie appears on p. 407.

REPORT OF THE COUNCIL.*

Standard Specifications.—The Sub-Committee on Physical Standards of the Engineering Standards Committee, upon which the Association is represented, have in hand at the present moment a standard specification for bayonet socket electric lampholders. This specification is already printed in draft. The Sub-Committee also engaged, in co-operation with the manufacturers, in preparing a specification for metal filament lamps. The completion and issue of this specification is, however, likely to occupy some considerable time.

Charges for Current Supplied for Traction Purposes.—A small Sub-Committee has been appointed, consisting of Messrs. McElroy and Spencer, representing the Municipal Tramways Association, and Messrs. S. L. Pearce and T. Roles, representing the I.M.E.A., and the latter Association's representatives have outlined a suggested method of arriving at a correct traction charge which will be considered in due course by the tramway representatives.

Electric Lighting Act, 1909.—The clause to enable local authorities generally to provide electrical fittings, &c., was unfortunately thrown out, although great efforts were made to get it retained. A clause was inserted protecting the property of undertakers from being seized by mortgagees or otherwise. A clause was also inserted protecting authorised undertakers from encroachment by unauthorised undertakers. This clause did not, however, go quite as far as was desired, although it is of considerable assistance.

Financial Organisation and Administration.—Several letters have passed to and from the Local Government Board on this matter, as a result of negotiations carried out by a Sub-Committee representing the different classes of municipal trading departments, and on which the Council is represented by the Honorary Secretary. Sundry meetings were held last summer, but the Local Government Board have taken no further action in the matter, probably owing to the Government being so much engaged with other matters; and as the Council's desire is that the present law shall not be amended, the question remains at present in a condition that is considered satisfactory. It will, however, be carefully watched.

Income Tax and Depreciation.—The Council have given very careful consideration to the above question, but at present they are unable to make any definite recommendations. It is felt generally that there is far too wide a divergence between the lives of assets, as allowed by the Inland Revenue Department for the purposes of assessment, and the Local Government Board for the purposes of loan periods. As indicated in a circular letter addressed to the members on March 4th, one of the largest cities in the kingdom was about to be penalised under the question of assessment of its mains. It is pleasing to be able to record that immediately the attention of the Inland Revenue authorities was drawn to this letter, the question was re-opened, and the allowance will probably be made. Of about seventy-six returns received, it is found that there are eighteen undertakings where the income tax, although payable, has not yet been paid, and eight of these undertakings are resisting the terms offered by the Inland Revenue Department.

Economic Wiring.—The Sub-Committee of the Council appointed to deal with this matter have been in negotiation with a Sub-Committee of the Cable Makers' Association, who, in accordance with suggestions offered, have drawn up a specification for a class of conductor which it is considered would satisfactorily meet the requirements of the fire insurance authorities, and enable installations of this class to be carried out in an efficient manner at a minimum of cost. The Association's representatives on the Wiring Rules Committee of the Institution of Electrical Engineers (Messrs. Edgcome and Christie), have reported on the matter to this Committee, and the question is coming up for their consideration when this section of the rules is being dealt with.

Travelling Studentship.—The Council again expresses its regret at the lack of interest shown by the Associates in regard to the scholarship of £10 offered annually for the best Paper on some approved subject. This year again no entries were received, and the award has only been made twice in four years.

General.—The membership has increased by 26, but there are still some undertakings not represented at all. The Asso-

* Slightly abbreviated.

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ciates' Class, in which there are only 41 Members—and 11 Chief Assistants as Associate Members—does not make the progress which it might.

The attendances at the annual Conferences have increased so much that it has been found necessary to reduce the number of invitations sent to those not members of the Association.

DISCUSSION.

Municipal Wiring Powers.

Mr. M. RUDDLE (Dublin) said he desired to impress upon the Council the urgent necessity of taking vigorous steps to have the power of supplying fittings, wires, &c., extended to all municipalities represented in the Association. It was an absurd anomaly to find a very large number of the members of the Association were prohibited from exercising powers which had proved of such great advantage to the remaining members of the Association who possess them. The motto of the Association should and must be equal rights and opportunities for all its members. It might be said that any municipality desiring such powers could promote a Bill, but the cost of an opposed Bill was prohibitive; and, further, such an important matter of the general good should be fought by the Association. He understood that there were some forty or fifty municipalities which had not these wiring powers, and if they would all join in sharing the expense to which the Association would be put, he did not think a large sum would be required from each. In the case of Dublin, he could promise that the Corporation would pay its fair share of any necessary expenditure. He did not know if it was necessary to move a formal resolution, but would ask that the Council should take steps at the earliest possible moment to have the wiring and plant-hiring powers now possessed by some municipalities extended to all the municipalities upon its membership roll.

Mr. F. W. PURSE (Watford) seconded Mr. Ruddle's proposal, and heartily endorsed all that he had said.

Mr. A. C. CRAMB (Croydon) supported the suggestion, and said he did not think the ratepayers of the country really appreciated the importance of this matter. There was rather a tendency to misrepresent the question in the Press. There was no real antagonism to contractors, but it had been found impossible to arrive at a basis of co-operative working. Especially in the direction of developing heating and cooking, contractors would do nothing. In Croydon, solely through the efforts of the supply authority, they had been doing a fair business with electric irons, and he received objections from the contractors as to the discount. He contended that the supply department should at any rate have a portion of the discount.

Alderman PEARSON (Bristol) referred to the Electric Lighting Bill of last year, which originally gave powers to all municipalities to undertake the wiring of premises and the hiring out of plant. When the Bill reached the House of Lords, words were introduced precluding any work being carried out except through a contractor. The Association at once saw that under these circumstances they would be worse off than they were without a clause at all, and, rather than jeopardise the remainder of the Bill, which contained many other valuable clauses, the only alternative (which was adopted) was to secure the deletion of the wiring clause. If all municipalities who had not these powers were to unite in the promotion of a Bill and bring pressure to bear upon their members of Parliament, the Bill could be passed through the House of Commons, but he did not see how they would get the Bill through the House of Lords in its present temper. They had these powers at Bristol, but had secured them by inserting the clauses in a General Powers Bill, some years ago when the Electrical Contractors' Association was not so lively as it was at present. In attempting to promote a Bill their only chance lay in impressing their members of Parliament that they could influence more votes than the contractors.

Councillor BONES (Hastings), in supporting the resolution, said that the Electricity Committee at Hastings had done their best to get these powers, but at present the Corporation outvoted them. He thought that if the Association promoted a Bill itself his own Council would pay their share, but he could not pledge them.

Mr. J. E. EDGCOME (Hon. Treasurer) said that if the different municipalities who desired the Bill were prepared to find the funds the Association would be prepared to promote the Bill, but, as an Association, they had no funds to promote a Bill themselves.

Councillor BONES said his intention was that a Bill should be promoted officially by the Association, but that they should be guaranteed the necessary funds.

Mr. A. BLACKMAN (Sunderland) asked what the cost would be.

Alderman PEARSON said it entirely depended on the degree of opposition met with. It might pass through the House of Commons and cost practically nothing; but, on the other hand, the Contractors' Association might oppose them in both Houses, and they would have to spend anything from £100 to £500.

Mr. T. D. CLOTHIER (Bootle) said that all the speakers so far seemed to be in favour of taking some action in this matter, but he was connected with a corporation who were opposed to municipal trading of this character, and he thought there must be many others of the same opinion. So strong did the Bootle Corporation feel on the matter that he believed they would withdraw their support from the Association if any such strong action were taken as had been suggested that morning.

Mr. H. FARADAY PROCTOR (Hon. Secretary) said that the members could have every confidence that the Council would not take any action unless they had the confidence of a very large majority of the members.

Mr. W. G. PICKVANCE (Wrexham) said he was astonished to hear Mr. Clothier's remarks. When he first went to Wrexham he had intended to dispose of the wiring department, and to continue the work with the assistance of contractors. He found, however, that it was no use attempting co-operation, and he had been compelled to continue the department, which was a very successful one. It was evident that there was business to be had if the contractors had only endeavoured to get it. He did not believe many municipalities held the views held by Mr. Clothier.

Mr. S. J. WATSON (Bury), asked what had become of the proposal by Mr. Hoadley, of Maidstone, to promote a Bill dealing with this matter.

Mr. A. C. CRAMB (Croydon), in the absence of Mr. Hoadley, said this Bill had had to be dropped owing to the necessity for every municipality calling a town's meeting to put the Borough Funds Act into force.

The PRESIDENT then announced that Mr. Ruddle had agreed to an alteration in his proposed resolution, so that the powers sought should not be confined to members of the Association, and that subscriptions should be asked from all municipalities. Speaking for Glasgow, although the Corporation had these powers, they were prepared to support such a Bill, but not if it were promoted by the Association. As the matter stood now, it merely devolved upon the Council to consider what action could be taken in the promotion of a Bill.

The report was then put to the meeting and adopted.

Honorary Member.

The PRESIDENT announced that the Council had unanimously elected Mr. C. H. Wordingham as honorary member of the Association.

An Information Bureau.

Mr. E. S. RAYNER (Doncaster), referring to the number of inquiries which central station engineers receive each year for information on various points, asked if it would not be possible to deal with these from some central source by the Association. This would avoid a great deal of repetition work, as records could be kept, and many of the points upon which information was now asked could be answered immediately.

Mr. J. E. EDGCOME said this idea was a pet hobby of his, and he had raised it in his Presidential Address in 1906. The difficulty, however, was expense, and the only way of meeting this seemed to be by a large increase in the annual subscription. His idea was that engineers wishing to have information should pay for it, just as now they had to bear the cost of postage, &c., in sending out circulars all over the country. The Council would only be too pleased to co-operate any suggestions that might be made on the subject to prevent the constant overlapping of inquiries, which no doubt they all found irksome to some extent.

Mr. H. FARADAY PROCTOR said that, as honorary secretary, he was to a certain extent treated as an information bureau, and he heartily supported the suggestion of Mr. Rayner. He felt, however, that there would be a tendency for the number of inquiries to increase considerably if a central bureau were established, and unless sufficient funds were forthcoming it would not be feasible to carry it on.

Mr. J. H. CLOTHIER (St. Annes-on-Sea) thought a start might be made with a central bureau if those engineers who had collected information on various points were to present copies of it.

Mr. F. AYTON (Ipswich) supported Mr. Clothier's suggestion, and proposed that the Council might decide at the end of the year which information was worthy of inclusion in the proceedings.

Mr. H. RICHARDSON (Dundee) thought the trouble had, to a great extent, been exaggerated. It was very little trouble to answer these questions, and it should be remembered that the engineers themselves did not do the actual work.

Mr. J. H. CLOTHIER made another suggestion, namely, that special committee rooms should be set aside at each annual Convention, where subjects on which special information was desired could be discussed.

The PRESIDENT announced that the Council would give the matter their careful consideration.

Constitution of the Council.

Mr. W. G. PICKVANCE suggested that the Council might be enlarged with a view to including a few representatives of smaller stations. At present the members of Council mainly represented the large power stations, whereas there were a far larger number of smaller stations represented by the Association, but which were not represented on the Council.

The PRESIDENT pointed out that Mr. Pickvance could, with the assistance of ten other members, requisition a special meeting of the Association to discuss the matter. It was a point which could only be dealt with by special meeting, and was fully provided for by the Articles of Association.

Mr. PICKVANCE, in answer to Mr. Edgcome, said his idea was

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to define that the Council should consist of so many members, each representing certain sized stations.

Special Committees.

Mr. C. TURNBULL (Chief Electrical Engineer, Tynemouth) asked if it would not be possible for the Council to appoint special committees to discuss problems which were not of interest to the general body of the members, but which were of extreme importance to those working under particular circumstances, such, for instance, as those supplying tramway companies with electrical energy. Difficulties of this character had arisen at Peterborough and Hartlepool, and considerable assistance might be afforded by the appointment of special committees as he suggested.

Supply Outside Area.

Mr. F. W. PURSE (Chief Electrical Engineer, Watford) called attention to a difficulty which he had encountered in connection with supply outside his borough by authority under the Electric Lighting Act of 1909. Before they could go to the Board of Trade for permission to lay their mains, they had to get the permission of the road authority concerned. In his case the Hertfordshire County Council had compelled him to deposit certain sums of money before granting their permission.

Alderman PEARSON (Hon. Solicitor) thought the case was covered by the Electric Lighting Act of 1909, which provided for granting a licence by letter for supplying energy outside their boroughs. If unreasonable conditions were imposed by the outside authority, the Board of Trade could dispense with their consent.

The Joint Publicity Committee.

Mr. A. C. CRAMB (Chief Electrical Engineer, Croydon) mentioned that the Joint Publicity Committee of London has decided to extend their scope, if possible, to include all the provinces, and had dropped the words "of London" from their title. He had been asked to suggest that the Association should appoint two members to represent the provinces on this Committee.

It was decided to appoint Mr. J. Christie (Brighton) and Mr. F. Ayton (Ipswich).

Special Clauses.

The PRESIDENT stated that there were three clauses to which the Council was giving special attention with a view to getting them passed into law. There was the wiring clause; the stand-by clause, which did not cover everything, there being cases in which motors were used as stand-by to gas-engines; and there was the question of expenses of delegates attending their conferences, which in some cases the Local Government Board would not pass.

The Conference concluded with a hearty vote of thanks to the retiring President, Mr. W. W. Lackie, and to the Glasgow and Edinburgh Corporations for their hospitality during the Convention.

THE WATKIN SWITCH

WE have had an opportunity of inspecting the latest pattern of the device known as the "Watkin" switch, at the offices of the Adams Watkin Co., Ltd. (56 Victoria Street, London, S.W.). This device is intended to be inserted in series with electric lamps, motors, fans, or heating or cooking apparatus, and enables the user to regulate these in a convenient way and to effect economy. It consists of a seven-way switch similar in external appearance to an ordinary tumbler switch. The dolly-head, however, works a lever which moves a contact-piece over a row of contacts and successively cuts out or inserts resistances in series. The resistance units each consist of a large number of short pieces of rod of a special composition laid side by side and clamped in a brass frame with mica insulation. Both the switch-movement and the resistances are enclosed in a metal case of artistic design. Special care has been taken to ensure that the resistances are well ventilated to prevent excessive heating, and the composition employed has a temperature coefficient of practically zero, so that the resistance does not vary. Thus, if the device is in series with a delicate rotary surgical instrument, the speed is claimed to remain steady and not to vary due to the heating up of the resistances. When used in series with lamps, any desired reduction of illumination can be obtained, and the current in the circuit is reduced. Thus in the case of lamps reduced to about half brilliancy, an actual economy of about 20 per cent. in the consumption is effected. The use of this regulating switch is also claimed to lengthen the life of metal filament lamps, as they are run for a considerable time below the rated candle-power, and, furthermore, as they may be turned on only after cutting out the resistances, the rush of current on first switching on (due to the low resistance of the cold filament) is avoided. The switch is supplied in various sizes for lamps or other apparatus taking from 70 up to 600 watts, and larger sizes can be obtained to order.

Junior Institution of Engineers.—The summer meeting of this Institution will take place at Dublin and Belfast, from July 16th to 23rd. Visits will be paid to the Ringsend power station of the Dublin United Tramways Co., the shipbuilding and engineering works of Messrs. Harland & Wolff, and other works of engineering interest. Receptions and meetings will be held in Dublin and Belfast.

MUNICIPAL v. COMPANY SUPPLY AT RADCLIFFE

Competition by Lancashire Power Co. Refused

THE Board of Trade have given their decision in regard to the application made a few months ago by the Lancashire Electric Power Co. for a provisional order to supply electricity in Radcliffe in competition with the Council. The Council at present supply under an ordinary electric lighting provisional order. The company alleged that there is a large demand in Radcliffe at present which the Council is unable to meet, and they asked to be allowed to compete for all power consumers above 50 h.p.

Whilst refusing the company the provisional order which they sought, the Board of Trade express the opinion that from the evidence at the inquiry it appears to them the facilities for a cheap supply of electric power in Radcliffe are inadequate, and urge the Council to take the necessary steps to remedy this. In the event of the company making a fresh application at a later date, the Board state they may find it necessary to arrive at a different conclusion if it is again shown that the demand is not being adequately met.

PREVENTION OF ELECTRICAL ACCIDENTS IN FACTORIES

THE annual report of the Chief Inspector of Factories and Workshops for the year 1909 contains the annual statement of the electrical inspector, Mr. G. S. Ram. At the outset Mr. Ram points out that the new regulations came into force generally on July 1st, 1909, and on January 1st of this year as regards such parts of electrical stations as were constructed before July 1st, 1908. These regulations were given in ELECTRICAL ENGINEERING, Vol. V., p. 57. Mr. Ram states that, though in general steps are being taken to comply with the regulations, a good deal of difference of opinion exists as to what is sufficient and adequate, and that some guidance, such as that contained in his recent memorandum, of which a notice was given in ELECTRICAL ENGINEERING, is very generally desired. He suggests that public supply undertakings should supervise the factory installations connected to their mains in reference to the regulations. After referring to one or two doubtful cases of exemption from the rules, such as house circuits supplied from auto-transformers connected to mains at more than 125 volts, Mr. Ram remarks that his suggestions with regard to the design of wall plugs to obviate danger to the user's hand by arcing, have been taken up, and that plugs embodying the features he described have been put on the market. These have a guard disc between the person's fingers and the contacts, and the flexible wires enter from underneath the disc, and do not pass through the hand. In connection with fuse-boards, Mr. Ram points out these are frequently constructed so that the fuses cannot be renewed without danger, especially in the case of small distributing boards. In a design obviating the danger the fuse wires are attached to contacts fixed in porcelain holders, arranged in such a way that they can be readily handled without danger of touching any live metal, and the operator's fingers are also shielded. The fixed contacts are also protected by porcelain plates.

Out of 447 accidents in electricity works, 90 were due to electrical causes, and of these only four were fatal. Of the 24 accidents at switchboards during ordinary routine work, six appear to have been due to faulty switches, in some cases owing to the non-provision of a quick-break action. Several were due to mistakes on the part of the switchman. Two accidents occurred in operating isolating switches on a H.T. system. In one case the accident was due to a faulty method of interlocking the switches, and in the other to a mistake in pulling out a switch while it was on full load. A mistake of this kind on a large system is always likely to involve serious injury to the operator, and may cause a stoppage of the supply. In many stations no means are provided for guarding against such mistakes; thus, there are often a number of isolating switches, all exactly alike, and without labels. Some recent switchboards have the isolating switches enclosed in cells having doors interlocked with the oil switches, so making it impossible to operate them under current. In other cases the isolating switches are worked by gearing interlocked with the oil switches. For existing switchboards, where a positive interlocking arrangement may be impracticable, an ammeter might be provided on each conductor, just below the isolating switch, or an indicator might be fixed at the isolating switch, mechanically operated by the oil switch, to show whether the latter is open or closed. Accidents to persons cleaning, or working near live conductors number 50, and include the four fatal cases. Three of these

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occurred to unskilled labourers. Mr. Ram points out that since January 1st of this year, the employment of unskilled persons under such circumstances is forbidden under the regulations, and that such accidents, may therefore involve serious consequences to those responsible. The fourth fatality occurred to a sub-station attendant. A transformer, one of several connected in parallel, had broken down, and he was disconnecting it for removal. The H.T. supply had one conductor connected to earth, and in removing the connection to the earthed conductor he appears to have broken its continuity. The terminal which he was holding, although normally at earth potential, consequently became charged at high pressure. The man was acting contrary to the rules of his employers in undertaking such work when alone. Under the regulations such work in future may not be undertaken by any person unaccompanied.

The number of electrical accidents in factories and engineering shops is slightly more than last year, namely, 257, but there have been only eight fatalities. The 39 accidents due to the arcing of switches and motor starters are mostly caused by defects in the apparatus. The use of cheap switches, too small and flimsy for the work, is not unfrequently the primary cause. The 17 accidents from arcing of fuses nearly all occur through the use of unprotected open fuses; ten of these were on motor-starting panels, where the fuses were placed near the switch handle. The 27 accidents in the renewing of fuses were mostly due to short circuits in replacing fuses in live terminals. Of 45 accidents with portable apparatus, 23 were due to burns from short circuits, or shock, when handling the flexible wires. Frequently the flexible wires are insufficiently protected against damage, or are in a damaged condition. Twelve were due to short circuits at connectors when plugging in or out. Three were due to shock from portable lamps, one being fatal. In the fatal case, the lamp was of the old type, now prohibited by regulations. The 32 accidents from unprotected conductors include six fatalities. One of these occurred to a man working close to the live wires of a travelling crane. The obvious precaution of switching off the pressure before the work was undertaken was omitted. Under the regulations definite responsibility is now placed upon the occupier or the contractor in such circumstances. The second fatality was similar. A third fatality due to contact with bare conductors on an overhead travelling crane appears to have been due to the man's own fault. The fourth fatality occurred to an experienced electrician, working on a corrugated iron roof over which passed bare wires (400 volts, three-phase), at a height of five feet from the roof, and Mr. Ram again emphasises that wires crossing roofs of buildings should be at such a height that they cannot be touched. The fifth fatality occurred to an unskilled man who was "cleaning up." He touched a bare terminal at the back of a motor switch panel, 440 volts, three-phase. Mr. Ram writes that many appear to think that if a switch is covered it is all that is necessary, although there may be exposed live terminals at the back. In this case the man appears to have got a shock to earth while standing on a dry cement floor. It is frequently supposed that such a floor is insulating, whereas it cannot be relied upon for safety, even at low pressures. The sixth fatality occurred on a 230-volt single-phase system. A lighting wire, having no protection beyond the ordinary covering of insulating material, was attached to a wooden beam. A chain sling had been put round the beam, and a block and tackle were suspended therefrom for lifting an iron plate weighing half a ton. The chain cut through the insulating material of the wire, and the whole tackle and iron plate became live. Two men received shocks, one being killed. Of the 26 non-fatal accidents under this heading, thirteen were due to unprotected wires within reach of any person employed. Thirty-three accidents occurred to skilled persons when working on live conductors, and one was fatal. In this case, a wireman having to carry out some alterations removed the main fuses in order to make the circuit dead. To do this he had to remove the cover of the fuse box, but he did not trouble to replace it, and subsequently accidentally touched one of the live fuse terminals when standing on wet ground.

Finally, Mr. Ram comments on the use of danger boards, asserting that they are rarely necessary in factories, as there should be no exposed conductors. Boxes, dangerous only when opened, should only be opened by authorised persons, and such boxes might have warnings on their covers. In works where high-pressure is employed temporarily for testing, boards are necessary, but they should be put out only when there is danger.

LOCAL NOTES

BRADFORD: *Tramway Accounts.*—The total expenditure for the year has been £170,699, which is a slight increase over that of the previous year. The expenses per car mile amounted to 7·149d., as against 7·221d. for the previous year, in spite of an increase of 0·039d. per car mile for repairs and maintenance. The net profit on the year's undertaking was £32,365, as compared with £15,318 for the previous year. £20,000 is being handed over to relief of rates, and £12,365 transferred to reserve and renewals account.

CARDIFF: *Trolley Omnibuses.*—The suggestion of the electrical engineer regarding a trolley omnibus service for the outlying districts, such as Whitchurch and Llandaff, has been referred to the Parliamentary Committee.

DOVER: *Electricity Accounts.*—The total receipts amounted to £16,574, and the expenses to £9,545. The capital charges, however, were £12,333, so that there is a final adverse balance of £227, a slightly better result than that of the previous year.

GREAT YARMOUTH: *Electricity Accounts.*—The total expenditure, including generating expenses, management expenses, &c., for the year ended March 31st, was £11,147, and the total income £20,334, giving a gross profit of £9,087; of this £948 was carried to depreciation, and £7,490 absorbed by capital charges, leaving a final net profit of £649.

HANLEY: *Appointment of Electrical Engineer.*—At a meeting of the Electrical Committee of the Federated Boroughs last Wednesday, the applications from the four engineers who had charge of the undertakings of Hanley, Burslem, Stoke, and Longton, for the post of engineer to the combined undertaking, were considered. After considerable discussion it was decided to recommend Mr. C. H. Yeaman, of Hanley, for the appointment. We understand that Mr. Yeaman had a majority of five or six votes over Mr. Tiddeman, of Stoke.

LEEDS: *Electricity Accounts.*—The annual report states that there has been a reduction in every group of items of expenditure except rates and taxes, the aggregate reduction being £5,762. The cost per unit generated, including capital charges, works out at 1·74d. per unit and the average price obtained at 1·91d. The net surplus is £8,931, which has been applied to the relief of rates.

LONDON: *L.C.C. Tramways.*—A report of the Finance Committee gives the estimated surplus on the electric lines for 1910-11 as £934,180, and the deficiency on the horse trams as £22,170. The net surplus, after deduction of capital charges, &c., is given as £244,132, which would be divided between renewals and general reserve funds. It is estimated that a further capital expenditure of £2,800,000 will be required to complete the system.

The first portion of the tramway shelter on the Embankment, near Blackfriars Bridge, is now in position, and will be used experimentally before the completion of the work. The complete shelter will provide a length of 180 feet under cover, and the estimated cost is £1,200. The consent of the City Corporation will be necessary before its completion.

The Highways Committee of the London County Council recommend approval of estimates amounting to £54,350 for the construction of the authorised new line from Battersea Park Road to King's Road, Chelsea. The line will involve special conduit construction where it crosses Battersea Bridge, and considerable alterations will have to be made to the structure of the bridge. The cables will be carried in steel pipes suspended from the steelwork under the road surface.

Hammersmith.—The Borough Accountant reports that the gross receipts of the electricity department for the year ended March 31st, 1910, were £53,433, and the gross expenditure £28,278. After payment of interest and instalments of loan a net surplus for the year of £3,482 is shown.

Hampstead: Electricity Accounts.—The receipts of the undertaking for the year ended March 31st last amounted to £60,270, as against £62,879 in the previous twelve months.

Westminster.—The Assessment Committee report that an appeal was entered by the Kensington and Knightsbridge Electric Lighting Company, Ltd., against the Supplemental Valuation List, dated May 30th, 1908, in respect of the omission on the part of the undertaking of the company in the parish of St. Margaret and St. John. The correction which the company desired to have made in the list was that the property should be inserted therein at a reduction of £900 rateable value. By agreement the appeal came before the arbitrators and an umpire, and a special case was subsequently stated for the decision of the High Court. The matter was referred back to the umpire, but a settlement has since been effected on the terms that the property of the company be inserted in the Supplemental List in question at a reduction of £400 rateable value, that the appellants and respondents respectively bear their own costs, and that the committee pay one-half of the umpire's fees.

LOWESTOFT: *Trolley 'Buses.*—The General Manager of the Tramways has been directed to prepare a report on the trackless trolley system in connection with the Kessingland Light Railway.

ROCHDALE: *Tramways.*—The new line from Ending to Whitworth was opened for traffic last week, after inspection by the Board of Trade, and a through service from Rochdale to Whitworth has been commenced.

STAFFORD: *Electricity Accounts.*—The receipts showed a slight decrease, and were £7,344, and the net revenue was £2,478. After meeting capital charges, £340 was transferred to depreciation, and £144 carried forward.

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WEYMOUTH: *Electricity Accounts.*—The gross receipts amounted to £6,184, and the expenditure was £2,822. After meeting capital charges, however, there was deficiency of £113, but £101 was carried forward from the previous year.

WORKSOP: *Electricity Accounts.*—The total income showed a small increase over that of the previous year amounting to £17,918, and the final balance, after meeting capital charges, was £576.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BELFAST.—Tenders are invited for erection of a chimney shaft and flues at the power station. Particulars from the City Surveyor, and tenders by Monday next, June 27th.

GILLINGHAM.—Application is to be made to the Local Government Board for a loan of £3,500 for various items connected with the electricity undertaking.

LLANDAFF AND DINAS POWIS.—The Council require E.H.T. switchgear, transformers, distribution switchboard, mains, &c. Particulars from the Consulting Engineers, Messrs. Herbert Lewis & Fletcher, Prudential Buildings, St. Mary Street, Cardiff, and tenders by July 4th.

LONDON: *Battersea.*—Application is to be made to the Local Government Board for a loan of £13,909 for extensions to mains, &c.

Hammersmith.—Tenders are to be invited for a supply of service cables and one 200 kw. transformer.

Hampstead.—The recommendation of the Committee that further plant be installed at the station to the total amount of £6,600 (condensers £3,100 and cooling towers £3,500), has been agreed to.

Islington.—An estimate of £60 has been passed for extending mains to give a supply of current for lighting and power purposes to the Shoreditch Board of Guardians' Workhouse in Hazelville Road.

MANCHESTER.—Tenders are invited by the Corporation for two 25-K.V.A. three-phase transformers, and high- and low-tension switchgear. Particulars from Mr. F. E. Hughes, Secretary of the Electricity Department, Town Hall, and tenders by Friday next, June 24th.

NEWPORT (MON.).—Tenders are invited for high- and low-tension switchgear. Particulars from Borough Electrical Engineer; deposit, £3. Tenders by June 27th.

PEMBROKE (Ireland).—A Local Government Board inquiry was held last week regarding a loan of £8,000 for extensions.

PORTSMOUTH.—A Local Government Board inquiry was held last week regarding a loan of £24,000 for electricity purposes.

RAWTENSTALL.—The Corporation have instructed the Town Clerk to make application to the Local Government Board for sanction to borrow a further sum of £11,000 for electricity purposes.

ROCHDALE.—A Local Government Board inquiry was held last week regarding a loan of £13,941 for extensions to the Electricity Works, including battery and boosters, transformers, mains, &c.

SHANGHAI.—Tenders are invited for two 940 k.v.a. transformers and switchgear. Particulars from Messrs. Preece & Cardew. Tenders by July 10th.

Miscellaneous

AUSTRALIA.—Tenders are invited by July 19th for 4,000 telephone sets.

BARNET.—Subject to the approval of the Local Government Board, tenders are to be invited by the Guardians in regard to a scheme for providing electric light and power at the workhouse at an estimated cost of £700.

DUBLIN.—Tenders are invited for the installation of an electric lighting plant in the neighbourhood of Dublin. Particulars can be obtained from Mr. P. O'Hare, 15 Wellpark Avenue, Drumcondra. Fee 10s. 6d.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

W.C.—Proposed nurses' home at the London Homœopathic Hospital, Gt. Ormond Street, Holborn. Architect, E. T. Hall, 54 Bedford Square, W.C.

Reconstruction of Middlesex Music Hall, Drury Lane, W.C. (£2,700). Architects, F. Matcham & Co., 9 Warwick Court, W.C.

Reconstruction of Royal Standard Music Hall, Victoria Street, S.W. Architects, F. Matcham & Co., 9 Warwick Court, W.C.

N.—Handicraft centre, Barnsbury Park site, Islington, N. Builders, Patman & Fotheringham, 100 Theobalds Road, W.C.

The London County Council invite tenders for wiring and fitting the St. Mark's Road and Haverstock Hill schools. Particulars from the Chief Engineer to the Council, and tenders by July 6th.

E.—Cinematograph palace, Plashet Lane, East Ham. Sir John H. Bethell, M.P., Woodford.

School, Malmesbury Road, Bow and Bromley, E. Architect, L.C.C., Education Committee, Victoria Embankment, E.C.

PROVINCES.

ARMAGH.—School (£2,000). Secretary, Education Committee, Armagh U.D.C.

ASHINGTON (Northumberland).—Council offices (£3,000). Architect, O. Blyth, 28 Wansbeck Terrace, Ashington.

BLACKWALL.—Extensions, Masonic Hall (£1,700). T. Kershaw, architect, Halifax.

BOOTLE.—Theatre. Architect, J. H. Sutton, 101 Dale Street, Liverpool. J. & G. Chappell, builders, Walton, Liverpool.

BOURNEMOUTH.—Theatre (1,000 pl.), for the Bournemouth, Exeter & Plymouth Bioscope Theatres, Ltd.

BRIDGWATER.—Drill hall (£2,000). Architect, P. G. Fry, 49 High Street, Weston.

BURNLEY.—Extensions, Trafalgar Mill (£6,000). Architect, S. Taylor, 78 Manchester Road, Burnley.

BURY.—Extensions to workhouse (£8,700). J. Isherwood, Clerk, Board of Guardians, Bury.

CHICHESTER.—Improvements at infirmary (£10,000). F. B. Tompkins, Clerk, Board of Guardians, Chichester.

DOWLAIS.—Congregational Church (£6,000). The Trustees.

EXMOUTH.—Manual training and art school (£1,800). Architect, P. Morris, 1 Richmond Road, Exeter.

GLASGOW.—Extensions, Andersbon Special School (£2,500). Architects, J. M. Munro & Son, 28 Bath Street, Glasgow.

HEATON (Newcastle).—Hall (£12,000). Architects, White & Stephenson, Grey Street.

READING.—Proposed county offices (£19,276). Surveyor, Berks County Council.

WELLSHOT.—Extensions, school (£10,000). Architects, J. McKissack & Sons, 68 West Regent Street, Glasgow.

TENDERS RECEIVED AND ACCEPTED

BURY.—The tender of the British Westinghouse Co. for a Belliss engine and dynamo (£1,083) has been accepted, subject to the approval of the Local Government Board for the loan.

LONDON: *Battersea.*—The Borough Council has accepted the tender of Baxter & Caunter, at £63 3s. 6d., for the supply of two motors at the Culvert Road depôt.

Hammersmith.—The Borough Council recently accepted the tender of Ferranti, Ltd., for the supply of high-tension switchgear at £155 2s. 6d., and low-tension switchgear at £32 10s. The firm subsequently wrote that they had made an error, and that their tender for high-tension switchgear should be £256 15s. The Council has permitted Ferranti, Ltd., to withdraw their tender, and has accepted the tender of Cowans, Ltd., for high-tension switchgear at £217, and low-tension switchgear at £39 10s. They have also accepted the tender of W. R. and A. Hyde to construct a sub-station at Chancellor's Wharf for £49 10s.

METROPOLITAN ASYLUMS BOARD.—An order has been placed with W. J. Fryer & Co., to carry out, under the supervision of the Engineer-in-Chief, the installation of low-voltage metallic filament lamps at Tooting Bec Asylum. The estimated cost of the work is £350.

NEWPORT (Mon.).—The contract for motor generator plant has been awarded to the General Electric Co., Ltd., the lowest tenderer. Tenders were also received from the following firms: British Thomson-Houston Co., Ltd.; Dick Kerr & Co., Ltd.; Johnson & Phillips, Ltd.; British Westinghouse Electrical and Manufacturing Co., Ltd.; Brush Electrical Engineering Co., Ltd.; Lahmeyer Electrical Co., Ltd.; Crompton & Co., Ltd.; Siemens Bros. & Co., Ltd.; Electric Construction Co., Ltd.; Lancashire Dynamo Co., Ltd. Bruce, Peebles & Co.

WEST HAM.—The Education Committee has accepted the tender of Pritchetts & Gold, at £75 4s. 7d., for renewing the plates of the main storage battery at the Technical Institute.

OSRAM·LAMPS

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APPOINTMENTS AND PERSONAL NOTES

Colonel R. E. Crompton, C.B., has been appointed Consulting Engineer to the Road Board.

Mr. P. F. Allan has resigned his position with the Clyde Valley Electric Power Co. to join the London staff of Messrs. Siemens Bros. Dynamo Works, Ltd. On taking leave of Mr. Allan last week, the staff of the Clyde Valley Electric Power Co. presented him with a suit-case.

In connection with the foreign appointment which, as announced in our last issue, is being taken up by Mr. H. M. Sayers, we are asked to announce that the business which he has carried on at 39 Victoria Street, S.W., since August, 1906, has been transferred, as from Friday, June 10th, to his eldest son, Mr. William Higley Sayers, who is carrying it on in his own name and responsibility. All matters of account referring to Mr. H. M. Sayers' practice will be dealt with by Mr. Alfred G. Sayers, chartered accountant, of Messrs. Sayers and Wesson, 19 Hanover Square, W.

A proposal of the Devonport Electricity Committee that the salary of the Borough Electrical Engineer, Mr. J. W. Spark, should be increased from £300 to £350 per annum by two annual instalments of £25 each was referred back to the Committee, who, however, have confirmed their previous proposal.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Liverpool Electric Cable Co., interim dividend of 5 per cent. Melbourne Tramway & Omnibus, 4½ per share for the quarter ending June 30th, equivalent to 15 per cent. per annum. Winnipeg Electric Railway, 10 per cent. for the quarter ending June 30th. Hobart Electric Tramway Co., 1s. per share, payable July 1st.

ANGLO-ARGENTINE TRAMWAYS CO.—An issue of £1,500,000 five per cent. debentures is offered at 96½ per cent. by the Law Debenture Corporation.

ELECTRIC LIGHT & POWER CO. OF COCHABAMBA.—Subscriptions are being invited for an issue of £300,000 six per cent. bonds of this company, which is incorporated under the laws of Bolivia.

NORTH-WESTERN ELECTRICITY AND POWER GAS CO.—A petition for the winding up of this company will be heard on June 29th at the Court House, Manchester.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 10s. to £58 per ton (last week, £58 to £58 10s.).

SUNBEAM LAMP CO., LTD.—This company has taken premises at 58 Berners Street, which will be in future their London stores department. Communications are to be addressed as before to 102 Charing Cross Road, but supplies will be made from the stores at 58 Berners Street (Tel., Central 2855).

COMPANIES' MEETINGS AND REPORTS

TORQUAY TRAMWAYS CONSTRUCTION SYNDICATE.—At the annual meeting recently it was stated that an issue of prior lien debentures would have to be made to carry out the extension to Paignton. The profit on the year's working was £2,427, which has been carried forward. The traffic receipts increased by £490, but owing to the heavy cost of working the surface-contact system, there was a decrease in the profit. In consequence of the refusal of the Board of Trade to sanction a continuation of the surface-contact system, negotiations are being carried on with the Corporation for installing the overhead system, and there seemed to be every reason to assume that this course would be adopted.

ARON ELECTRICITY METER.—The directors recommend the payment of a further 9 per cent. on the preference shares, representing 3 per cent., the remainder of arrears, and the full 6 per cent. dividend for the past financial year, amounting altogether to £11,240, and a transfer to reserve towards goodwill and patents of £6,000 (making this reserve £25,000), leaving a balance of £6,679. Out of this amount it is proposed to appropriate £1,326 to pay off the arrears of management commission and directors' fees, held in suspense pending the payment of arrears of preference dividend, and to carry forward to next year's account the balance of £5,353.

BRITISH ELECTRIC TRACTION CO.—At the ordinary general meeting last Friday, Sir Charles Rivers Wilson said that the net profit was only a little better than in the preceding year, but that there were indications of future improvement. The dividend paid on the preference shares was small, but strengthened the financial position of the company in various ways. The general reserve fund now amounted to £633,000, including the addition of £41,780 made during the year. Special reserves and sums written off also amounted to £13,000. The portion of their investments which did not yield any return was £342,000 less than in the previous year. It was as yet impossible to trace how much of the improvement in receipts was due to the introduction of the "fair fare" system. He spoke hopefully of the prospects of the Metropolitan Electric Tramways, but said that the Birmingham and Midland group had suffered severely from the system having been cut up into sections owing to local authorities deciding to municipalise. The City of Birmingham Company, however, was a good example of what could be done in large cities. The Bombay tramways and supply business promised to become one of their best undertakings. Business in the Yorkshire and Potteries districts had been very depressed, but they were receiving a small return for their shares in these companies. The report and accounts (see ELECTRICAL ENGINEERING, June 16th, p. 402) were adopted.

MARCONI WIRELESS TELEGRAPH CO.—According to the report for 1909, the profit for the year, notwithstanding the effects of the destruction of the Glace Bay station by fire, was £11,432. Arrangements were being made whereby the £144,279 owing by the Canadian Company would be repaid at an early date. The French and Belgian companies had declared dividends of 5 and 10 per cent. respectively. A dividend is recommended on the 7 per cent. cumulative preference shares up to June 30th, 1909. It is stated that the Transatlantic service is being conducted regularly.

Wireless Telegraphy.—According to the *Times*, the New York police have arrested Mr. C. Wilson and Mr. S. Bogart, president and vice-president of the United Wireless Telegraph Co. of New York, on a charge of fraud. The company ostensibly sought to combine all the wireless telegraph concerns, including the De Forest and Marconi, and professed to have secured a controlling interest in all the concerns. This is now declared to be untrue. It was also stated that the assets included patent rights worth over £1,100,000, whereas their actual value is said to be under £4,200. The shares sold are believed to have brought in several millions of dollars.—As already stated in ELECTRICAL ENGINEERING, the Marconi Co. have already commenced proceedings against this company for infringing the British Marconi patents.

Parliamentary.—The London Electric Supply Bill, which provides for the purchase by the London County Council of the five electric supply companies in the West-end of London, was read a second time in the House of Commons on Thursday.

The Yorkshire Electric Power Bill, which gives the company authority to raise new capital and to finance firms taking electric power from the company, was before the Unopposed Committee of the House of Commons last Thursday. As in the case of the Newcastle-upon-Tyne Electric Supply Bill last year, the Committee objected to the principle of this application, holding the view that it practically turned the company into a money-lending concern. The clause in question was modified, limiting the company to lend money only in respect of electrical undertakings authorised by Parliament.

The London County Council Tramways Bill is still under consideration by a Committee of the House of Commons, the various lines proposed by the Bill being considered in considerable detail.

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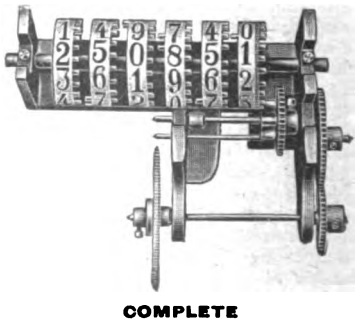
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ELECTRICAL ENGINEERING

No. 183 [Vol. VI., No. 26] THURSDAY, JUNE 30, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

A proposal by the London County Council to delete the word "black" from the clause dealing with smoke nuisance in the Public Health Act has been rejected in the House of Commons. The North and South Shields Tube Railway Bill has been withdrawn. The London United Tramways Co. are to be allowed to use the overhead system on Kew Bridge. (Page 426.)

Captain Scott's South Pole Expedition will have the advantage this year of carrying telephones, enabling conversation to be carried on between the main party and the exploring party up to a distance of 26 miles. Aluminium wire will be employed for the line, laid on the ice or snow without other insulators. A description of the equipment appears on page 427.

Sir John Gavey, C.B., delivered the "James Forrest" Lecture at the Institution of Civil Engineers last week, and dealt in an interesting manner with the progress of telegraphy and telephony. (Page 427.)

A short article describes the principal features of the thermo-electric recording and other pyrometers of Messrs. Siemens Bros. & Co. (Page 428.)

Among the features of electrical engineering interest at the Brussels Exhibition are some generators of large size, including a 10,000-kw. Bergmann turbo-alternator. German electric plant is better represented than that of any other nation, but there are, as might be expected, some fine exhibits of Belgian plant. The electrical industries of the Netherlands and Switzerland take their place, but the French exhibits have suffered by extreme backwardness in their erection. The British Section contains little heavy plant of a purely electrical nature, but there is a fine display of electrical instruments and smaller appliances. British gas engines are well represented, however, and British-made air-compressors, coal-cutters, electric lifts, railway signalling gear, and clocks are shown, and there are some interesting exhibits of boiler-house plant. (Page 429.)

A new alternating-current instrument, designed by Dr. W. E. Sumpner, was described in a Paper recently read before the Physical Society. (Page 432.)

A novel electrical machine has been introduced. It consists of a worm-wheel meshing magnetically with a worm wound like an ordinary armature. Running the worm as a motor provides a means of obtaining a low-speed drive without mechanical gear or a slow-speed motor, while the worm can be run as a high-speed dynamo by coupling the worm-wheel to any slow-speed engine. (Page 432.)

The following are reviewed in this issue: "Walker's Loose-Leaf Pocket-Book for Engineers," with tables, &c., by Norman R. Corke; Spon's Architects' and Builders' Price Book. (Page 433.)

In a Paper read before the Birmingham Section of the Institution of Electrical Engineers, Mr. H. W.

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Kefford described some experiments on fuses, and put forward some suggestions for a specification of standard fuses. (Page 434.)

THE annual staff dinner of the National Telephone Co. was held on Thursday last. Some interesting statistics of the continued growth of the concern were given, and reference was made to the coming transfer to the Post Office. (Page 435.)

NOTES on some insulating materials appear on page 436.

IN the House of Commons last week, the Post Office Vote, amounting to nearly £20,000,000, was discussed. Mr. Herbert Samuel, the Postmaster-General, referred to the success which has attended the purchase by the Post Office of the wireless telegraph stations around the coast, and also gave some figures indicating the progress of the Post Office telephone undertaking. He holds out no hope of an agreement being come to between the Post Office and the National Telephone Co. as to the price to be paid for the company's undertaking, and the matter will therefore go to arbitration. (Page 436.)

DAMAGES to the extent of £500 have been awarded against the Bury Corporation in respect of a tramway accident.—Some serious charges in respect of the management of the Carlisle electricity undertaking have been proved to be unfounded.—Glasgow ratepayers protest against the tramway profits being applied to relief of rates.—It is proposed to separate the management of the Leicester gas and electricity undertakings.—After a lengthy experiment, a special Committee of the Llandudno Corporation recommend the continuation of electric lighting on the promenade.—Portsmouth Corporation telephone accounts show a profit of £400 for the past year.—The L.C.C. tramway accounts for 1909-10 show a profit, after meeting capital charges, of £192,109. The statutory amount has been placed to renewals and £59,878 to reserve. (Page 437.)

CABLES are required at Tunbridge Wells; a cooling tower at Newport (Mon.); low-tension cables, cable boxes, &c., by the L.C.C.; and boiler, superheater, &c., at Luton. Loans are being applied for as follows: Aldershot, £1,500; Hereford, £3,000; Norwich, £17,783; Battersea, £18,909; and Beckenham, £500. Extensions are contemplated at Barking and Surbiton. (Page 438.)

A NET profit of £64,802 was made by Messrs. J. G. White & Co. last year. At the meeting of the Marconi Wireless Telegraph Co. on Tuesday, important negotiations with the British and a number of foreign governments were referred to. The Bombay Electric Supply Co. have abandoned the maximum demand system of charging. (Page 440.)

AMONG the specifications published by the Patent Office on Thursday last was one by Siemens Bros. & Co. for a method of strengthening the lead covering of cables for house-wiring by embedding wires or metal strips in the lead.—A petrol-electric combination, in which the dynamo is coupled to the engine and one driving wheel through a differential gear, while the motor is coupled to the other driving wheel, is covered by the Felten & Guilleaume-Lahmeyer-Werke A.G.—C. J. Beaver and E. A. Claremont have patented a special form of funnel for filling joint-boxes with compound.—Opposition has been entered to the grant of a patent to R. Hopfelt for a process of removing hydrocarbons from metal filaments.—The Glühlampenwerk Anker Ges. has appealed against the decision of the Comptroller to refuse their patent for the use of phospham compounds in metal filament lamps. (Page 442.)

PARLIAMENTARY INTELLIGENCE

LONDON UNITED TRAMWAYS.—A Select Committee of the House of Lords last week passed the London United Tramways Bill, which sought an extension of time for the conversion to electric traction of the line from Kew Bridge to Richmond. When powers were granted in 1908 to the construction of the line over Kew Bridge, it was agreed that the overhead system should not be adopted, but a clause is now inserted in the Bill under which the overhead system may be adopted, with the consent of the Richmond Council.

CAVEHILL TRAMWAYS.—The Belfast Corporation Bill, which provides for the purchase of the Cavehill and Whitewell Tramways Co.'s undertaking upon arbitration terms, was passed by the Unopposed Committee in the House of Commons last week.

NORTH AND SOUTH SHIELDS ELECTRIC RAILWAY.—The Bill authorising the construction of an electric tube railway under the River Tyne between North and South Shields has been withdrawn. The promotors have found considerable difficulty in coming to terms with the South Shields Corporation on the question of the acquisition of certain land, and also with regard to a money deposit.

ELECTRIC LIGHTING PROVISIONAL ORDERS.—Electric Lighting Provisional Order Confirmation Bill No. 3 was read a third time in the House of Commons on Friday. The following are the Provisional Order Confirmation Bills promoted by the Board of Trade this session:—

No. 1.—Chesham (extension), Church, Clevedon, Dawlish (amendment), Derby (extension), Gorseinon, Huddersfield (extension to South Crosland), Ormskirk (amendment), Runcorn Urban and Runcorn Rural, Runcorn (Weston), Smethwick (amendment), Widnes (amendment).

No. 2.—Ardrossan Saltcoats and District, Cambuslang (extension), Cowdenbeath, Lochgelly and District, Skelmorlie.

No. 3.—Navan, Swinford.

No. 4.—Bath (extension).

PROGRESS OF ELECTRICAL BILLS.—The Dunfermline & District Tramways (Extension) Order Confirmation Bill was read a second time in the House of Commons on Friday.

Rhondda Urban District (Tramways & Extensions) Bill was read a first time in the House of Lords on Thursday.

Middlesbrough Corporation Bill has been read a first time in the House of Lords.

Leeds Corporation Bill was read a third time and passed in the House of Lords on Monday.

The North-East London Railway Bill was read a second time in the House of Lords on Tuesday.

WIMBLEDON & SUTTON ELECTRIC RAILWAY.—This Bill, which proposes the construction of an electric railway, starting from the District Railway's terminus at Wimbledon, running to Sutton, came before a House of Commons Committee on Tuesday. The capital powers taken in the Bill are £350,000, and the estimated cost of construction is £311,554. The Bill is still under consideration.

THE "BLACK" SMOKE NUISANCE.—The London County Council (General Powers) Bill has been under consideration by the Local Legislation Committee in the House of Commons during the past ten days. One section of the Bill related to the "black" smoke nuisance, and proposed the deletion of the word "black" from the sections of the Public Health Act, 1891, which deal with this matter. The proposal met with the strongest opposition from the Electric Lighting Companies of London, the Gas Companies, and the Government Departments, the views expressed being that it was unfair to place such restrictions upon statutory undertakings which had spent thousands of pounds upon the most up-to-date smoke prevention apparatus available. For the Electric Supply Companies, it was also urged that they were doing a good service in reducing the smoke problem generally by encouraging the use of electric driving. Evidence was also brought showing that by far the greater nuisance from smoke was from domestic chimneys. On Tuesday, after the London County Council had agreed to withdraw a number of sections of the clauses dealing with this matter, the Chairman of the Committee announced that no evidence had been put before them which would justify the omission of the word "black" from the Act of 1891.

Telegraph Traffic.—There has only been one day last week when interruptions of submarine cables have taken place. The cable between Bonny and Duala failed on Friday, and also that between Obok and Djibouti.

Wireless Telegraph Notes.—The War Office are in negotiation for the purchase of 300 sets of wireless telegraph apparatus from the Marconi Co. The particular apparatus ordered is a very portable arrangement introduced by Major Beddington, which is capable of being easily transported.

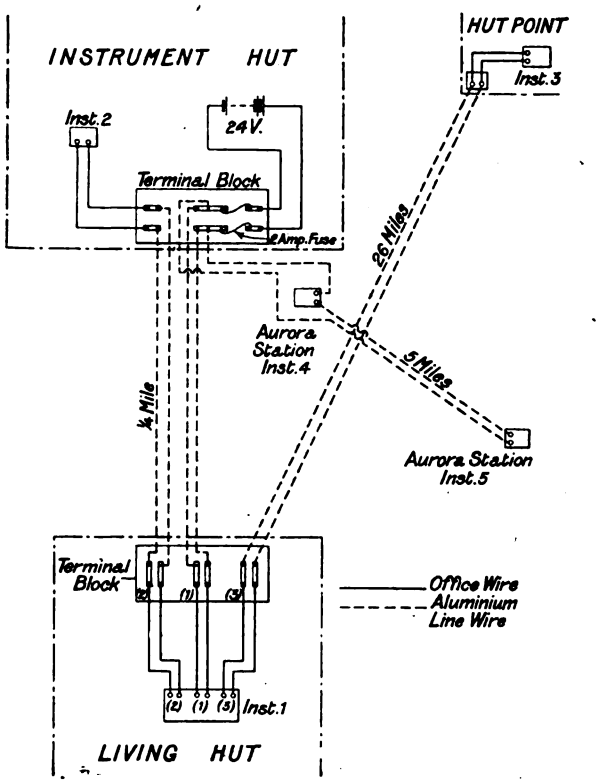
The Daily Telegraph Copenhagen correspondent states that Captain Howland, of the Norwegian Navy, has been granted permission to visit London to demonstrate an improved wireless telegraph apparatus which he has invented.

A site has been selected for the new Admiralty wireless telegraph station at Scarborough, and the construction of it will be commenced shortly.

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TELEPHONES FOR THE ANTARCTIC EXPEDITION

AMONG the new arrangements that have been made in connection with Captain Scott's Expedition to the South Pole, one which will materially improve his chances of success is the provision of a telephone equipment to enable the exploring party to keep in touch with the ship up to a distance of twenty-six miles. The telephones for this purpose have been



presented to Captain Scott by the staff of the National Telephone Co., and, through the courtesy of Mr. F. Gill, the company's engineer-in-chief, we are able to give a description of the equipment.

The instrument employed is a standard hand set with black celluloid mouthpiece and ebonite earpiece. As it is uncertain whether the extreme cold, continued for a long period, may not affect celluloid and ebonite, which are more or less unstable mixtures, a spare metal mouthpiece and two spare wooden earpieces have been supplied for each instrument. The circuits are of the simplest possible description. The minimum temperature recorded by Lieutenant Shackleton was −70° F., and at this low temperature it is highly problematical whether the ordinary dry cells would work satisfactorily. A single 24-volt storage battery will therefore be used at one end of the line, and will be placed in either the Living or Instrument Hut, and the microphones and receivers at the two ends of the lines will all be connected simply in series. Before deciding to employ a direct-working instrument and to dispense with the usual induction coil, a series of experiments were made through resistances equivalent to those of the longest line which will be used, and it was found that this connection gave as good results as any other for the particular purpose, and it has, of course, the particular advantage of simplifying the apparatus considerably. No switch hook is employed, but there is a handle key in the hand set. A magneto bell is used connected permanently across the line through the condenser, and there is a magneto at each station which only comes into connection across the line, in the usual way, when the handle is turned.

The diagram above shows the five lines on which telephones are to be used. There are two instruments five miles apart to enable simultaneous observations to be made of the aurora. These have to be left in the open, and are fitted in strong wooden cases, and it was decided to make all the instruments in similar wooden cases, so that they could be shipped without any packing-case being required. Three other instruments will connect the instrument hut, the living hut, and "hut point," the last-mentioned being where Shackleton built the hut on the exploration route between the ship and the Pole, twenty-six miles distant from the ship.

The fifty-two miles of wire which it is necessary for the exploring party to carry to reach this point will be of hard-drawn aluminium wire of No. 19 S.W.G., which was procured from the British Aluminium Co. The wire is made up in six reels, each containing 100 lb. weight of wire, which has been drawn in lengths weighing about 25 lb. each, and four of these are jointed together with aluminium McIntyre sleeves for each drum. It is interesting to note that, owing to the low temperature, both the tensile strength of the wire and the conductivity will be enormously increased. The drums have wooden barrels 6 in. in diameter and sheet-iron flanges 16 in. in diameter, the width between the flanges being 10 in., and the weight of each drum empty is about 13 lb. A hundred aluminium McIntyre sleeves for jointing have been sent with the apparatus, a couple of jointing clamps, and also a large number of spare instrument parts.

No insulators are necessary, as the ice and snow are non-conductors, and the two wires will simply be laid on the ice a certain distance apart—probably about 6 ft. Detailed instructions how to use these instruments have been sent with them and a sample joint.

PROGRESS IN TELEGRAPHY AND TELEPHONY

AT the Institution of Civil Engineers, on Wednesday last week, Sir John Gavey, C.B., delivered this year's "James Forrest" Lecture, for which the above subject had been selected.

For many years, said Mr. Gavey, the simple Morse apparatus or its equivalents served the requirements of most countries, but as the telegraph traffic grew, means were designed for the transmission of several messages simultaneously over the same conductor, by the use of suitable devices the actual speed of transmission was raised in overhead wires to ten or twelve times that possible by manual operating, and, thirdly, type printing and writing systems were invented with varying degrees of success.

Dealing historically with the first of these three lines of development, the Lecturer described the duplex and quadruplex systems, for the simultaneous transmission respectively of one or two pairs messages in opposite directions over the same wire; the tuning fork system of multiplex telegraphy which originated in America, and was developed and improved by Mercardier in France (where it is said to have given good results recently); and the Delany multiplex, which was developed to some extent in this country, but owing to various causes has recently been abandoned.

Under the second heading, the Wheatstone automatic or machine-transmitting instrument was described. This system has been very fully developed in the United Kingdom. It is capable of dealing with traffic at a maximum rate of 450 words per minute, and it is invaluable when items of news have to be transmitted to fifty or more towns simultaneously. For ordinary public message traffic, on lines of moderate length, where each individual message is short, it is generally considered preferable, in this country, for circuits of moderate length to provide direct Morse apparatus worked simplex, duplex, or quadruplex as circumstances may dictate. With overhead lines the limit of speed in automatic working is that imposed by the self-induction of the receiving apparatus. This difficulty has been overcome by substituting a chemical for an electro-magnet receiver; the current passes through a paper ribbon saturated with a solution which is decomposed by a positive current, and the Morse signals appear in blue lines on the slip. It is said that with this method a maximum speed of 1,000 to 1,200 words is possible under favourable conditions, but there are difficulties in working at such high speeds, one of which is the division

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and distribution of the slips amongst the large number of writers necessary to keep abreast of the work.

All these methods increase the carrying capacity of the wires—i.e., they reduce the capital expenditure per message—but none increase the output per operator, or diminish the working cost in the instrument-room. Inventors have turned their attention to increasing the speed and reducing the cost of transcription at the received end, in the case of manual as well as automatic sending, by the substitution of typing apparatus worked mechanically or electrically for the manual transcription. Sir John then described the Hughes type-printing instrument, which, although one of the earliest, had met with permanent success. Besides providing a clearly-typed message for delivery, it increases the speed of working as compared with Morse by about 25 per cent., and it can be duplexed. It is used by the Post Office on all its Continental wires. The Baudot system was next dealt with. This admits of the transmission of a much larger number of messages over each wire than the Hughes, and is also more flexible. It is largely used in France, and has been introduced into this country. The Murray type-printing telegraph, in which a punched slip is passed through an automatic transmitter, and the received message is typed in page form, was shown at work, and the system devised by Creed was also described. Both these systems are in use in the British Post Office. The lecturer also dealt briefly with the Siemens and Halske automatic system in which, by means of suitable apparatus, the message is printed by the receiving apparatus direct by photographic methods, the Barclay automatic type-printing apparatus used by the Western Union Telegraph Company in America, the telewriter, and the beautiful writing apparatus designed by Pollak and Virag.

He then passed on to the subject of conductors, and explained that overhead wires are even now the only conductors that serve satisfactorily for really long-distance telephony, having the advantages of low resistance, low electrostatic capacity (from 0·015 to 0·014 microfarad per mile), and relatively great self-induction. Their use admits of attaining the maximum speed in telegraphy; and perhaps the most important limiting factor in this case is the self-induction of the receiving apparatus, which would be a useful factor if distributed over the line, but which tends to act as a choking coil when massed at the extremity. This self-induction in the case of the Wheatstone receiver amounts to as much as one henry, and its effect in prolonging the current, combined with that due to the capacity of the line, is neutralised to some extent by inserting a shunted condenser between the instrument and the earth. Overhead telegraphs are, however, subject to serious interruptions, due to the falling of trees during heavy storms, and to breakdowns arising from a combination of sleety snow and gales of wind. The Post Office has within the last few years laid 138,000 miles of paper-insulated wire underground for telegraph purposes alone; and between 1900 and 1902, as the first step in the development of the London system, the Post Office had laid 240,000 miles of wire underground before a single subscriber had been served. Although at that period 36,000 wires only were led into the building, the spare duct capacity admitted of increasing this number to 125,000 or 150,000 wires as the system grew. The mileage of underground wire laid by the Post Office in Great Britain for telephones is now 521,000 miles.

In submarine telegraphy the high electrostatic capacity, varying from 0·3 to 0·4 microfarad per mile, and the very long lengths that are necessary to connect the great continents of the world, render the use of any but the most delicate apparatus impossible on long cables. The receiving instruments originally invented by the late Lord Kelvin, then Sir William Thomson, are still the only apparatus available for the reception of messages on long cables, and so far it has not been found possible to increase the speed of working materially. Attention has been devoted to eliminating disturbing elements and perfecting the signals by the use of automatic transmission and by the use of curbing devices at the receiving end. The introduction of repeaters at intermediate points where cables land at suitable localities has recently become possible, and it may be that methods of distributed induction referred to later may ultimately be of some value, but this subject, in the lecturer's opinion, "is not ripe for consideration."

In ordinary telegraphy when transmitting through an overhead line the frequency of the current alternations is only 180 per second for 450 words per minute, and the current has actuated the apparatus at the further end before the battery connection has ceased. Another condition is introduced, however, when a conductor is used for telephonic speech in which a maximum frequency of 1,800 to 2,000 vibrations per second has to be dealt with, and the effect of even a moderate capacity becomes far more marked. Sir John then dealt with the "loading" of cables by adding artificially to their self-induction. Attempts have been made to effect this by lapping a copper conductor with thin iron wire or tape of a high magnetic permeability. Another method consists in distributing magnetic coils at uniform distances of a mile or two apart throughout the length of the line. Under these conditions the distance over which speech is possible has been increased from two-and-a-half to three-and-a-half times. The British Post Office has recently laid a cable with distributed inductance between England and France (see ELECTRICAL ENGINEERING, March 17th, page 179), which will increase the range of speech about four times as compared with similar type of unloaded cable.

To illustrate the magnitude of the problem to be dealt with in a telephone exchange, Sir John mentioned that the number of telephone subscribers in a large city runs into five or frequently six figures, when the area covered, like that in London, amounts to 640 square miles, which has to be served by 60 to 100 separate exchanges, between all of which intercommunication must be provided, with the minimum amount of delay. The interurban communications between all the principal cities in the country has also to be dealt with, and when the fact is appreciated that the major part of the business of the 24 hours is concentrated in about 2½ hours in the morning, and a similar period in the afternoon, the difficulties to be solved become apparent, even to the uninitiated. The gradual development of the modern telephone exchange was next traced: first the marked advance which was made by the introduction of the multiple switchboard, then the self-restoring indicator, and finally the common battery system, with glow-lamps as indicators. The working of the automatic telephone exchange was also illustrated.

The following figures were then quoted to show the development of telegraphy and telephony throughout the world between 1902 and 1907:—

Telegraph and Telephone Statistics—Wire Mileage.

	1902.	1907.	Increase.
Telegraphs.			
Land wires	3,659,659	5,038,981	1,379,322
Submarine cables ...	212,894	259,000	46,106 = 21·6 %
Telephones.			
Wire.....	7,467,417	19,839,537	12,372,120
Subscribers' stations.	3,534,036	8,406,336	4,873,330

Large figures frequently fail to impress the mind, but when it is stated that this mileage of wire will soon, if it has not by this time, equalled one-third the distance from the earth to the sun, the remarkable activity of the modern telegraph and telephone service will perhaps be more forcibly realised.

In America the associated Bell companies only possessed 300,000 telephones in 1896. In 1905 this number had risen to 2,000,000, and in 1907 to 3,000,000, whilst at the beginning of the present year the corresponding figure was 5,100,000.

The lecture, which was illustrated by a large number of extremely interesting lantern slides, terminated with a reference to wireless telegraphy and telephony, the progress of which was very briefly sketched from the early Post Office systems to Rathlin Island and from the Skerries to Holyhead, down to the present day. Sir John gave the distance to which it has been found possible to transmit actual speech as 30 or 40 miles, whilst the limit of telegraphy he placed at "perhaps 5,000 miles."

ELECTRICAL PYROMETERS

A QUANTITY of interesting information regarding the industrial applications of electric pyrometry in its various forms is contained in a pamphlet which we have received from Messrs. Siemens Brothers and Co. It is pointed out how the need for specially skilled and experienced furnace attendants can often be dispensed with by the use of electrical pyrometers and other advantages obtained by the substitution of exact measurement for personal judgment. The Siemens thermo-electric pyrometers of the highest class employ platinum and platinum rhodium couples, and these give results accurate to 5° C. up to 1,000° C. The cheaper platinum and platinum iridium couples can also be used up to this temperature, but are not quite as accurate. Up to 600° C. silver-constantan is used with a maximum error of 1° C. and a similar degree of accuracy can be obtained from −190° to 500° C., with copper-constantan couples. Various forms of protecting tube are used. For the highest temperatures, double Marquardt tubes are used, owing to being impermeable to gases and vapours, but for temperatures below 1,000° C., double quartz tubes are recommended, as they are better able to stand the effects of sudden changes of temperature. For temperature measurements of baths of molten metal and metallic salts, double iron tubes with plated inner tubes are used. A large number of patterns are standardised, some with wooden heads, and some with water-cooled iron heads. The indicating instrument employed consists of direct-reading moving-coil galvanometers similar to the ordinary testing-room millivoltmeter with pivoted coils, or a more delicate form with suspended coils. A wall type with horizontal edgewise scale is among the patterns supplied. Each instrument has an adjustment for bringing the needle exactly to zero or to the temperature of the outside terminals of the thermo couple. A special recording instrument is also made in which the needle normally free is pressed down periodically and caused to make a dot on the travelling chart. As many as five couples can be made to give records on one sheet by an automatic switch which causes them to record in turn. Recorders are made both with suspended and pivoted coils, the latter pattern being specially suitable for use in works where a situation entirely free from vibration cannot be found. Recorders can be fitted with minimum and maximum relay contacts for giving an alarm when any desired temperature is attained.

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THE BRUSSELS EXHIBITION

By Our Special Correspondent

ALTHOUGH special efforts are said to have been made to render the Brussels Exhibition complete in time for the official opening on April 23rd, yet it was not until long after this date that the various engineering sections were approaching completion.

Most of the exhibits of engineering interest are contained in the main Machinery Hall, which adjoins the Industrial Halls, and, together with the railway shed, occupies a floor-space of about 40,000 square yards. The remainder of the machinery and apparatus is distributed in the pavilions and sections of the various countries.

The best represented country undoubtedly is Germany, which has united all its industries in one large, well-laid-out building, occupying a site of approximately 33,000 square yards. This pavilion is self-contained, with its own steam plant, producing power for driving the machinery shown, which, together with the internal and external illumination, will take about 2,000 kw. when everything is in full swing. This power is derived from the generating plant put down by the various exhibitors.

The total power required throughout the exhibition for lighting and power, not including the German section, is estimated to reach ultimately 5,000 kw. Of this, about 2,000 kw. will be required for power, and the remainder for lighting. There are two distinct sources of supply to the exhibition—one from the Brussels station at 2×220 volts, and the other from the Ixelles supply at 2×110 volts. Of the 5,000 kw. the Brussels works supply 1,900 kw. from a sub-station situated in the grounds near the main entrance. The Ixelles station supplies 600 kw., which are paralleled with the remaining 3,100 kw. generated by the power plant of the various exhibitors, and distributed from a sub-station situated at the north-east end of the Main Machinery Hall. Steam is obtained from a battery of ten water-tube boilers of De Naeyer make, at a pressure of 162 lbs. per square inch. Four of these boilers supply superheated steam of 600-620° Fahrenheit, the remaining six saturated steam. The total steaming capacity of the battery of boilers is 110,000 lbs. of steam per hour. The monopoly for the supply of current, wiring, and hiring out of motors, rests with the Société Anonyme "La Mutuelle des Electriciens Belges," whose charges for current are:—50 centimes (5d.) per kilowatt-hour for lighting; 30 centimes (3d.) per kilowatt-hour for power with users of upwards of 70 hours per week. The grounds are lighted by upwards of 700 Körting arc lamps, and a great number of metal filament lamps.

Continental Exhibits.

The general impression one carries away from the exhibition is that the last years have not been very prolific in new electrical inventions or applications, and that manufacturers have devoted their time mostly to the perfecting of existing types. In this respect the exhibition is decidedly disappointing to the electrical engineer. Judging by the large number of slow-speed horizontal reciprocating steam engines, mostly of Belgian make, it looks as if the steam turbine has as yet not been entirely successful in ousting its rival. The following list shows the largest and most noteworthy steam turbines and slow-speed horizontal reciprocating engines on exhibition.

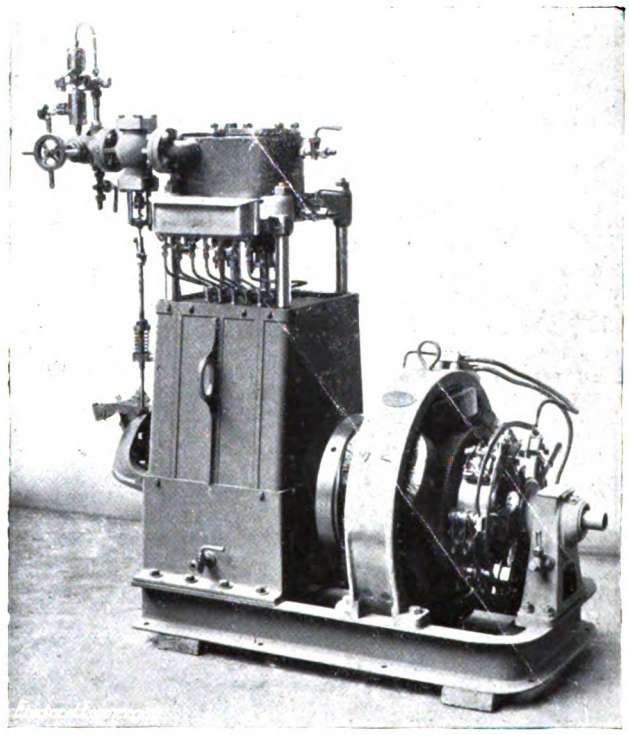
Steam turbo-generators: Bergmann, three-phase turbo-set, 10,000 h.p. and 2,200 h.p.; Brown Boveri-Parsons, three-phase, 1,500 h.p.; Franco Tosi-Parsons, 5,000 h.p., and Stork-Zoelly, 1,500 h.p.

Slow-speed horizontal reciprocating sets: Société Anonyme La Meuse, 1,500 h.p.; Ateliers Van den Kerckhove, 750 h.p.; Ateliers du Thirian, 650 h.p.; Soc. An. H. Bollinckx, 600 h.p.; Soc. An. Zimmermann-Hanrez, 550 h.p.; Carels Frères, 600 h.p.

All these engines are direct coupled to continuous current or three-phase generators. Large gas engines are conspicuous by their absence, which is rather striking in view of the large demand existing for this type of engine. Another significant fact is the scarcity of large slow-speed alternators to which we had grown so accustomed when visiting Continental exhibitions. There are only two of the large slow-speed alternators at the Brussels Exhibition, of which one is a 2,500 h.p. three-phase generator forming part of the exhibit of the Compagnie Générale Electrique of Nancy, France, and a 1,000-h.p. three-phase alternator exhibited by the Electrotechnische Industrie of Slikkerveer, Holland.

In the German engine section the aggregate amount of power plant installed reaches the large figure of 21,000 h.p.; this includes the 10,000 h.p. turbine exhibited by Messrs. Bergmann & Co., Ltd. This firm further has a 2,200 h.p. three-phase turbo-generator set, complete with condensing plant at work and a large variety of their well-known manufactures. They have also in the railway shed a new type of motor coach with electric transmission. The carriage is self-contained, as the energy for supplying the two 50 h.p. driving motors which are mounted direct on the axles is generated by a continuous-current generator driven by a Deutz petrol motor fixed at one end under the conductor's platform. The car can seat eight second-class and twenty-eight third-class passengers, and further provides standing room for ten more, bringing the carrying capacity up to forty-six passengers. The carriage is built for a maximum speed of 50 kilometres per hour.

Other exhibitors of note are the Maschinenfabrik Heinrich Lanz, of Mannheim, with a 1,000 h.p. superheated steam locomobile with direct coupled A.E.G. continuous-current generator, which is claimed to be the largest unit of this class ever made; the Maschinenfabrik R. Wolf, of Magdeburg, with a 600 h.p. superheated steam locomobile driving by belts two Deutsche Electrizitätswerke continuous-current generators. Conspicuous amongst the Belgian electrical firms is the stand of the Ateliers de Construction Electrique of Charleroi. A complete main shaft winding plant with Ilgner motor-generator set and auxiliary apparatus is exhibited by this firm. The winder proper is of the reel drum type, which continues to find favour in Belgium to the exclusion of other types. The drum is direct connected to the winding motor, which latter is separately excited and provided with compensating poles. The motor is capable of developing 1,800 h.p. during the acceleration period, and makes 55 revs. per minute when winding at full speed. The speed range of the flywheel set is 428/500 revs. per minute, and the weight of the flywheel 25 tons. The drum and motor have only two bearings between them, the armature of the motor being overhung. This arrangement has been adopted mainly in view of the ever-present danger of subsidence at the pit top.



12-KW. SHIP LIGHTING SET.
(Electrotechnische Industrie, Holland.)

The high-tension switchboard on their stand presents no novel features, with the exception of the thoroughness of the provision for earthing all non-current carrying parts. The incoming feeder is provided with an earth switch which puts the feeder to earth and is closed each time the board is under repair or inspection.

Switzerland is represented by Messrs. Brown-Boveri & Co., Ltd., whose stand, besides the 1,500 h.p. three-phase turbo set already mentioned, includes a 400-kw. continuous-current turbo-generator set. In order to ventilate the commutator, several small slots of about $\frac{1}{8}$ in. width by about 1 in. long have been provided in the segments. The brush gear is of their newest piston type, which, acting on the centre of the brush, ensures even distribution of pressure and wear. To demonstrate the working of their Aichele train lighting apparatus, a complete installation has been fitted up, including a pair of wheels and axle which will be driven round at greatly varying speeds by

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a single-phase Deri motor to imitate as near as possible conditions actually obtaining in practice. The Deri motor is specially suitable for these demonstrations, as its speed is varied by simply shifting the brushes on the commutator.

This is the first time in the history of the Netherlands that the Dutch engineering industry has participated to any great extent in an international exhibition. First, we must mention the Electrotechnische Industrie, whose stand is one of the most comprehensive in the whole exhibition. To show the range of their manufactures, this firm is exhibiting a three-phase generator of 1,000 h.p., 125 revs. per min. by the side of a 1,000-h.p., three-phase turbo-generator running at 3,000 revs. per min. Not the least noteworthy is their marine type of lighting set supplied to the Dutch navy, illustrated on the previous page. A feature of this set is its extreme lightness, weighing only three-quarters of a ton, for an output of 12·1 kw. when running at a speed of 600 revs. per min. In order to attain this lightness, the set is fitted with hollow shaft and hollow spider, which latter is directly bolted on to the flywheel of the engine, thereby obviating coupling or third bearing. The bedplate consists of a steel joist of I section.

Messrs. Stork Brothers, of Hengelo (Holland), exhibit the 1,500-h.p. Zoelly turbine already mentioned. Another speciality of this firm which is of interest to the electrical trade is their so-called "continuous flow" steam engine, which they manufacture under the Stumpf patents. For this engine, a very low steam consumption is claimed, the figure of 9·5 lb. of steam per 1 h.p. hour having been obtained with a 300-h.p. engine working with superheated steam at 650-660° F. and a pressure of 132 lb. per sq. in. This type of engine has only one cylinder of special construction, and is a departure from the ordinary design, inasmuch as the exhaust valves are eliminated and replaced by a series of grooves situated radially in the centre of the cylinder. The engine occupies little floor space, and is fitted with an eccentric regulator which reacts on the admission valves, and can be operated by a handle, thus affording an easy means of varying the speed of the engine for paralleling purposes.

A very effective display of metal filament lamps is made by Messrs. Philips & Co., Ltd., of Eindhoven (Holland), whose stand is in the Dutch pavilion. This firm, to demonstrate the immunity of their lamps against shock, have mounted four lamps on a rocking bar arrangement, which is submitted to violent shocks. An ammeter is also arranged to show the difference in current consumption of tungsten and carbon lamps of similar candle-power.

Amongst the French exhibitors we notice the Compagnie Générale Electrique, of Nancy, with the 2,500 h.p. slow-speed revolving field type alternator mentioned above, the Compagnie Gramme with some specially designed single-phase and three-phase commutator lift motors, and a compact direct-coupled gas engine set consisting of a 4-cylinder "Moteur Tabor," fitted with compressed air starting gear and driving a 48-kw., 120-volt, 500 revs. per min. dynamo.

The Verreries de Tolembray (Aisne) have exhibited a great variety of green glass insulators, from the ordinary reel insulator to the 18-in. high triple petticoated extra high-tension type. A great many test samples are shown bearing testimony to the great mechanical strength of both glass and cement, as in each case the stalk has succumbed to bending before insulator or cement gave way. In one particular case the insulator had been submitted to a side pull of 970 kgs., leaving the insulator intact, but bending the 1¼ in. stalk.

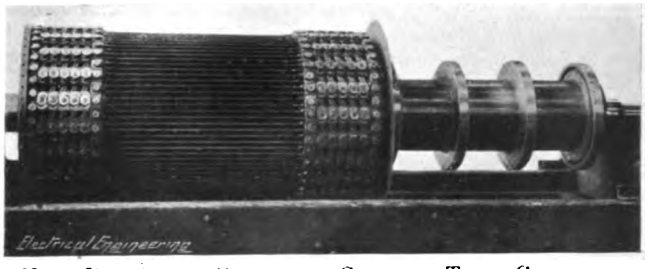
The French electrical section promises to become very interesting; unfortunately it was the most backward in the whole exhibition, and during the earlier weeks of the exhibition the public was actually excluded from it.

Finally, electrical engineers should not fail to pay the Belgian Army section a visit, as a very interesting "Generating Car" for field work is exhibited here. The car is of the auto-mixte type, and is fitted with a 30-h.p. motor, an 8·5-kw. shunt dynamo, and a 40-cell, 60-ampere-hour battery. The trailing car is provided with a searchlight of which the arc absorbs 100 amps. at 55 volts. The whole arrangement is very compact and solid looking. In this same department is exhibited the Bremer patent electric automatic targets, the principle of which is as follows. The target is divided up radially in sections which are fixed on movable levers. When a section is hit, it recedes sufficiently to establish an electrical contact, and the shot is recorded on a scoring apparatus placed near the marksman. The advantages of this type of target are that it is portable, and dispenses with the services of a marker. The various types of targets on view are well worth inspection.

British Exhibits.

The British exhibits of electrical and engineering interest are to be found partly in the main machinery hall already referred to, and partly in the British Industrial Hall, but it cannot be said that in either hall is the British electrical industry well represented, especially as regards its heavier branches.

Among stands of a purely electrical engineering nature, one of the most interesting is that of Messrs. C. A. PARSONS & Co. (Heaton Works, Newcastle-on-Tyne). Their principal exhibit is a portion of a 1,000-kw. 550-volt continuous-current turbo-generator for running at 1,800 r.p.m., of entirely new design. The armature, which is illustrated here, is provided with solid conductors firmly locked into dove-tailed slots in the core, a portion of the conductor being external to the core, and a portion embedded in the core. As a result, particularly satisfactory cooling of the windings and commutation is obtained. A part of the magnet system is also shown, including Messrs. Parsons' patented compensating winding. A working model is



NEW DESIGN OF CONTINUOUS-CURRENT TURBO-GENERATOR ARMATURE.
(Messrs. C. A. Parsons & Co.)

also shown, illustrating the magnetic leakage method of alternator compounding used by the firm (see ELECTRICAL ENGINEERING, Vol. III., page 546).

Another interesting electrical exhibit is that of the MORGAN CRUCIBLE CO., LTD. (Battersea Works, London, S.W.), who have a collection of their special "Morganite" and "Battersea" carbon brushes. Morganite brushes are made of pure graphite by a process not involving raising to a high temperature, which secures great resiliency, and also permits of construction in layers arranged so that the cross resistance is seven or eight times greater than the longitudinal resistance, a feature of the utmost value where commutation conditions are severe. A special brush is also made with a material of high resistance on one side and low resistance on the other. The brushes have a low coefficient of friction, and the method of manufacture renders it possible to embed metal tops and flexibles in the brushes to ensure good electrical connections without solder. A number of grades of these brushes are made, covering an extensive range of conditions. The "Battersea" brushes are of homogeneous carbon, and have flexible connections inserted in drilled holes by being splayed out and held in position by a special metallic powder compressed by a new method. The company also show examples of their carbon turbine gland rings and carbon dust resistances, for lightning arresters and similar purposes, of the type described by Mr. H. Brazil in a recent discussion at the Institution of Electrical Engineers (see ELECTRICAL ENGINEERING, May 14th, page 326).

Turning to electrical instruments, we find a very complete display of Messrs. NALDER BROTHER & Co.'s well-known instruments, both of the switchboard and portable patterns, for the measurement and recording of current pressure, power factor, and periodicity. These include soft iron and moving coil ammeter and voltmeter wattmeter of the dynamometer and Drysdale patterns; the last mentioned of which, for alternating current only, is a moving coil type instrument, with a long, narrow coil of Ayrton Mather form, moving in a field produced by a series winding. Examples of the well-known "Ohmer" electrostatic insulation testing sets are also shown. A novelty is exhibited in the thermal limit switch, which the firm have introduced for use with Messrs. Handcock & Dykes' system of charging. In this instrument, the current is taken through a steel wire, which, if the current exceeds a prearranged value, by means of the heating and expansion of the wire a contact is opened, across which is placed a resistance, which is introduced into the lamp circuit, thereby reducing the current and thus dimming the lights; this reduction of the current allows the steel wire to cool again, with the result that the circuit is closed and the lights return to their normal brilliancy; this goes on until the current is reduced to the limit of value, for which the instrument is set. Another interesting instrument shown is an electrical resistance "telethermometer."

A fine collection of electrical instruments is also shown by R. W. PAUL (33 Leicester Square, W.C.), including the well-known "Unipivot" series of galvanometers and measuring instruments, among which is the new testing set described in ELECTRICAL ENGINEERING, May 19th, page 329. Other instruments shown are electrical thermometers, standard and adjustable resistances, and such special pieces of apparatus as the Duddell-Mather standard wattmeter, the Ayrton-Mather electrostatic, wattmeter, and the Sumpner reflecting electrodynamometer, illustrated on page 432 of this issue.

Messrs. KELVIN and JAMES WHITE have also a fine collection of their well-known instruments on view. Attention may be called particularly to a horizontal scale pattern of the Kelvin astatic wattmeter and the latest type of multicellular electrostatic voltmeter. A new high-tension electrostatic voltmeter has also been brought out under the name of the electrostatic volt balance. This is a compact portable instrument, suitable for cable testing, and can be made to read up to 100,000 volts. There is a complete display of switchboard, recording, and

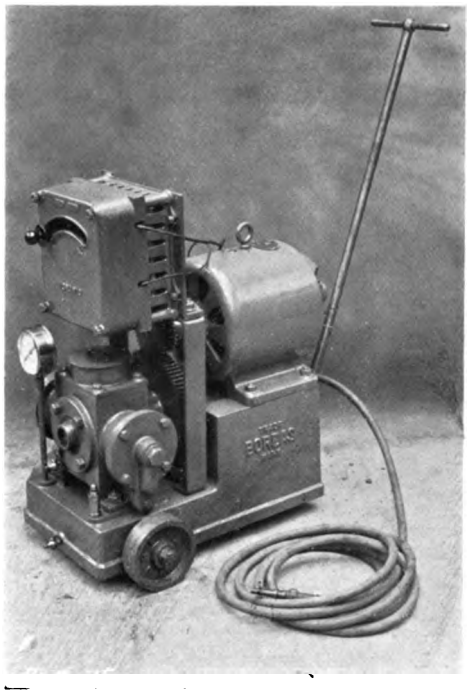
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portable instruments, the latter including a combined ammeter and voltmeter, in which all live connections are covered by a vulcanite plate, so that it is impossible to make a short circuit accidentally by dropping a piece of metal on the top of the instrument. Examples of Lord Kelvin's ships' compasses and sounding machines are also shown.

Attention may be drawn here to a semi-automatic pattern-making machine or universal wood milling machine, which, although exhibited in the German section by Messrs. A. H. Schütte, is a British exhibit in that it was manufactured at the works of Messrs. Kelvin and White, and is sold in this country by the Pattern-Making Machine Co., 16 Cambridge Street, Glasgow.

Among the numerous electrical instruments shown by the CAMBRIDGE SCIENTIFIC INSTRUMENT CO. (Chesterton Road, Cambridge), are several Duddell oscillographs, both of the electro-magnet and permanent magnet types. Among galvanometers shown are instruments of the Broca moving magnet and the Ayrton Mather types, and Duddell thermogalvanometers for wireless telegraph measurements. Mr. Duddell's thermo-ammeter on a similar principle is also shown, and another of his instruments is a moving earth-coil magnetic standard for the calibration of ballistic galvanometers. A new instrument is the so-called "string" electrometer, in which a stretched silvered quartz fibre observed through a microscope is supported in an electrostatic field provided by two oppositely charged invar pillars. Other electrostatic instruments are the Dolezalek quadrant electrometer and the Wilson micro-electroscope. Numerous recording and other pyrometers and thermometers, both of the thermoelectric and resistance types, are shown.

Among examples of appliances constructed especially for electric driving are the air compressors, &c., of Messrs. LACY-



PORTABLE AIR COMPRESSOR.
(Lacy-Hulbert and Co.)

HULBERT & CO., LTD. (91 Victoria Street, S.W.). The largest set shown is a substantial vertical double-acting air compressor, fitted with a heavy flywheel, and belt-driven by a 30 h.p. motor. A number of other types of their well-known air compressors are shown, including the convenient portable electrically-driven air compressor for use in central stations, illustrated here, and a small garage set for tyre inflation. Examples of the Boreas rotary pump are also shown.

Messrs. MAVOR & COULSON, LTD. (47 Broad Street, Mile End, Glasgow) have an interesting exhibit of their coal-cutters, including one of their "Pick-quick" electrically-driven bar machines for shallow seams, only 15¼ inches in height. Some larger machines of the same type are also shown.

Messrs. R. WAYGOOD & CO., LTD. (Falmouth Road, S.E.), have installed a double cage electric lift in the British Industrial Hall, for conveying visitors from the ground floor to the gallery. One cage goes up while the other goes down, and each has accommodation for seven passengers. The travel is 13 ft. 8½ in., and the speed is 110 ft. per minute. A lower speed is also provided for. Control is by a car switch and handle, as used in the London Tube lifts. In addition to this lift, the firm are showing a model of an automatic electric push-button lift, which is a replica of one installed by them at Marlborough House.

In addition to a representative exhibit demonstrating their well-known system of electric clocks on their stand, the SYNCHRONOME CO. (32 and 34 Clerkenwell Road) are equipping the whole of the British Section with a circuit of large dials, giving a complete time service. Three types of controlling pendulum are shown, the domestic three-quarter seconds master clock, the commercial seconds, and the high-grade seconds with "Invar" pendulum. It is one of the latter which operates the dials throughout the British Section. The case and dials are of one sheet of metal enamelled at high temperature, which produces a surface entirely unaffected by any of the bad conditions which are likely to exist in a factory. Another feature of interest in their exhibit is a new type of automatic bell controller for working in conjunction with a system of clocks to ring any number of electric bells at pre-arranged times. The one shown permits of any individual minute throughout sixteen of the twenty-four hours being chosen. By means of a slight addition to this instrument an entirely different set of calls can be arranged for the different days of the week.

Among other British electrical exhibits that may be mentioned are the demonstration of the Great Western Railway Company's audible cab-signalling gear (see ELECTRICAL ENGINEERING, Vol. I., page 431); Messrs. Kelvin & White's display of electrical and other instruments; a complete push-button electric lift by Messrs. Marryat & Place, and some examples of Messrs. Reavell and Co.'s well-known electrically-driven quadruplex air compressors. Messrs. Wellman, Seaver & Head also show some electrical apparatus in their exhibit, relating more particularly to controlling apparatus for the electrical equipment of steel works. Fittings are also shown by Messrs. Faraday & Sons and Messrs. J. Dugdill & Co.

British gas engines of moderate size are well represented; Messrs. CROSSLEY BROTHERS, LTD. (Openshaw, Manchester), have a fine display of their engines, driven from a new type suction gas plant using bituminous fuel. The most interesting engine shown is a 110 b.h.p. vertical four-cylinder engine, running at 250 r.p.m. A 175 b.h.p. single-cylinder engine, running at 170 r.p.m., specially built for export, is also shown. As an example of the small engines for direct-coupled lighting sets, the firm show a 7 kw. set with two vertical cylinders. A 4 b.h.p. vertical single-cylinder petrol engine for direct coupling to a dynamo is also shown. Attention should also be called to the redesigned series of single-cylinder horizontal engines exemplified by a 66 b.h.p. engine. There are also some smaller engines fitted for running on benzine or petrol, as well as a marine type oil engine and a lampless crude oil engine.

Several gas and oil engines are shown by the CAMPBELL GAS ENGINE CO., LTD. (Halifax). These include a vertical four-cylinder 100-B.H.P. engine of the type described in detail in ELECTRICAL ENGINEERING, February 17th, page 107, and designed for direct coupling to a Phœnix alternator. This set is destined for the Bradford Technical College. A horizontal single-cylinder electric lighting type engine, also of 100 B.H.P., and fitted with the firm's latest system of throttle governing, is also shown. Other engines exhibited include a 25-B.H.P. suction gas engine with hit and miss governing, and a 15-B.H.P. crude oil engine. The first three engines mentioned are supplied with gas from a 200-h.p. open hearth gas plant. A compressed-air starting apparatus driven by a small oil engine is also shown.

THE NATIONAL GAS ENGINE CO. (Ashton-under-Lyne) show one of their standard single-cylinder horizontal gas engines, and a complete suction gas plant.

The exhibit of the POWER GAS CORPORATION, LTD. (Stockton-on-Tees) consists of a model of a modern Mond gas plant to deal with 120 tons of coal per day of 24 hours, with sulphate of ammonia and tar recovery apparatus. A working 40-B.H.P. suction plant is also shown connected up to a Humphrey gas pump on an adjoining stand.

Exhibits of interest in connection with boiler plant, to which attention may be drawn, include the automatic stokers of the UNDERFEED STOKER CO. (Coventry House, South Place, E.C.). Ten of the boilers in the main boiler house are fitted with these stokers, and further types are shown on their stand, together with examples of their new air-heater. MESSRS. E. GREEN & SON, LTD. (Wakefield) show on their stand a model of one of their well-known economisers attached to a model water-tube boiler, and they have also supplied the 1,440-tube economiser, which is in use in connection with the boiler plant of the exhibition. MESSRS. C. & J. WEIR, LTD. (Cathcart, Glasgow), are exhibiting several examples of their well-known steam feed pumps, and MESSRS. J. HOPKINSON & CO., LTD. (Britannia Works, Huddersfield) have an effectively arranged stand on which are exhibited a pair of full-sized models of a flued and a water-tube type boiler front, respectively fitted with their well-known boiler mountings. There is also an arch at the front of the stand, built up of Hopkinson valves for all purposes.

It may also be mentioned that a display of their well-known driving chains is shown by Messrs. HANS RENOLD, LTD. (Progress Works, Brook Street, Manchester). This includes three complete drives exemplifying the patent bearing, and the bushed roller, silent chains, and the block chain. Numerous examples of these types of chain are shown, as well as chains for special purposes, including chains for balance weights or machine tools, coal cutter chains, and a complete mortising chain outfit.

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AN ALTERNATING CURRENT GALVANOMETER

A NEW form of vibration galvanometer was described in a Paper by Dr. W. E. Sumpner and Mr. W. C. S. Phillips read recently before the Physical Society.

Tests of effects due to change of current, such as induction phenomena, are often hard to carry out because the ballistic galvanometer available is not sensitive enough. The vibration galvanometer overcomes only a few of these difficulties. It must be adjusted to resonance for the best effects, and its indications vary with current frequency. The instrument described is illustrated here, and is like a moving coil galvanometer in almost every respect, except that its field is due to a specially constructed electromagnet excited by an alternating voltage. This voltage V is applied to a winding of m turns of the electromagnet, and the core flux N is such that

$$V = rA + mN,$$

where r is the resistance of the winding and A the current traversing it. The coil and electromagnet are so designed that for currents of the frequencies used the value of rA is negligible in comparison with V. The rate of change of N will therefore be at each instant a measure of V, whatever the permeability or hysteresis of the core. The instrument has a laminated electro-



THE SUMPNER REFLECTING ELECTRODYNAMOMETER.

magnet formed of stampings of two kinds—a rectangular portion with two straight limbs forming the core of the electromagnet, and a specially shaped stamping between the poles. The moving coil of 50 turns swings in a narrow gap separating the stampings, in much the same way as in a permanent magnet instrument. On the limbs of the magnet are windings of 200, 2,000, and 4,000 turns. The iron will not be too strongly magnetised if the winding used contains 20 turns per volt on 50-cycle circuits, but the instrument is so sensitive that such excitation will only be needed for exceptional tests.

If a voltage V be applied to one of the field coils of m turns, and if the same, or another, field winding of n turns be joined up, through a condenser of K microfarads, to the moving coil, the torque acting on this moving coil will be a measure of

$$Kn\left(\frac{V}{m}\right)^2;$$

i.e., the deflection is proportional to the square of the voltage. The deflection is independent of frequency and wave-form if the field-winding to which the voltage is applied has a resistance negligible in comparison with its impedance. The instrument may be used with great advantage to compare inductances and capacities by the ordinary bridge methods, the working conditions being (i.) the alternating voltage V applied to the field coil of the instrument must also cause the current in the bridge conductors, (ii.) the alternate current in the bridge must be made in phase with the voltage V by the use of suitable non-inductive resistances, (iii.) the moving coil must be placed directly across the bridge.

The balance can be adjusted with ease to 1 part in 10,000 when the voltages set up on the coils or condensers are of the order of 1 volt. When a balance of great precision is needed, the minute electromotive force e induced in the moving coil by the alternating field of the magnet tends to cause a small deflection disturbing the balance. When the moving coil circuit is non-inductive, the current due to e will be in phase with e and in quadrature with the flux, so that the corresponding deflection will be negligible. But in all cases any effect due to e can be accurately eliminated by working to a false zero.

LOW-SPEED ELECTRIC DRIVE WITHOUT MECHANICAL GEARING

A NOVEL form of electrical machine, applicable as a low-speed motor for driving all classes of low-speed machinery, and as a high-speed dynamo for driving by low-speed engines, has been developed by Mr. J. Lecoche, who some time ago introduced a frictionless magnetic worm gear. In the latter arrangement, the worm and wheel run out of contact with a clearance of about $\frac{1}{32}$ in. The worm is provided with a magnetising coil, and a magnetic circuit is arranged through the teeth so that the whole of the power is transmitted by means of the flux passing from worm to wheel. The motor or other source of power is coupled to the worm, and so long as the torque does not exceed the magnetic pull between the teeth, the gear runs synchronously.

In the present device, the driving motor has been combined with the worm, so that the motor flux serves also the purpose of transmitting the torque. This effects a saving in that the additional field for the gear is dispensed with, and, as shown in the accompanying figures, gives a most compact driving gear especially suitable for machine tools, compressors, air pumps, and other low-speed machines. Fig. 1 is a photograph of a 2-h.p. motor drive of this type designed for a machine running at about 175 r.p.m., and Fig. 2 is a diagrammatic sketch of the same gear. It will be seen that the worm is built up of a

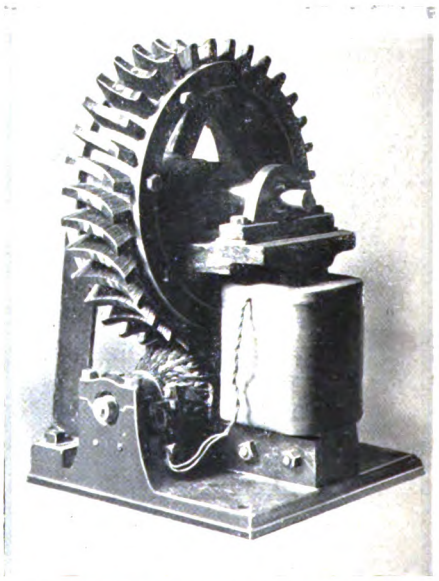


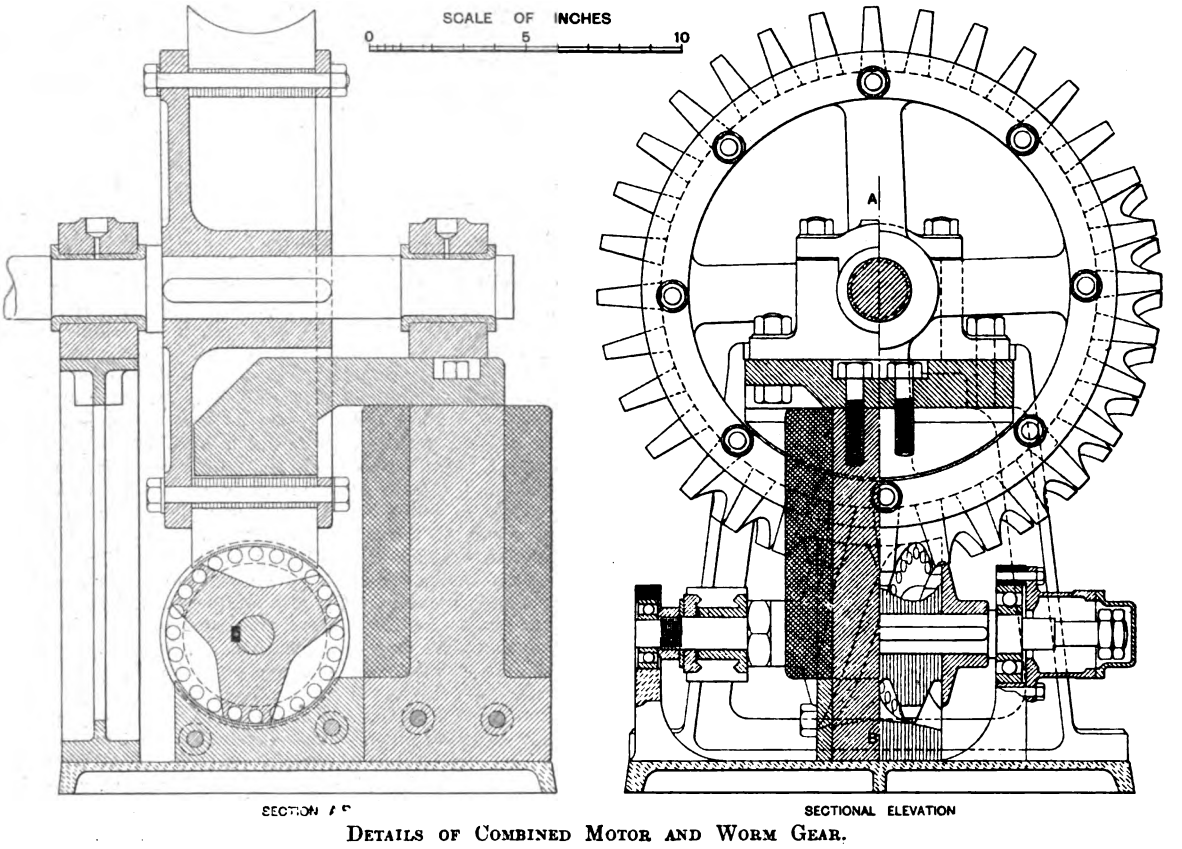
FIG. 1.—VIEW OF COMBINED MOTOR AND GEAR.

number of star-shaped laminations successively displaced so that the projections form the teeth of the worm. Slots are cut parallel to the axle, and the armature thus formed is wound and provided with a commutator. Semi-enclosed slots are used in order to avoid further decreasing the useful armature surface, which consists of the top surface of the teeth of the worm only. The motor illustrated is a two-pole machine with one pole under the armature. The worm-wheel is also built up of laminations displaced so as to give the same pitch, and the second pole of the motor projects over the inner periphery of this wheel. The path of the flux is thus through the rim of the worm-wheel and the armature in series. The gap between the upper pole and the worm-wheel rim need only be very small inded. As shown in the figures, the worm-wheel is cut concave so as to envelop the armature. The magnetic pull on the worm-wheel rim is practically balanced, and the only losses in the gear are the small friction losses in the ball bearings, the losses in the motor, and a very small hysteresis and eddy-current loss in the teeth of the worm-wheel. In the example illustrated, the worm is a 200-volt armature running at 1,850 r.p.m. and the worm-wheel runs at about 175 r.p.m., the ratio being 32 to 3. There is no friction at the teeth, and no wear. The combined gear is claimed to be both more efficient and cheaper than an ordinary high-speed motor coupled to a machine-cut worm gear, and runs noiselessly. It starts up under load, but once the wheels have fallen out of synchronism, the worm-wheel stops, and the motor

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has to be stopped and started up again. If all the load is taken off, however, the worm-wheel can be run up to speed without stopping the motor. It will be seen that the motor cannot be overloaded, as the wheels will drop out of step directly the torque exceeds the magnetic pull between the teeth. The load at which this will occur is determined by the flux-density employed, and can be fixed at any desired figure. Among the various cases of electric drive for which this device would seem to be suitable are those of coal cutters, compressors, and various machine tools where a slow speed and an elastic drive are required. The device might also be used in place of the small motor with worm-gear and overrunning clutch, which is a feature of some systems of printing-press driving.

The combination is reversible, and Mr. Lecoche has designed a dynamo on the same principle for driving by low-speed engines.



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DETAILS OF COMBINED MOTOR AND WORM GEAR.

In this case, the flywheel of the gas or other engine is provided with a laminated iron rim, the teeth of which mesh magnetically with the dynamo armature, the latter being constructed in exactly the same manner as described above in connection with the motor. Though a mechanical worm gear is usually not reversible, the magnetic gear runs equally well in both directions. An interesting feature of a dynamo driven in this manner is that, in the event of a short-circuit, the gear merely drops out of step and shock to the engine is avoided. The 2-h.p. motor described above can be inspected at the offices of MM Lecoche & Cattaneo, 39 Victoria Street, Westminster, London, S.W.

The Zeppelin Airship.—Among the passengers in the first passenger trip from Dusseldorf to Cologne of the new Zeppelin airship *Deutschland* (which was afterwards completely wrecked on Tuesday), was Mr. Sam Mavor, of Messrs. Mavor & Coulson, who was at Dusseldorf attending the International Congress of Mining and Metallurgy.

Conversazione of the Institution of Electrical Engineers.—The annual conversazione of the Institution of Electrical Engineers was held on Tuesday evening at the Natural History Museum, when a large number of members and their friends were received by the President, Prof. Gisbert Kapp, Mrs. Kapp, the President-Elect, Mr. S. Z. de Ferranti, and the Council. The scene was, as usual, brightened by the uniforms of the Corps of Electrical Engineers, and a number of distinguished persons connected with the electrical engineering profession were present. The string band of the Royal Engineers gave a selection of music in the Central Hall, and a vocal entertainment was given in the shell gallery by the Alexandra Ladies' Quartette.

Finsbury Technical College Engineering Society.—The annual dinner will be held on Tuesday next, July 5th, at the Holborn Restaurant.

REVIEWS OF BOOKS

Walker's Engineer's Loose-Leaf Pocket Book, with tables, &c., by N. R. Corke. 50 pp., and blanks. 4¼ × 6½. (London: John Walker & Co., Ltd.) 10s. 6d. net.

THIS is a special form, adapted to the requirements of engineers, of the well-known series of Walker's loose-leaf books, and consists of fifty printed, and a number of plain, ruled and section paper sheets. The printed sheets contain a large number of tables and data which appear to be presented in a very concise form with careful ruling and choice of type to make reference easy. Besides the more general matter, such as metric equivalents, useful constants, logarithm and trigonometric and other tables, a large amount of data peculiar to civil, hydraulic, steam, and other branches of engineering, is included. Data and memorandum sheets not in general use can be filed away, if desired. Fifteen sheets, printed both sides, refer to purely electrical data, including S.W.G. and B. & S. wire tables, British standard cable dimensions, tables of dielectric strength, specific resistance, and other useful constants. It is a pity that the author has chosen, for his formulæ giving sectional area for a given drop, constants which give the result in circular mils, as in almost every other case the tables and formulæ are in British units. New sets of tables can be obtained, as well as refills of blank and used sheets, which can be obtained eyeletted to prevent tearing.

Spons' Architects' and Builders' Pocket Price Book, 1910. 628 pp. 6½ in. by 3¾ in. (London: E. & F. N. Spon.) 3s.

THIS handy little pocket book, which is edited by Mr. Clyde Young, and has been revised by Mr. Stanford M. Brooks, is principally addressed to architects, and is conveniently arranged to provide technical information, quantities, model forms of specification, as well as prices. There is a short electrical section, which has been brought up to date by the insertion of an extra slip with the latest prices and sizes of metal filament lamps. The general notes on supply and lighting are thoroughly practical, and are followed by an example of a detailed specification for an electric light installation with oil engine generating plant at a large country house, which, although based on the use of carbon lamps, will be useful in planning metal filament lamp installations. Extracts from the wiring rules of the Institution of Electrical Engineers are also given.

The Electrical Engineering Laboratory at Oxford.—The Electrical Engineering Laboratory at Oxford University, which has been presented by the Drapers' Company, was opened last week. The cost of the Laboratory has been £23,000.

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FUSES AND THEIR STANDARDISATION

AT a meeting on Wednesday, May 25th, of the Birmingham Section of the Institution of Electrical Engineers, Mr. H. W. Kefford read a Paper in which he described a series of experiments on fuses of commercial types, and considered the question of the standardisation of fuses and the relative merits of various patterns. In dealing first with the relations between the rated and normal fusing currents of a fuse, he gave a typical diagram showing how the curve of time intervals after switching on plotted on a current base was asymptotic to an ordinate representing the limiting current which theoretically would cause the fuse to blow if applied for an infinite period. He suggested, however, that for practical purposes four hours should be taken in defining the limiting current, and put forward the following way of defining the rated current:—

A fuse which is rated at R amperes must fuse within four hours when carrying a times its rated current, but must be capable of carrying $a-\alpha$ times its rated current for at least four hours without fusing. If L amperes is the limiting current, the rated current R amperes must lie between $\frac{L}{a}$ and $\frac{L}{a-\alpha}$.

The values chosen for a and $a-\alpha$ depend on a large number of practical considerations. The wiring rules of the Institution of Electrical Engineers require that no fuse shall carry more than 200 per cent. overload without fusing (*i.e.*, $a=3{\cdot}0$), whereas the rules of another recognised authority in this country restrict the permissible overload to 50 per cent. ($a=1{\cdot}5$). The writer has recently heard of suggested modifications to the overload regulation from two independent sources, one of which was a proposal to permit an overload of 300 per cent. ($a=4$), while the second authority was of the opinion that the permissible overload should be even less than 50 per cent. if manufacturers could work to a narrower limit. The regulations for enclosed fuses by the Underwriters Association in the United States, which have been framed with the co-operation of manufacturers, fix the values of a and $a-\alpha$ at 1·25 and 1·10 respectively, but these figures were only decided upon after manufacturers had endeavoured to work to a smaller value of a than 0·15.

With a view to determining the possible values of a and $a-\alpha$ and the limit between which the ratio of the limiting and rated currents must lie, a number of tests were carried out on a representative collection of fuses in common use, of which full results are given in the Paper. These tests include the investigation of voltage drop and watts lost in fuses, and it is pointed out that, owing to the greater voltage drop on small fuses, it may be desirable to increase the value of a in a range of fuses as the normal working current diminishes.

In the case of fuses of the totally enclosed type, we have also to consider the effects of the increased cooling facilities and capacity for heat of the fuse enclosure. Owing to the large radiating surface, the size of wire for a given limiting current is reduced, and the drop of volts may therefore become large if the length of the fuse is not reduced or a metal adopted which has a low melting-point. If the fuse is very short, on the other hand, conduction and dissipation of heat from the terminals will play an important part and exercise a similar influence in increasing the voltage drop and power loss. In order to reduce these two quantities to economical and safe limits, it becomes necessary to rate the smaller fuses at a lower percentage of the limiting current. Since well-designed fuses of the enclosed type may be made very much shorter than a corresponding open-type fuse for the same voltage, advantage should be taken of this possibility in order still further to reduce the losses; the alternative course of using a low melting-point metal is far inferior, and the larger volume of metal required may prove a source of danger. The value of a recommended for copper fuses is 2·0, and for silver fuses 1·43, and the author considers that these are the only two suitable metals for standardised fuses.

A number of cases of faulty construction revealed by the tests are mentioned. For example, in one case the copper fuse wire remained intact, while it was the soldered connection that gave way on overload. In another series of fuses of the totally enclosed or cartridge type, rated for over 500 volts maximum pressure, a solid single link of soft fusible metal is used, containing a volume of metal nearly fifteen times as great as that contained in another make of cartridge fuse of the same rating. This protective device is completed as an explosive of a most dangerous kind by the provision of a number of vent holes in the metal cap at each end. The behaviour of these fuses on short circuit was of a violent description.

The author favours the use of enclosed cartridge fuses, particularly those in which means for non-interchangeability of sizes is provided. Bare wire fuses are objected to on account of their liability to scatter molten or hot metal, and the rapidity of corrosion unless certain non-active metals are used. On the other hand, with enclosed fuses, the fuse wire is less liable to corrode or become injured, and therefore enclosed fuses lend themselves to more exact calibration. Tampering with the fuse wire is also difficult, and a system of non-interchangeability is greatly facilitated.

If properly designed no molten or hot matter can be thrown about, and good operation can be obtained on heavy overloads at full voltage. Also less metal is required, and the weight and size of the complete fuse fitting is reduced.

The following points are put forward as essential to the satisfactory operation of any fuse whether of the open-wire, tubular, or totally enclosed type: The volume of fusible metal should be reduced to the minimum compatible with correct rating and moderate temperature rise. The fusible metal should be subdivided so that the ratio of exposed surface to cross-section does not fall below a figure depending on the design. The provision of cooling arrangements adequate to extinguish the arc formed on overload. In exposed wire fuses the provision of sufficiently free expansion space to prevent explosion when a short circuit occurs. In enclosed fuses the same end must be attained by precisely opposite means, and no opening or weakness of any kind is permissible in the enclosing case.

It is unfortunate, continues the author, that instead of attacking the problem of an enclosed fuse in an appropriate manner, some designers have considered that the simple enclosure of an open-type fuse would produce the desired end. Provided that subdivision is properly carried out and efficient means of cooling the arc are employed, a small fuse is far safer and more efficient than a much larger or longer fuse containing a considerable volume of metal, all of which may be vaporised on a short circuit. From this same point of view, the use of soft metals such as tin, lead, or zinc is to be deprecated, although with very careful design successful use may be made of the non-arcing property of the last-named metal. The means at disposal for cooling an arc and condensing the vapours are three in number: by mechanical draught, by the surface condensation and cooling action of masses of porcelain, metal, or asbestos, and by the analogous use of an absorptive condenser in the form of filling powder. When the last method is adopted it is important that the fuse wire and filling should be free from any mutual chemical action even when subjected for a long time to alternate heating and cooling. Fillings containing a capsule of liquid, or any hygroscopic or moist substance are bad in principle, and may be the cause of violent explosion or of chemical corrosion of the fuse wire. Tests carried out on a very large number of filling materials lead to the conclusion that the most suitable for use in enclosed fuses are thoroughly dry uniform powders of completely inert substance.

Finally, the author gives the following suggestions as a basis for the discussion of a specification for standard fuses:—

The fuse wire must not corrode or permanently change its conductivity or physical structure. Fuses up to 50 amperes rated current should be provided with a simple arrangement by means of which the capacity of the fuse which can be inserted by a non-technical user is restricted within definite limits. An enclosed cartridge type of fuse is recommended. All fuses must be provided with a simple means for detecting fusion simply by inspection of the fitting.

The rated current marked on the fuse shall bear a definite relation to the limiting current or least current which will produce fusion within four hours. The minimum value of the ratio of the limiting current to the rated current shall be 1·54, and the maximum value shall not be higher than 30 per cent. above the minimum. In a correctly proportioned line of fuses a should decrease from the maximum to the minimum values specified, as the size of the fuse increases from the lowest to the highest capacity. This regulation is based on the assumption that silver is the best metal for fusible links, taking into consideration its permanent character, the small volume required, and its "clean" action when breaking the circuit. Standard fuses shall be so rated and constructed that when loaded with 50 per cent. above the limiting current they will fuse within one minute. The actual time required for fusion shall be taken as a measure of the "time element" of the fuse.

Every fuse shall be clearly marked with its rated current and the maximum voltage for which it is suitable. The standard rated currents and voltage suggested are as follows:—

Maximum Voltage, 250.—2, 4, 6, and 10 amperes.

Maximum Voltage, 500.—2, 4, 6, 10, 15, 20, 30, 40, and 50 amperes.

When loaded continuously with 80 per cent. of the limiting current no exposed part of any fuse fitting shall attain a temperature exceeding 100° C. above that of the atmosphere.

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Fuse fittings shall be tested for insulation between terminals with the fusible portion removed and between the live parts and "earth" with the fusible portion in place. Fuses shall be tested for satisfactory operation on overload and short circuit in accordance with the specified arrangements for carrying out such tests.

At the end of the evening Mr. H. W. Kefford gave an interesting demonstration by the kind permission of Dr. Gisbert Kapp. Three experiments were made. (1) To show there is practically no extra rush of current when switching on a lamp circuit: The circuit of 18-32 c.p. lamps, protected by a Siemens cartridge fuse, was arranged so that each lamp and the whole circuit was under the control of switches. Starting with 14 lamps in circuit, the number was increased by one lamp at a time to 17, and at each step the whole circuit was alternately made and broken two or three times. Then, while the current was on with the 17 lamps in circuit, the 18th was added when the fuse went. (2) To show the necessity of care in choice of a fuse to work in atmospheres containing explosive gases: A small gasometer was filled with a mixture of coal gas and air, in which was arranged on separate circuits an ordinary tubular fuse and a Siemens' cartridge fuse. On blowing the cartridge fuse, no effect was produced, but on the breaking down of the tubular fuse a violent explosion occurred. (3) A 4a and a 6a cartridge fuse were arranged in series, and by suitable adjustment of resistance in circuit the 4a fuse was blown, leaving the 6a, thus demonstrating the possibility of rating fuses with reasonable accuracy.

NATIONAL TELEPHONE CO.'S STAFF DINNER

THE sixteenth annual staff dinner of the National Telephone Co., Ltd., was held on Thursday last at the Trocadero Restaurant, London, Mr. Albert Anns, Secretary to the company, in the chair. There was an attendance of close on 300 members of the staff and their friends, and besides those who spoke there were present Lord Harris, Sir John Gavey, Sir Alexander Kennedy, Major O'Meara, and also Messrs. W. A. Smith, A. M. J. Ogilvie, A. H. Norway, F. Gill, S. J. Goddard, and other prominent members of the staff.

After the loyal toasts had been honoured, the Chairman, Mr. Albert Anns, proposed the toast of the National Telephone Co. He first referred to the unavoidable absence of the Postmaster-General, the Assistant Postmaster-General, and the Secretary to the Post Office, Sir Matthew Nathan, on account of the fact that the Post Office Estimates had been fixed for discussion in the House of Commons that night. With regard to the coming transfer, the rumours of an earlier settlement had come to naught, and both parties were busy preparing for the fight. He estimated that the cost would not run far short of £100,000 before the matter was settled. Though the service was still steadily increasing, the capital expenditure during the past year had been about half what it was two years ago. The revenue was increasing, and the prospects from the shareholders' point of view were very bright. They were not so bright from the staff's point of view, however; the reduction in expenditure had meant that many hundreds of their employees had been obliged to seek employment elsewhere. That competition ended in combination seemed particularly true of the telephone business; only Hull and Portsmouth remained now. The transfer was a very big transaction; over half a million clients bringing in a revenue of between 3½ and 4 million pounds a year would be handed over. These assets would be valued for the purpose of the transfer, but the assets represented by the brains, energy and devotion of the staff would not be. The President and the other members of the Board regretted that they could not give any assurances, but they hoped that matters would have a happy issue. He congratulated the Staff Transfer Association on the work they had done. He understood that one of the most important points at issue was whether the Government would include the number of years spent in the service of the Company when reckoning up the years of service in connection with pensions, &c. He had no doubt that some satisfactory arrangement would be come to.

In responding for the Company, Mr. George Franklin, President of the Board, stated that the transfer would involve considerations of the highest importance and the utmost delicacy. He was sure that the Post Office would be able to count on the loyalty of the staff, and that they would continue to show the same zeal and ability as they had done for the company. It would be a great day for the Post Office when the 18,200 odd servants of the Company were taken over. The Company had not been idle during the past year; 52,153 new stations had been added, bringing the total up to 516,888 stations connected. The number of exchanges now numbered 15,069, fourteen having been added during the year. A total of 13,062 million messages had been dealt with during the year, the average cost per message being 0·51d. We stood well as compared with other countries; we had one telephone for every 77 of the total population; Germany had one for every 71; France had one for every 202; Italy one for every 625. There never was a time when the staff was more efficiently organised, and he would like to express the sincere appreciation of the Board of their work. They intended to keep the plant and business of the concern at concert pitch until the time of transfer eighteen months hence. It would be an anxious time for all concerned, but he was certain that justice would be done alike to staff and shareholders.

Mr. C. B. Clay proposed the toast of the visitors, and referred to the proposed continuation of the dinners of the Company's staff after the transfer. The toast was responded to by Sir Albert K. Rollit in a characteristic speech, and by Sir Robert Hunter. Mr. A. E. Ruddock proposed the toast of the Chairman, and Mr. Anns replied briefly.

AN ELECTRICALLY DRIVEN THIMBLE WORKS

THE old-established Iles Thimble Works, Birmingham, has recently been forced, by the keenness of foreign competition, to realise the possibilities of electric driving. The firm decided to throw out the gas-engine plant, and to equip electrically their whole works. The contract was placed in the hands of the British Westinghouse Electric & Manufacturing Co., Ltd., and as a result, not only have the power costs been considerably reduced, but the great convenience of the electric drive been fully realised.

It is interesting to follow the thimble through the various stages of manufacture. The different metals used are taken from the warehouse to the punching department, where blanks are cut out from the thin sheets. These blanks are then taken to the machine shop, where they are formed roughly into shape by passing them through two sets of dies. This shop is driven by a 7-h.p. Westinghouse shunt-wound motor, running at 830 r.p.m., which operates the lathes, presses, and small grating machines from a shafting running the whole length of the building. The rough thimbles are next taken to the raising department, where they are put into hand-operated presses, and given the correct shape, and from there to the finishing departments, of which there are two, one which is operated by a 4-h.p. Westinghouse shunt-wound motor is used for finishing off steel thimbles, and the other, driven by a similar motor, for aluminium ones. In this department, the thimbles are grated, machined inside and on the edges, and then sent to the annealing department. The next operation is carried out in the dipping shop, where they are cleaned in an acid solution, and then, should they require silvering, they are passed to the silvering vat, before being put into which, however, they are dried in a rotating barrel, containing sawdust. From here they pass to the polishing room, which is operated by a 1½-h.p. Westinghouse motor, and to the inspection and store rooms.

The manufacture of celluloid thimbles is a distinct branch of the business, and is carried out in a separate building. These thimbles are made from solid celluloid rods of about half-inch diameter, which are first cut into lengths of about three-quarters of an inch, and then heated with hot water for a few minutes, from which they are taken and moulded into shape and size in a small press. These rough thimbles are then put into the drying chamber for from 10 to 15 days, and when they are sufficiently hard, taken to the finishing department, where they are machined inside and finished in small lathes. In this department celluloid finger shields are also made in thousands a week. The power necessary for operating this building is small, and a 3-h.p. Westinghouse motor is ample for the work.

This firm manufacture a number of thimbles lined with celluloid, and their most recent patent is for ventilated thimbles. It does not confine itself only to the manufacture of thimbles, but also makes fancy boxes for enclosing them, and cardboard boxes in a special department. Here the guillotine, marking, and cornering machines are driven from a shafting running the length of the building, and operated by a 5-h.p. Westinghouse motor placed on the floor. Beside the motor is its control gear, which is mounted on the wall.

Aeronautics at the Northampton Institute.—The silver medal offered by the Women's Aerial League to the best student in the pioneer courses in aeronautics, held during the session 1909-10, has been awarded to Mr. Duncan George, Mr. E. R. Moffat being *proxime accessit*. Extended courses of a more complete and practical nature are being arranged for next session under Mr. F. Handley Page, and there is under consideration the establishment of full-time day courses in aeronautical engineering extending over four years, and similar to the well-known day courses in electrical and mechanical engineering.

Bogus Tramway Accidents.—A somewhat unusual charge was heard at Bow Street on Tuesday, when a paperhanger named George Weller, was charged with falsely representing that he had sustained personal injuries upon a tramcar belonging to the Metropolitan Electric Tramways, Ltd., and for claiming compensation. It appears that the man was suffering from some injury to his wrist, and had an out-patient's card from the Great Northern Hospital. About a fortnight ago he travelled on top of a tramcar from Stamford Hill to Finsbury Park, and asserted that he had tripped over a damaged slat on the roof and hurt his wrist. He produced the hospital card and wrote to the Company claiming £5 10s. compensation. The date on the card showed signs of having been altered, and as the result of enquiries the prisoner was arrested. The case was remanded.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

ACCUMULATORS.—The latest list of the Chloride Electrical Storage Co. (39 Victoria Street) gives a very good idea of the completeness of the range of styles and sizes of cells supplied by this company, and includes particulars of various accessories, spares, testing apparatus, &c.

DYNAMOS AND MOTORS.—We have received from the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., an attractive and well-arranged list of their standard four-pole motors and dynamos of the open protected, enclosed ventilated, and totally enclosed types, up to about 80 b.h.p. Speed outfits are standardised for 110, 220, 440, and 500 volts, and a complete telegraphic code for ordering is included.

INSTRUMENTS.—We have received from Messrs. Elliott Brothers (Century Works, Lewisham) a collection of leaflets which they have recently issued. These deal with moving coil switchboard instruments of the round and edgewise patterns, current and potential transformers, Mr. Haydn Harrison's well-known portable flicker photometer for street illumination, &c., the Elliott five-dial universal shunt and Wheatstone's bridge, the Robbins station-keeper for naval purposes, the Wimperis accelerometer and gradient measurer, detectors and galvanometers of various patterns, testing keys and switches, distance and speed recorders for ships, and drawing instruments.

STORAGE BATTERY INSTALLATION.—A pamphlet from the D.P. Battery Co., Ltd. (Lumford Mills, Bakewell, Derbyshire), describes a storage battery installation recently put down by the firm at Messrs. Rowntree and Co.'s Works, York, for steadying the voltage of the steam and gas-driven stations and providing a standby supply. The battery is of 112 cells, capable of a discharge of 800 amperes for 1 hour, and is used in conjunction with a fully automatic reversible booster made by Messrs. Crompton and Co.

DYNAMOS AND MOTORS.—A list from the British Thomson-Houston Co., Ltd. (Rugby), gives particulars of the company's latest standard series of dynamos and motors ranging from 27 h.p. to about 125 h.p., which, we understand, have been entirely redesigned. These machines can be fitted with various styles of covers, rendering them flame-proof, dust-proof, and moisture-proof, and they can thus be installed for tool-driving where small chips of metal are liable to drop into the motor, for tool-driving in exposed positions where rain may beat into the motor, for operating paint-mixing machines, pumps, &c., where the motor would be liable to splashes of paint or water, or for driving wood-working machinery, coal hoists, &c., where dust is likely to enter the motor. They can also be supplied fitted with a fan. All the sizes can be obtained with split frames if desired, and commutating poles are used in the case of some of the higher voltages, and outputs and speeds are given for more than a dozen standard voltages. The general design of the machines is on most modern lines; laminated poles are used bolted on to the cast-iron frame. The outputs are based on 40° C. rise after six hours.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

CONCENTRIC WIRING.—Messrs. Siemens Brothers and Co., Ltd. (Caxton House, Westminster), have brought out a new pamphlet on their O.S. system of wiring. This consists of a more or less popular description of this method of wiring, and includes illustrations of actual surface "Stannos" runs, as well as a series of pictures of all sorts of buildings that have been wired with "Stannos." It has been prepared chiefly for architects and prospective consumers, and in this connection should form useful propaganda for electrical contractors, station engineers, and others. An accompanying pamphlet describes some recent installations of concentric "Stannos" wiring at certain Cambridge colleges, where the nature of the architecture and decorations were able to be negotiated inexpensively and neatly by this system of wiring.

SUPPLY ADVERTISING.—We have from the Electricity Supply Publicity Committee of London and District (Moorgate Court, E.C.) a copy of the very effective coloured poster showing a lady using an electric iron, which is to be used to call attention to this particularly attractive domestic use of electric supply which has so often led to other applications of electricity.

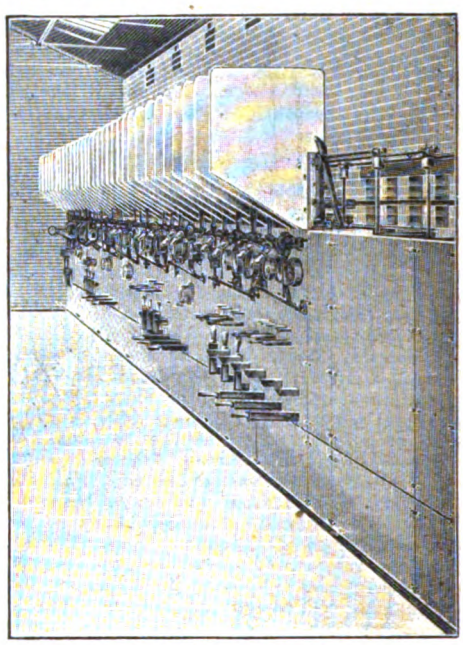
FLEXIBLE COUPLINGS.—A very ingenious spring coupling known as the pillow flexible coupling, which can be insulated or non-insulated is described in a leaflet issued by C. E. Lugard & Co., of Chester.

ACCESSORIES.—A new list of accessories for electric light installations is being issued by Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.) This embraces a considerable variety of tumbler and other switches, combined switches and plugs, ceiling roses, wall and floor sockets, lamp-holders, simple fittings, fuses and distribution boards, and other installation material.

METAL FILAMENT LAMPS.—A revised list from Siemens Brothers Dynamo Works, Ltd., gives the latest reduced prices of the complete range of tantalum lamps now on the market, with sizes of the new series of standard bulbs in which they are now supplied.

INSULATING MATERIALS

THE following particulars of the insulating materials manufactured by the firm of H. Weidmann (Rapperswil, Switzerland) are of interest. A speciality of this firm is a high quality non-hygroscopic press-spahn, the surface of which is treated in a special manner. The results of tests by the Physikalische Reichsanstalt have shown that a sheet of this material 0·25 mm. thick has a breakdown pressure of 3,000 volts A.C. It is supplied in sheets of thicknesses varying between 0·1 and 15 mm., and also in rolls of strip which are convenient where pieces of varying length are required. Several different widths between 15 and 500 mm. can be obtained; the total length of one roll is between 50 and 200 metres according to the thickness. The thicknesses lie between 0·1 and 1·0 mm. in the case of the rolls, which are especially suitable for slot insulation, cables, and for the strip insulation required between long copper bars and under armature binding wires. Special forms of press-spahn, impregnated with oil or paraffin, or with intermediate layers of mica, are also manufactured. The firm informs us that a cheap kind of glazed pasteboard has been introduced under the name of "press-spahn," but that this is far inferior to the genuine press-spahn, for the manufacture of which comparatively costly raw materials are required.



ASBESTOS-CEMENT SEPARATING SHIELDS FOR SWITCHGEAR.

Other specialities of this firm are tubes of press-spahn with or without the addition of asbestos or mica. Transformer-winding cylinders, rings, discs, and various special moulded pieces of the same material are supplied. Articles of mica compositions, micanite, &c., are manufactured at the firm's works, where a large plant, including several special presses, is installed. Cornite is a special material for high-tension switchgear, and withstands temperatures of 300° C. or more. Asbestos-cement and amianite are materials suitable for magnet-coil frames; a switchboard with separating shields of asbestos-cement is illustrated in the accompanying figure. Pyrostat, vitrite, and pierrite are heat-resisting insulating materials, especially prepared for use in the construction of electric ovens and furnaces.

THE POSTMASTER-GENERAL'S ANNUAL STATEMENT

In the House of Commons on Thursday, Mr. Herbert Samuel, the Postmaster-General, made his annual statement on the vote for the sum required for salaries and expenses of the Post Office, telegraphs and telephones. The sum necessary is £19,828,256, and this was compared with £10,000,000 fifteen years ago. Dealing with the Post Office telephone undertaking, Mr. Samuel said that 123 new exchanges have been opened during the past year, and the number of subscribers has increased by 12 per cent. The number of conversations on the trunk lines increased by 15 per cent., and in view of the coming acquisition of the National Telephone Co.'s business, two Departmental Committees were at work, one dealing with the question of telephone plant, and the other with the details of the transfer, especially in relation to taking a general inventory

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of the Company's plant. He had very small hope that the terms of purchase would be arranged otherwise than by arbitration, and it was proposed to introduce a Bill at the beginning of the next session to deal with the necessary finance.

With regard to wireless telegraphy, the purchase of the Marconi Co.'s and Lloyd's stations had been amply justified by the result. An enquiry was now being held as to the distribution of the stations around the coast, and also in relation to installing new ones in such places as Newcastle and other districts, which at present have no wireless telegraph communication. In this way it was hoped to complete a ring of stations around the coast and parts of Ireland, which would undoubtedly be of the greatest service to ship owners.

After several years of declining receipts, the Telegraph Department has begun to show some expansion. The sum of £2,000,000 has been spent in laying underground cables in various parts of the country, to avoid interruptions from storms, and a considerable amount is included in this year's estimates for further extensions of the underground system.

Dealing with the sensational statements which have been published in the daily press as to the effect of telephone exchange work upon the physique of telephone operators, Mr. Samuel characterised the figures which have been quoted as grossly exaggerated, which, on investigation, required to be divided by two or three, and sometimes ten, in order to get the truth. At the same time, it is recognised that the work of a telephone operator does impose some strain upon the nervous system, and his predecessor, Mr. Buxton, had caused an enquiry to be made into the question. The Committee which carried out investigations had reported during the past two days, and he had given instructions for the recommendations of this report to be regarded as a matter of urgency. The Committee recommend certain alterations in the allocation of hours, intervals for meals and rest, and some small improvements in the instruments.

During the lengthy debate which followed the Postmaster-General's statement, apprehension was expressed as to the possibility of increased rates when the National Telephone Co.'s undertaking was acquired. In answer to questions raised the Postmaster-General said he would give no pledge as to municipal powers in relation to telephones. Every effort would be made to acquire the National Telephone Co.'s undertaking on the best conditions for the public, with no payment for good-will.

LOCAL NOTES

ABERDARE: *Tramways.*—The Council propose to promote a Bill in the next session of Parliament for the construction of an electric tramway.

BELFAST: *Tramway Accounts.*—The tramway revenue for the past year amounted to £203,875, and the working expenses to £107,335, or 52·62 per cent. of the gross revenue, as against 55·87 per cent. in the previous year. The net profit was £46,296. The receipts for the year show an increase of £8,831, and work out at 9·65d. per car-mile.

BOURNEMOUTH: *The Conduit System.*—Before actually applying to the Board of Trade for consent to abandon the conduit system in Bournemouth, and substitute the overhead trolley system, the Council has decided to ask Mr. A. L. C. Fell, Chief Officer to the London County Council Tramways, to report upon the matter generally.

BURY: *Damages for Tramway Accident.*—At the Manchester Assizes last week a machine-minder, named Walter Hoyle, sued the Corporation for damages for personal injuries sustained in a tramcar accident. It was stated in evidence that the plaintiff, who is a heavy man, was on the point of boarding a car when it suddenly started and jerked him backwards into the roadway, fracturing his thigh. For the defence it was alleged that the plaintiff slipped on the greasy setts whilst he was still some yards away from the car. Judgment was entered for the plaintiff with £500 damages.

CARDIFF: *Tramwaymen's Wages.*—The motormen and conductors on the tramway system have asked that their wages should be increased to a maximum of 7d. per hour and 6½d. per hour respectively, compared with the present maximum of 6½d. and 5¾d. A sub-committee has been appointed to meet the tramwaymen's representatives.

CARLISLE: *Charges against Electrical Engineer.*—Certain charges made by Councillor Eggleston at the last Council meeting, reflecting very seriously upon the management of the electricity undertaking, have been investigated by the Electricity Committee, who report they are satisfied that the charges are untrue and have no foundation. The Council is recommended to call upon Mr. Eggleston either to substantiate the truth of the charges or to unreservedly withdraw them.

CHESTER: *Electricity Supply.*—The net profit upon the electricity undertaking for the past year was £2,046, compared with £1,858 in the previous year. In presenting the accounts at the last meeting of the Corporation, the Chairman of the Electricity Committee stated that during the past few years the revenue account of the undertaking had provided extensions, alterations, and improvements amounting to £7,922.

FLEETWOOD: *Street Lighting.*—The Electrical Engineer has been directed to prepare an estimate of the cost of lighting all the streets in the town with electricity instead of gas.

GLASGOW: *Tramway Profits.*—A ratepayers' meeting was held last week, at which a protest was made against the decision of the Corporation to apply the tramway surplus to relief of rates.

HARROGATE: *Street Lighting.*—It has been decided to charge 17s. per annum for the five hundred 50-c.p. metal filament lamps which are to be installed for street lighting.

HASLINGDEN: *Electric Supply.*—A recommendation by the Electric Lighting Committee that the Council should put their Provisional Order into force has been referred back.

HINDLEY: *Electric Lighting.*—The Council's Electric Lighting Provisional Order expires this month, and an extension of time is to be applied for.

HULL: *Electricity Accounts.*—The total revenue from the electricity undertaking for the past year was £54,000, and the net revenue £27,000. The income from lighting increased by £585, whilst the revenue from power supply was greater than that of the previous year by £2,500. The number of units sold was 6,346,007, against 5,723,074 in the previous year, and the total cost of generation, including capital charges, was 1·83d. per unit.

LEICESTER: *Management of Electricity Undertaking.*—The Corporation are considering the advisability of separating the management of the electricity undertaking from the gas undertaking. It will be remembered that the late Mr. Colson was both gas and electrical engineer.

LEIGH: *Electricity Charges.*—At the last meeting of the Council, when the Tramways and Electricity Committee's proceedings came up for approval, Councillor Ashworth suggested that the charges for electricity should be increased. To make a profit of only £112 on a capital expenditure of £40,000 or £50,000 was not, he said, satisfactory. According to the accounts the generating costs were 1·37d. per unit, and the average price for power was 1·32d. He suggested that the charges should be so revised that the average price for power should not be less than 1.45d. No other Councillor took the point up, and the matter was dropped.

LINCOLN: *Electricity and Tramway Accounts.*—The Electric Lighting Department has made a gross profit for the year of £6,493, leaving a net profit of £2,503, after meeting capital charges. Out of this, £44 is to be used to meet the deficit on the tramway account, and £2,459 carried to depreciation. It is stated that the running cost of the tramways is considerably below the average of other undertakings in this country, and the small deficit is mainly due to the shortness of the line.

LONDON: *London County Council: Tramway Accounts.*—The Highways Committee have presented a statement of the accounts of the tramways undertaking for the year to March 31st, 1910. The system now has a total length of 135½ street miles, of which 20 miles are horse lines. The whole system is worked by the Council, with the exception of 1⅝ miles in the Harrow Road and ⅜ mile in Archway Road, Highgate, which are worked by the Metropolitan Electric Tramways, Ltd., and ⅜ mile in Lea Bridge Road, which is at present worked by the Leyton Council. Capital expenditure amounts to £10,709,504, of which £1,225,942 were expended last year. The total receipts during the year from electric traction were £1,891,035, and from horse traction £131,967. There was a loss on the horse undertaking of £45,172, and a surplus on electric working of £834,208. The gross surplus was, therefore, £789,036. After meeting capital charges, income tax, Parliamentary expenses, &c., there is a surplus of £192,109. Provision for renewals at the rate of ¾d. per car-mile, plus a small amount to meet shortage in previous years, leaves a sum of £58,868, which has been transferred to the general reserve. This fund now amounts to £70,752, after deducting £25,265 special expenditure in connection with the surface-contact tramways in the Mile End Road. The total expenses per car-mile were 7·15d., against 7·37d. in the previous year. The surplus on working is 5·06d. per car-mile.

The London County Council propose to serve notice upon the Metropolitan Electric Tramways, Ltd., of their intention to purchase the line between Finsbury Park and the Manor House. The position in connection with the line is interesting. The boundary line of Middlesex and London is down the centre of the roadway, with the result that one pair of rails belong to the London County Council, and the other pair of rails to the Middlesex County Council. In order to avoid a deadlock, terms were arranged under the L.C.C. Tramways Act, 1906, by which the L.C.C. was to acquire the other pair of rails.

Battersea.—The Electrical Engineer has reported the results of trials which have been made by him in the use of carbon brushes in place of wire gauze brushes for the turbine generator sets. The results have proved, he says, that by adopting carbon brushes the machines are more reliable and efficient, and the committee has decided that the necessary works

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be carried out for providing and adapting the gear for carbon brushes to the remaining turbine generator sets at an estimated cost of £85 10s

Poplar: Systems of Charging.—In March, 1909, the Council approved experimentally the wiring of 25 houses at a tariff of 12½ per cent. on the cost of installation to cover depreciation, repairs, and interest, with a charge of £4 per annum per kw. installed, and £1 per kw. installed for heating, &c., plus ½d. per unit for all current consumed; lighting in cellars, lavatories, &c., not extensively used at the time of the maximum load being charged at the same rate as for heating. The Committee are now of opinion that this class of installation may be usefully extended. It is also suggested that in the case of business premises a charge of £15 per annum per kw. for inside lighting, and £6 10s. for outside arc lighting, plus ½d. per unit is to be made. For power consumers it is proposed to establish a general rate of £4 per kw., plus ½d. per unit for all current consumed, and to offer rebates to large consumers. The Engineer has come to the conclusion that the scale of charges proposed would materially assist the undertaking in further development, and reach the class of consumer to whom the present rates appear to be prohibitive, while at the same time allowing a sufficient margin of profit to meet depreciation. The Engineer has been authorised to wire a number of premises, not exceeding 50 for domestic and business supplies on these terms, at a cost not exceeding £20 for any one installation. The Finance Committee are to report upon the proposal.

MONAGHAN.—It is understood that the scheme for the lighting of this town by electricity has not been dropped, and that another public meeting will be held at an early date.

NELSON: *Tramway Supply.*—The offer of the Burnley Corporation of 2d. per Board of Trade unit for electricity supplied to Brierfield tramways has been accepted.

PENMAENMAWR: *Street Lighting.*—After considerable discussion, the Council has decided to adopt electric lighting on the promenade.

PLYMOUTH: *The Trolley Omnibus.*—The Tramway Manager has prepared a report upon the trolley omnibus, in which he describes the various systems available. He expresses himself favourably impressed with the experimental line at Hendon, and is convinced that whenever the Plymouth Council considers the question of communication with certain of their outlying districts, the trackless trolley system will be very suitable. Consideration of the report has been deferred.

Tramway Accounts.—The receipts from the tramway undertaking last year amounted to £36,638, and there is a gross profit of £10,127. After meeting capital charges there is a net profit of £850.

PORTSMOUTH: *Telephone Accounts.*—After meeting capital charges, the telephone accounts for the past year show a surplus of £400.

RUGBY: *New Electric Supply Agreement.*—The Electric Light Committee have obtained more favourable terms from the British Thomson-Houston Co. with regard to the supply of electrical energy, and as a consequence the agreement with the company, which would have expired in 1915, has been extended to 1918.

SOUTH AFRICA: *Electric Supply in Durban.*—According to the *South African Mining Journal*, amalgamation proposals have been put forward affecting the two generating stations in Durban. The proposals will provide for the taking over by the Corporation of the railway power station. If the idea is carried into effect, two new generating sets will be installed.

STALYBRIDGE, HYDE, &c.: *Joint Boards' Accounts.*—The accounts of the Stalybridge, Hyde, Mossley, and Dukinfield Joint Boards for the year to March 31st show a loss on the tramway undertaking of £6,448, and on the electricity account of £469.

STIRLING: *Electricity Accounts.*—There was a net profit of £718 on the working of the electricity undertaking last year.

TOTTENHAM: *Street Lighting.*—The Council has received a letter from the North Metropolitan Electric Power Distribution Co. in regard to street lighting. The company asked to be allowed to submit a tender for a minimum of five years for the whole district, but stated that if they might tender only for those portions where the mains were already laid, they would do so for a minimum of three years.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ALDERSHOT.—An inquiry was held last week concerning a loan of £1,500 for electrical extensions.

BARKING.—A sub-committee has been appointed to consider a report from the Electrical Engineer upon extensions to the generating station.

BELFAST.—Tenders for condensing plant are to be invited by the Harbour Board.

HEREFORD.—An inquiry was held last week concerning a loan of £3,000 for electrical extensions.

LONDON: *London County Council.*—Tenders are invited for the supply and delivery of low-tension cables, cable boxes, &c., at the central car repair depôt (see an advertisement on another page).

Battersea.—A loan of £18,909 is to be applied for for mains.

LUTON.—The Electricity Committee require a boiler, superheater, and mechanical stokers. Particulars from the Borough Electrical Engineer, and tenders by July 6th.

NEWPORT (MON.).—A wooden water-cooling tower, natural draught, is required, having a capacity of 200,000 gallons per hour. Particulars from Borough Electrical Engineer, and tenders by July 8th.

NORWICH.—An inquiry was held last week concerning a loan of £17,783 for electrical extensions. The account is made up as follows:—Exhaust steam turbine and condenser, piping, switchgear, &c., £5,000; centrifugal pump, £200; balancer for mains, £160; coal elevator, £150; alteration to boiler, £70, for Paterson feed-water filter, £203; and mains and services, £12,000.

RAWTENSTALL.—An application is to be made for a loan of £11,000 for electrical extensions.

SURBITON.—The Local Government Board have sanctioned loans of £615 for house services, and a similar sum for meters, repayable in fifteen and five years respectively. The Board have stipulated that the loan expenditure must not include payments for permanent workmen and salaried officials of the Council other than the Clerk for regular work in connection with the loans, not within the scope of the duties of Clerk.

TUNBRIDGE WELLS.—High- and low-tension paper insulated cables are required. Particulars from Borough Electrical Engineer, and tenders by July 9th.

Miscellaneous

BECKENHAM.—An application is to be made for a loan of £5,000 for further free wiring.

NETHERLANDS.—The Dordrecht City Authorities have decided to construct an electrically-driven swivel bridge at a cost of £8,000.

[illegible]ERHAM.—Tenders are invited for the supply of electricity meters of 2, 5, 10, 25, and 50 amperes. Particulars from the Borough Electrical Engineer, and tenders by July 9th.

The Tramways Committee require incandescent lamps, among other stores. Particulars from the Clerk, and tenders by July 9th.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

S.E.—The L.C.C. invite tenders for the wiring and fitting of the second portion of the central car repair depôt (see an advertisement on another page).

PROVINCES.

ABERDEEN.—Extensions by Northern Co-Operative Society (£2,500). Architects, Brown & Watt, 17 Union Tee, Aberdeen.

Works, Links Street (£2,150). Architects, Wilson & Walker, 181 Union Street, Aberdeen.

BELFAST.—The Board of Guardians invite proposals for the carrying out of an electrical installation at the Whiteabbey Workhouse. Messrs. Young & Mackenzie are Consulting Engineers, and plans, &c., can be seen at the Clerk's office.

BRENTFORD.—Heating and other engineering works for the Board of Guardians (£11,500). Consulting engineer, Mr. Dolby, c/o Clerk to the Guardians.

BRIDLINGTON.—Town hall. Surveyor, E. R. Matthews, Bridlington T.C.

The governors of the Bridlington Grammar School invite tenders for an electrical installation on the O.S. system, supply being taken from the Corporation mains. Mr. A. J. Beckett, Borough Electrical Engineer, is advising.

BRISTOL.—Surgical department at infirmary (£70,000). The Hospital Governors.

CHRISTCHURCH.—Workhouse infirmary (£12,000). A. Druitt, clerk, Board of Guardians, Christchurch.

DEWSBURY.—The Batley Carr Council School is to be fitted for electric light. Architects, Messrs. Holton & Fox, Corporation Street.

DUNDEE.—Training college (£60,000). St. Andrew's Provincial Committee.

FARNWORTH.—Electrical fittings will be required for the new secondary school which is to be built here at a cost of £19,000.

GELLIGAER.—Isolation hospital (£8,000). J. Lloyd, builder, Ystrad Mynach.

HASLEMERE.—Church (£7,000). Vicar, St. Stephen's, Portsea.

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It has been decided to instal electric light in St. Christopher's Church. The matter is in the hands of a local gentleman, Mr. Methuen.

HEREFORD.—Extensions of fruit market (£5,000). Surveyor, Hereford Town Council.

LANCASTER.—Salvation Army Barracks. Lancaster Branch.

MERTHYR TYDVIL.—Theatre. G. S. Valentine, Architect, 19 Charing Cross Road, London, W.C.

MERTON.—Cinematograph theatre. Surrey and Sussex Picture Palaces. Ltd., 27 Coombe Lane, Kingston Hill, Surrey.

MINEHEAD.—Public hall (£3,500). T. W. Andrew, architect, Northwood, Minehead.

NEWCASTLE-ON-TYNE.—Home for Incurable Children. Architects, Shewbrooke & Hodges, 24 Grainger Street, Newcastle.

NEWPORT (Mon.).—Congregational institute. Architect, G. Jackson, 49 Risca Road, Newport, Mon.

NORWICH.—The Education Committee recommend that the Duke Street School should be fitted for electric lighting at an estimated cost of £65.

PENZANCE.—Secondary school for girls. Architect, H. Maldern, Morral Road, Penzance.

POLLOCKSHAWS (Glasgow).—Court-house (£1,500). Architect, W. Nichol, 29 Main Street, Pollockshaws.

PONTYPRIDD.—Cinematograph theatre. Architects, Richards & Kaye, Pontypridd.

SHEFFIELD.—Theatre. Architect, A. Winstanley, Temple Chambers, St. Anne's.

STANLEY (Durham).—Concert hall. I. J. Eltringham, architect, Derwent Street, Blackhill. Builder, P. Duffy, Stanley.

SWANSEA.—Church and lecture hall (£10,000). Arhcitect, G. Moxham, Swansea.

WEST DERBY.—Hospital (£6,000). Mr. Lancaster, architect, West Derby Union, Liverpool. Builders, Kelly Bros., Walton, Liverpool.

YOKER.—Extensions, Halley's Industrial Works (£10,000). Architects, Halley & Neil, Kilbourne Road, Clydebank.

TENDERS RECEIVED AND ACCEPTED

AUSTRALIA (Victoria).—The tender of Messrs. Siemens Brothers & Co. for 1,640 iron telegraph poles (£5,119) has been accepted.

The Chief Commissioner of the New South Wales Government Railways, since his arrival in this country a few weeks ago, has confirmed the provisional order which had previously been given to Messrs. Willans & Robinson, Ltd., of Rugby, for a turbo-alternator and surface condenser of 6,000-k.w. normal capacity. A turbine of the Willans "Impulse-Disc and Drum" type is being supplied for meeting the requirements of the Sydney authorities. Two turbo-alternators of the above capacity are already installed in the Sydney power house.

BELFAST.—Messrs. James Allen, Sen., & Sons, Ltd., have withdrawn their tender for the supply of twenty-two tubular electric light masts for the harbour lighting, and the tender of Messrs. Hind Bros. & Co., at £7 15s. 6d. each, less 2½ per cent., has been accepted.

CARLISLE.—The tender of Messrs. John Laing & Son at £12.305 for extensions to the electricity works buildings is recommended for acceptance.

LONDON: *London County Council.*—The tender of Messrs. Pinching and Walton at £230 19s. has been accepted for the wiring and fitting in connection with the electric lighting of Hammersmith Bridge.

Islington.—The Borough Council has accepted the tender of the Crown Engineering Co., at £155 10s., for a lathe for the electricity works.

Southwark.—The Borough Council has placed an order with the General Electric Co., Ltd., for an 8 h.p. slow-speed motor at £33.

LONDONDERRY.—The Corporation have placed an order for a 400-kw. "Disc and Drum" turbine of the mixed pressure type with Messrs. Willans & Robinson, Ltd., of Rugby. The turbine is intended primarily for working with exhaust steam, but can also be used with high-pressure steam when required.

VENTNOR (I.O.W.).—The Finance Committee recommend the acceptance of a tender by the Electric Light Co. for the improvement of the lighting of the Town Hall by the installation of eighteen 100-c.p. metal filament lamps.

The following tenders have been accepted during the past month by the Government Departments named :—Admiralty Contract and Purchase Department : Fittings, Evered & Co., Ltd.; Gabriel & Co.; General Electric Co., Ltd.; Hawkers, Ltd.: Sir James Laing & Sons, Ltd.; W. McGeoch & Co., Ltd.; Player & Mitchell; Spagnoletti, Ltd. Switches, bells, &c., British Insulated & Helsby Cables, Ltd.; Edison & Swan Electric Light Co.; Electric & Ordnance Accessories Co., Ltd.; Evered & Co., Ltd.; Hawkers, Ltd. India-rubber, gutta-percha, &c., Co.; International Electric Co.; Johnson & Phillips, Ltd.; Kelvin & James White, Ltd.; McGeoch & Co., Ltd.; Player & Mitchell; Reid Bros.; Spagnoletti, Ltd.; Sterling Telephone & Electric Co., Ltd.; Walters' Electrical Manufacturing Co., Ltd.; A. Watson & Co. War Office : Electric light fittings, Credenda Conduits Co.; Edison & Swan United Electric Light Co., Ltd.; General Electric Co., Ltd.; S. Heath & Sons, Ltd.; Kensington Stamping Co., Ltd.; Veritys, Ltd. Electric cranes, C. & A. Musker. General Post Office : Telegraphic apparatus, Gell Telegraphic Appliances Syndicate, Ltd. Magneto bells, British L. M. Ericsson Manufacturing Co., Ltd. Insulator spindles, Bullers, Ltd. Telephones, Western Electric Co., Ltd. Bronze wire, F. Smith & Co., &c., Ltd. Annealed copper wire, R. Johnson & Nephew, Ltd. Flameproof wire, London Electric Wire Co. & Smith's, Ltd. Electric lighting of Edinburgh head post office, J. Gray & Son. Ditto, of Western District post office, Wimpole Street, W., A. Maund. Telephone equipment private branch exchange lamp signalling system at Harrod's Stores, Brompton Dynamo Co., Ltd.; Bruce Peebles & Co.

The London and North-Western Railway have accepted the tender of Messrs. W. Geipel & Co., Vulcan Works, St. Thomas Street, London, S.E., for the supply of Henrion arc lamp carbons during the year ending June 30th, 1911, for the whole of the Company's requirements, the total annual consumption amounting to 1,373,000 carbons. This is a renewal of last year's contract.

APPOINTMENTS AND PERSONAL NOTES

Mr. E. W. Moss, who has been for four years assistant to Dr. Silvanus P. Thompson at the Finsbury Technical College, has joined the electrical department of Messrs. Boult, Wade & Tennant, patent agents. Mr. J. Mould has been appointed assistant to Dr. Silvanus P. Thompson in place of Mr. E. W. Moss.

Mr. H. Webber, Chief Assistant Electrical Engineer to the Sunderland Corporation, has been appointed Borough Electrical Engineer at Keighley, at a salary of £250 per annum. There were 123 applications for the post.

Mr. J. A. Robertson, Borough Electrical Engineer at Greenock, has been granted an increase of £50 in his salary. We believe that Mr. Robertson was a candidate for the position of Borough Electrical Engineer at Salford.

The Senior Charge Engineer of the Willesden undertaking having resigned on obtaining another appointment, Mr. J. C. Johnson has been appointed to fill the vacancy at a salary of 40s. per week. Mr. J. D. Ravenscroft is to take Mr. Johnson's place at 35s. per week, and a third man is to be appointed at a salary of 30s. per week, rising to 32s. 6d. at the end of six months.

Owing to Mr. C. W. Salt, Chief Assistant Electrical Engineer at Bradford, having been appointed Chief Electrical Engineer to the Torquay Electricity Undertaking, the Bradford City Council have made the following appointments: Mr. Harry S. Ellis, Assistant Electrical Engineer, has been appointed Deputy Electrical Engineer and Manager; Mr. J. H. Schnauber, Chief Draughtsman, has been appointed Assistant Electrical Engineer.

MISCELLANEOUS CITY NOTES

MORTGAGES AND CHARGES.—W. H. Allen, Son & Co., Ltd., £50,000 debentures, created June 15th, 1910. Property charged, freehold lands and premises at Bedford and leasehold property at Liverpool, Westminster, and the company's undertaking generally. Trustees: W. P. Norton, 57½ Old Broad Street, E.C.; G. H. Morse, Thorpe St. Andrew, Norfolk; and A. G. Scott, Westminster.

DIVIDENDS ANNOUNCED.—Eastern Telegraph Co., first quarterly dividend of 1¼ per cent. on ordinary stock, free of tax, for 1910. The Electric and Beneral Investment Co., 6 per cent. on the ordinary shares for the year to May 31st. National Electric Supply Co., interim dividend of 3s. per share.

Mexican Electric Light & Power Co., 1 per cent. on the ordinary shares for quarter to June 30th.

The South London Single-Phase Railway.—It is stated that the work of extending the single-phase railway of the London, Brighton and South Coast Railway Co. to the Crystal Palace has been commenced.

Birthday Honours.—Among the Birthday Honours, Sir Wm. Mather, chairman of Messrs. Mather & Platt, Ltd., has been made a Privy Councillor, and Dr. R. T. Glazebrook, F.R.S., has been made a C.B.

Revocation of Patents.—An interesting decision has just been given by the Comptroller-General of Patents in connection with an application under Section 27 of the Patents Act for the revocation of seven patents owned by the Mercédès Daimler Motor Co., Ltd., on the ground of inadequate manufacture in this country. The applicants admitted that, in addition to the manufacture by the patentees and their licensees, there was an extensive manufacture by infringers in the United Kingdom, but they contended that this manufacture by infringers should not be taken into consideration, and could not be relied upon by the patentees in defence. The Comptroller, however, has decided that "the term 'patented article' in Section 27 means an article which is the subject of a British patent and is manufactured in accordance with the specification, or by means of the process therein described, by whomsoever manufactured, and that consequently manufacture by infringers in this country must be taken into account in favour of the patentee." The application for revocation was dismissed, but an appeal has been lodged by the applicants against this decision.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 5s. to £57 15s. per ton (last week, £57 10s. to £58).

OSRAM LAMPS FOR TRAIN LIGHTING.—We have received from the General Electric Co. some particulars of the experimental use of Osram lamps for train lighting on the Waterloo & City Railway. The lights are placed in the centre of the roof, 26 fittings being utilised for each four-car train, each of the larger cars taking seven 55-watt Osram lamps, and the smaller cars six 55-watt Osrams, each independently arranged in an opalite globe. The lamps are burned four in series, and were installed in June, 1909. Many of the original lamps are still in use.

AGENCY.—Mr. S. Heilpern (82 Hamilton Road, Longsight, Manchester) informs us that he is now acting as agent for measuring instruments of switchboard and other patterns, made by Rubert Abrahamsohn, of Charlottenburg.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—A meeting of Mackey's Electric Lamp Co., Ltd., will be held on August 3rd, at 12 noon, at 174 and 175 Aldersgate Street, London, to hear the liquidator's account of the winding-up.

A meeting of the Electric Sterilizing, Carbonizing & Stripping Co., Ltd., will be held at Prudential Buildings, Market Place, Dewsbury, on July 27th, at 4 p.m., to receive the liquidator's account of the winding-up.

The trustee in the bankruptcy of Herbert Shuttleworth, electrical engineer, Cross Court, Briggate, Leeds, has been released.

The adjudication of bankruptcy against George Huntingdon, electrician, 83 Battersea Rise, and Dering Street, Bond Street, London, has been annulled, all the debts having been paid in full.

The trustee in the bankruptcy of Arnold Roberts, electrical engineer, 21 North Parade, Bradford, has been released.

In the London Bankruptcy Court on Tuesday the public examination of Mr. W. H. Trentham, Consulting Electrical Engineer, 39 Victoria Street, London, S.W., took place. It was stated that the debtor started business as a consulting engineer in 1892 with about £50. The business was very successful down to about 1904, when he began speculating upon the Stock Exchange in copper and other shares. A firm of stockbrokers were now creditors for £7,718. In 1907 he took in partnership a Mr. Hemming, who paid a premium of £500, and agreed to bring in £500 capital. Of the latter sum, only £75 was provided, but there was a dispute with regard to a payment of £250 from the Mile End Board of Guardians, which Mr. Trentham claimed as his own property, and paid into his private banking account, instead of into the partnership banking account. Under the partnership agreement an arbitration took place, but it was held that £186 of the amount in question belonged to the partnership, and that Mr. Trentham's action in this matter constituted a breach of the partnership agreement, which was accordingly dissolved. The examination was closed.

MESSRS. SIEMENS BROS. LAMP WORKS OUTING.—On Saturday the employees of Messrs. Siemens Bros. Lamp Works had their second annual outing to Brighton. Over 500 made the journey, Brighton being reached at 8.30 a.m. Luncheon was served in the Aquarium, and the outing was thoroughly successful.

POOLEY & AUSTIN.—We are informed that Messrs. Pooley & Austin have, owing to greatly increased business, removed to larger offices at 25 Victoria Street, London, S.W., where they propose carrying a stock of cable, control gear, and other apparatus for which they hold sole agencies in the southern district.

Telewriter Exchange.—The first exchange to be put into operation by the Telewriter Syndicate will be opened to-morrow (Friday) by the Rt. Hon. the Lord Mayor of London. The Exchange is situated at 20 Bucklesbury, and at present there are 40 subscribers, mostly large City firms.

L.C.C. Engineering School, Poplar.—The Electrical Engineering Students' Association held a debate on "Gas v. Electricity," last Wednesday, in which a large number of students and members of the staff took part. On taking a vote electricity had a triumphant victory.

The Institution of Mining Electrical Engineers.—Owing to the similarity between the title under which this body was orignially founded to an existing institution, the Council have decided that the title be altered to the Association of Mining Electrical Engineers.

The Proposed Crystal Palace Tube Railway.—The scheme for the construction of a tube railway from Victoria to the Crystal Palace has undergone some slight modification. The terminus of the railway will now be at the Penge entrance to the Palace, instead of at Upper Norwood, as originally proposed. The total length of the line will now be at 6¼ miles, with a branch line of 1½ miles long, running from the Elephant and Castle to a point near the Walworth Road. The estimated cost of the new line is £340,800 per mile.

COMPANIES' MEETINGS AND REPORTS

UNITED ELECTRIC TRAMWAYS OF MONTE VIDEO.—At the ordinary general meeting last week, Mr. G. A. Touche said that the year under review was the first complete year of working under electric traction. Eighty-two miles of track were now in use. The net receipts, £105,472, showed an increase of 26 per cent. The net profit for the year, after meeting debenture interest, &c., was £63,863, of which £2,000 had been set aside for debenture redemption, and £15,000 placed to renewals and contingency account. A final dividend on the preference shares, making 6 per cent. for the year, was recommended, and a dividend at the rate of 3 per cent. for the half year on the ordinary shares, making 6 per cent. for the year. £11,847 has been carried forward.

R. WAYGOOD & CO.—At the ordinary meeting last week the report and accounts given in our last issue were adopted. The chairman complained that in spite of the fact that they had done more work, profits had been reduced owing to the exceptionally low prices obtained. He referred to several large contracts for lifts which had been carried out.

ANGLO-PORTUGUESE TELEPHONE.—At the annual meeting on Thursday last, the Chairman, Mr. H. Allen, stated that in five years the income had increased from £25,962 to £49,489, and the net profit from £8,360 to £16,571. The dividend was 8 per cent., including the final dividend of 5 per cent., now to be paid, and a sum equal to a further 7½ per cent. was being placed to reserve. After setting aside a substantial sum for redemption of debentures, an amount equal to another 5 per cent. was being carried forward. The systems at Lisbon and Oporto have been inspected by Mr. F. Gill (Chief Engineer to the National Telephone Co.) during the year.

NATIONAL ELECTRIC CONSTRUCTION.—Mr. L. B. Schlesinger presided at the annual meeting last Friday, and spoke hopefully of the progress of undertakings in which the company was substantially interested. The profit on contracts completed had declined from £24,016 to £6,957, as there has been practically no tramway construction during the year in this country. The net profit for the year was £1,868, which, with the amount brought forward, made a total of £11,530, of which £5,208 was transferred to reserve and depreciation accounts, and £6,321 carried forward. As there was no work of importance to be obtained in England, the directors were devoting their energies to securing contracts abroad.

COMPANIES STRUCK OFF REGISTER.—The names of the following companies will be struck off the register within three months, unless cause is shown to the contrary:—Electric Vehicles Development Co.; Macclesfield Tramway Syndicate; Newark Electric Supply Co.; Ystradgynlais Electric Lighting Co.

INDIA RUBBER, GUTTA PERCHA & TELEGRAPH WORKS CO.—At the annual meeting last week, the instability of the markets for raw material was referred to. Major L. Darwin, who presided, said that rubber stood at a high price, gutta percha was expensive, cotton had been uncertain, and copper gradually dwindling in price. At present they were fairly well occupied in the submarine and electrical departments.

MARCONI INTERNATIONAL MARINE COMMUNICATION CO.—After providing for debenture interest, the accounts for 1909 show a net profit of £1,466.

MARCONI WIRELESS TELEGRAPH CO.—Mr. G. Marconi presided at the annual meeting on Tuesday, and referred to important negotiations which are taking place with foreign Governments for the development of wireless communication abroad. In this matter they had the hearty support of the Foreign Office. Further, they had submitted a scheme to the British Government for a further extension of long-distance communication, and hoped that at a not distant date they would obtain the necessary licenses. In this connection the fire which destroyed their Glacé Bay station, although a great misfortune, was not entirely an unmixed blessing. The improvements which had been introduced in the reconstruction would, they were confident, compensate them in the future for the time lost, and would serve the company in good stead in other directions, for it would not be news to most of the shareholders that it was not by any means their intention to be satisfied with the Transatlantic service. The future policy of the company was to open a large number of telegraph services throughout the world.

PERTH ELECTRIC TRAMWAYS.—The net profit for 1909 was £12,456, to which has to be added £1,100 brought forward. A dividend of 2½ per cent. is recommended on the ordinary shares, and after placing £4,000 to reserve in respect of additional rolling stock and the North Perth extension, a sum of £1,056 is carried forward. In connection with negotiations for certain extensions, it was found that general feeling in Perth was that the tramways should be acquired, either by the municipality or the State. The directors have put forward certain suggestions which the various authorities are considering, and have intimated their willingness to listen to any reasonable proposals from the City Council or the Government.

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ARON ELECTRICITY METER.—The accounts for 1909, after providing for general charges and depreciation, show a net profit of £21,118, making, with the balance of £6,549 carried forward from last year, a total available profit of £27,667. Out of this amount the directors distributed in December last a dividend of 3 per cent. on the preference shares, absorbing £3,747, and leaving to be disposed of the sum of £23,920. The directors' recommend payment of a further 9 per cent. on the preference shares, thus wiping off the arrears due to the preference shareholders. The Board hope that the ordinary shareholders may in the near future participate in the distribution of dividends. The past year's trading has been, in the opinion of the directors, most satisfactory, the sales having exceeded those of any previous year. The increased demand for the company's products has employed the factories to the full.

Mr. H. Hirst, Chairman of the company, presided at the annual meeting on Friday, and remarked that the similarity of the figures in the balance-sheets of 1909 and 1910 showed that the business had attained a pleasant stability. The profits had risen in this year's accounts to the satisfactory total of £35,630, £1,330 more than last year, which was, up to that time, the record year. The other items on the profit and loss account were within a per cent. or two the same as last year. They had written off £400 more for depreciation, not because the plant was in any worse condition, but in an industrial business which is constantly in process of evolution, it was a good policy to use some of the profit of good years for writing down certain capital items. Maintenance of patents was a few hundred pounds less, and so, naturally, was debenture interest, for their debt decreased every year by the repayment of about £5,000. As regards the balance-sheet, only two figures called for comment compared with previous years. They had added to their leasehold land, buildings, machinery, and tools the sum of £9,279; this figure was largely composed of additional land and buildings rendered necessary by the increase of their business. They had less cash to the extent of £15,000 if loans at short notice were included. This was accounted for by the greater trading outstandings, which were £58,000 this year as against £40,000 last year, and also to some extent by the extensions of the taximeter business. The taximeter business particularly was at present absorbing money; these instruments were not sold outright, but hired out, mostly for periods of five years. They had received very satisfactory contracts in London, Brussels, and Vienna for hiring out taximeters, and while they had to manufacture and instal every instrument, the cost of both manufacture and installation had to be defrayed at present from their liquid assets; payment, however, was received only in monthly or quarterly instalments, and it followed that the outgoings so far as capital expenditure was concerned were still greater than the incomings, and this state of affairs was likely to continue for some time if they were successful in obtaining new contracts. The profits shown in this year's accounts had been made entirely by their old established meter and clock business. For the safety of the company the directors had so far used all the income received from taximeters against manufacturing and installation expenses.

It was a matter of great satisfaction to the Board, particularly to Prof. Aron as Managing Director, and to himself as Chairman, that they were able this year to recommend the distribution of a dividend which would clear off the last of the arrears due to Preference Shareholders. The conservative policy which necessitated in years gone by the accumulation of these arrears had been vindicated, not only by their ability to pay them back now, but also by having established a business which showed a greater turnover than at any time during its existence. They were firmly planted in nearly every European country, and had found a particularly useful outlet for their manufactures in the constantly growing and prosperous Power Companies on the Continent. The average yield per meter was less than in former years, but they had made up for this by selling a very much larger number of meters, and by manufacturing more cheaply. He sincerely hoped, and there was great reason for that hope, that the ordinary shareholders would in the near future be rewarded for their great patience. Before putting the motion for the adoption of the Report and Accounts to the meeting, he expressed his pleasure that Prof. Aron was able to be present at this year's meeting, and he was anxious to take this opportunity of thanking him for the hard and great work which he had given unstintingly to the Company and which had been the mainspring of their success. He had been loyally backed up by their excellent staff whom he had placed in charge of the Company's various undertakings in the different countries, and their efficiency and loyal and strenuous work was greatly due to his master-mind, who was constantly controlling them. He had much pleasure in moving "that the report and accounts as presented to the shareholders be received and adopted."

No questions being asked, the report and accounts were unanimously adopted.

The Chairman next moved that a dividend of 9 per cent. be paid upon the preference shares as recommended in the Directors' report, and on this being put to the meeting it was carried unanimously.

The retiring directors, Mr. H. Hirst and Sir James Pender, Bart., were re-elected. In moving the resolution, Mr. Roger W. Wallace, K.C., referred to the great advantage of retaining Mr. Hirst's services as Chairman. Being prominently identified with the electrical industry, he was in the City all day, and his work for the Company was, therefore, practically continuous.

Messrs. Price, Waterhouse and Co., having been re-elected auditors for the coming year, a vote of thanks to the Chairman closed the proceedings.

NEW PUBLICATIONS

International Language and Science. By L. Couturat, O. Jespersen, R. Lorenz, W. Ostwald, and L. Pfaundler; translated by F. G. Donnan. (London: Constable & Co.) 2s.

Practical Electrical Engineering for Elementary Students. By W. S. Ibbetson. (London: E. & F. N. Spon.) 3s. 6d.

The Telegraphic Transmission of Photographs. By T. Thorne Baker. (London: Constable & Co.) 2s. 6d.

"Cable-fault Localisation Graphs in Practice." By E. Raymond-Barker. (London: H. Alabaster, Gatehouse & Co.) 1s. 6d.

NEW COMPANIES

STEPHEN COTTON & CO., Sydney Street, West Belfast. Capital, £20,000. Electrical engineers, machine makers, iron and brass founders, &c.

R.O.E. SYNDICATE, 20-21 Essex Street, London. Capital, £1,000. Manufacturers, miners, electrical and mechanical engineers, contractors, &c.

BRITISH ARC WELDING CO.—Suffolk House, Cannon Street, London. Capital, £15,000 in £10 shares. Electrical and mechanical engineers, &c.

ELECTRICAL TRUST.—9-10 Pancras Lane, London, E.C. 2,500 shares (10,000 founders' shares of 1d. each). Electrical telegraph, telephone, and mechanical engineers.

ALLEN, WEST & CO.—47 Victoria Street, London. Capital £20,000. Electrical and mechanical engineers.

GARRETT, HUNT & CO., 181 High Street, Lewisham, London. Capital, £2,000. Electrical engineers and contractors.

RAILOPHONES, 21 Woodend Road, Erdington, Warwick. Capital, £500. Telegraph and telephone makers, electricians, &c.

EXPRESS CABLE INVENTIONS, 29A Charing Cross Road, London. Capital, £50,000. To acquire from H. Knudsen certain patents for transmitting and receiving photographs and printed and typewritten messages by wireless telegraphy, and over cables and land lines.

HILL, HARDING & CO., Shandon Road, Clapham Park, London. Capital, £1,000 (1,000 deferred shares of 1s. each). Electrical and optical instrument manufacturers.

HILL & HARRINGTON, 41 Berners Street, London, W. Capital, £2,000. Electrical and mechanical engineers.

W. T. PEARE, 3 Catherine Street, Waterford. Capital, £10,000. Electrical engineers, &c.

HARPIN & CO., Bank Chambers, 47 Temple Row, Birmingham. Capital, £2,500 (1,500 6 per cent. cumulative preference shares). To take over the business of electric lighting and power engineers at present carried on at Birmingham and Dudley.

GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE.—Registered by Ashurst, Morris, Crisp & Co., 17 Throgmorton Avenue, London, E.C. Capital, £20,000. Electrical and general engineers, and manufacturers of telephonic and telegraphic apparatus.

CRAMPTON & CO.—Registered by Waterlow & Sons, Ltd., London Wall, E.C. Capital, £2,500. Electrical engineers and contractors.

ELECTRO-CHLORINATION SYNDICATE.—Registered office, 39 Victoria Street, London. Capital, £50,000 in 48,000 preferred ordinary shares of £1 each, and 40,000 deferred ordinary shares of 1s. each. To acquire and lay down a working plant for the reduction of ores and the refinement of metals by new processes in chlorination and electrolysis, to carry on the business of miners, smelters, metal workers, &c., and to adopt an agreement with H. W. Couzens. Among the subscribers are A. E. Mavor, electrical engineer; H. W. Couzens, electrical engineer; C. Manuel, engineer; and G. W. Zeden, electrical engineer.

TELEGRAPH CONDENSER, LTD.—Capital of £5,000, to take over the business of the Telegraph Condenser Co., and to carry on the business of manufacturers of, and dealers in, electrical apparatus. Private company. First directors, J. A. L. Dearlove and S. G. Brown. Registered office: The Factory, Vauxhall Street, S.E.

ADAMS WATKIN & CO.—Capital £11,000, in £1 shares. Business: Bankers, financiers, &c. Private company. Office: 36 Victoria Street, Westminster.

OSRAM·LAMPS

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published June 23rd, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

12,808/09. **Station and Street Lanterns.** H. WARDLE. Lanterns for metal filament lamps, and suitable for station, shop, or street lighting, have the upper hood or casing perforated by the characters of a name or advertisement, so that the light is reflected through. An extra lamp may be placed in the hood to illuminate the characters. Five claims, three figures.

12,937/09. **Third-rail Construction.** R. J. HOUGHTON, P. ALLMAN, and W. T. GRAY. Positive and negative conductor rails electrically independent of the track are supported one on each side of a central continuous girder by means of divided insulators put together by bolts passing through the supporting girder. Four claims, twelve figures.

13,220/09. **Metal Sheathed Wiring Cable.** SIEMENS BROS. & Co., H. W. HANDCOCK, A. H. DYKES, and J. J. RAWLINGS. Cables of small diameter for house wiring, &c., have a covering of lead strengthened with metal strip or spirally-wound wires to prevent kinking at bends. The wire or strip is made integral with the lead covering by braiding it on the lead through a hot die, or by some similar process. Five claims, five figures.

15,282/09. **Petrol-electric Mechanism.** FELTEN & GUILLEAUME-LAHMEYER-WERKE A.-G. A purely electrical or a purely mechanical differential drive is obtained by a combination consisting of a dynamo coupled by a differential gear both to the petrol engine and to one of the two driving wheels. An electric motor supplied from the dynamo is coupled to the other driving wheel. For purely mechanical drive the dynamo and motor armatures are coupled together by means of a clutch. Two claims, one figure.

20,105/09. **Filling Joint Boxes.** C. J. BEAVER and E. A. CLAREMONT. To minimise the difficulties due to the rapid cooling of and solidifying of the compound when poured into the box, a special form of funnel, making a tight fit with the box inlet and provided with an outside jacket, is employed. The compound is poured into the funnel and into the annular space until it overflows through the vent-holes. These latter are then closed, and a head of hot compound is maintained in the funnel until all the gas and air in the box has bubbled through. Three claims, one figure.

25,156/09. **Switch with Locking Device.** S. EVERED and EVERED & Co., LTD. In a quick make and break knife switch, the blade is locked in its "off" and "on" positions by a simple spring device for preventing the accidental contact of the blade with the switch contacts. Two claims, four figures.

3,247/10. **Ignition Apparatus.** B. BROOKS and F. H. ALSTON. Ball or roller-bearing collectors are employed in place of rubbing contacts where electrical connection is to be made between fixed and moving parts. The ring of balls runs upon a fixed race in an open cup, and is engaged by a spring plunger on the rotating part. Two claims, two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Names in italics indicate communicators of inventions from abroad.

Arc Lamps: FRANCIS [Stage lamp] 13,265/09; TUBBS [Magazine lamps] 13,834/09; HEIMANN and SCHÄFFER [Running arc lamps in series with incandescent lamps] 22,302/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: HARVEY and BASS [Cable armouring] 13,576/09; SIEMENS BROS. & Co. and DIESELHORST [Manufacture of cables] 1,301/10.

Dynamos, Motors, and Transformers: SIEMENS BROS. DYNAMO WORKS and KIEFFER [A.-C. induction motors] 16,811/09; MIDGLEY and VANDERVELL [Generators] 17,189/09; BRITISH THOMSON-HOUSTON Co. (*Noegerath*) [Machines] 20,584/09; SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke-Ges.*) [Brush rocker] 3,914/10.

Electric Ignition: MARKS (*Milton*) [Interrupters] 13,573/09; LODGE [Sparking plugs] 15,251/09; BRÜCKERT [Magnetos] 20,013/09; LEWIS [Ignition of miners' lamps] 25,144/09; MILTON [Magnetos] 24,838/09.

Electrometallurgy and Electrochemistry: NIBLETT [Bleaching compound] 8,270/09; THUM [Electrolytic apparatus] 14,660/09; HÄRDÉN [Furnaces] 26,251/09; SOC. ELECTRO-METALLURGIQUE FRANÇAISE [Manufacture of nickel] 287/10; SOC. D'ELECTRO-CHIMIE and HULIN [Electrolytic production of alkaline metals] 6,065/10.

Heating and Cooking: BASTIAN, 13,827/09.

Incandescent Lamps: BASTIAN, 13,228/09; CLARKE [Nernst-type lamps] 13,591/09.

Instruments and Meters: EVERSHED & VIGNOLES, LTD. [Meters] 13,080/09; JOHNS and JOHNSON & PHILLIPS, LTD. [Signalling and indicating instruments of the resonance type] 13,237/09; WATKIN [Pyrometers] 7,813/10.

Switchgear, Fuses, and Fittings: MEHNE [Remote control gear] 14,052/09; ARCIONI [Excess-voltage protective devices] 14,965/09; HIRST and COATES [Lamp-holder insulating cover] 17,101/09; VAUGHAN [Table fittings] 23,071/09; BOULT (*Acme Automatic Street Indicating Co.*) [Switches] 23,719/09; DEUTSCHE GASGLÜHLICHT AKT.-GES. (*Auer-Ges.*) [Suspension of lamps in streets] 1,166/10.

Telephony and Telegraphy: ADAMS-RANDALL [Telephones] 13,771/09; SIEMENS & HALSKE A.-G. [Semi-automatic telephone exchanges] 6,875/10.

Traction: HADFIELD [Tramway points] 14,248/09; WALKER [Route indicators] 19,273/09; IRVING [Switch-points] 19,434/09; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Signalling] 21,101/09; LOWTHIAN [Electric fog signals] 26,687/09; BALACHOWSKY and CAIRE [Driving-axles of electric cars] 28,475/09; BROWN [Brake-blocks] 29,797/09; SAYERS and SALT [Electric staff signalling] 3,902/10; W. R. SYKES INTERLOCKING SIGNAL Co. [Signalling] 4,643/10; COTA [Air brakes] 10,776/10.

Miscellaneous: SUNDHEIMER [Burglar alarm] 13,956/09; LERTOURNÉ [Synchronising electrically driven machines] 15,981/09; NEWMAN [Burglar alarm] 23,506/09; SCHERL [Gyroscopic apparatus] 27,590/09; WILSON [Electric condensers] 9,832/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: JABURG, 13,305/10.

Electric Ignition: SOC. INDUSTRIELLE DE DELLE, 12,593/10.

Electrometallurgy, &c.: PETERSON [Charging resistance furnaces] 6,035/10; PRESSER [Manufacture of nitrogen oxides] 7,319/10.

Switchgear, &c.: DRUSEIDT [Switches] 9,399/10; SHEMWELL [Switch-throwing mechanism] 12,180/10.

Miscellaneous: SIEMUND [Electric welding] 12,724/10.

Opposition to Grant of Patents

8,146/09. **Metal Filaments.** R. HOPFELT. This patent has been granted in spite of opposition. It covers a process for removing hydrocarbons by sintering the filaments in an atmosphere of a halogen compound such as phosphorous tri-chloride.

19,847/08. **Phospham in Metal Filament Lamps.** GLÜHLAMPENWERKE ANKER-GES. The decision of the Comptroller to refuse this patent in consequence of the opposition of the "Z" Electric Lamp Manufacturing Co. has been appealed against. An abstract of the Comptroller's decision was given in ELECTRICAL ENGINEERING, June 16th, 1910, p. 390.

Application for Amendment

28,522/04. **Railway Signalling.** W. J. MACKENZIE. The Brown-Mackenzie Signal Co., Ltd., desire to amend this specification in order to limit the scope of the invention. The patent covers a system of electric signalling for railways, in which signalling apparatus on the locomotive is operated by means of contact rails laid along the track and controlled from the signal cabins.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

14,682 of July 2nd, 1896. **Stopping Trains.** A. SPENCER. Passengers are enabled to apply the brakes and attract the attention of the guard by pulling a chain. This opens the cocks of the Westinghouse or other pressure brake system, and also admits air to a whistle.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. C. LEVIS (*General Electric Co., U.S.A.*) [Magnetite lamp] 6,042/04.

Dynamos, &c.: H. CHITTY [Cooling of machines] 4,892/05.

Electric Ignition: E. EISEMAN [H.-T. ignition system] 6,000/02.

Electrometallurgy, &c.: B. J. ROUND [Electroplating] 4,865/99.

Instruments, &c.: E. WILSON [Electrometer] 5,582/04; H. OPPENHEIMER (*A.-G. Mix. & Genest*) [Meter counting trains] 6,001/04; H. H. LAKE (*N. Jacobsen*) [Testing buzzer for batteries] 4,780/05; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Prepayment meter] 4,783/05.

Switchgear, &c.: E. A. CARDAN [Resistance units] 5,169/03; J. M. BARR [Control of variable speed D.C. motors] 3,195/05; T. R. CHARLTON and G. H. TARVER [Control of electrically-driven pumps] 4,595/05.

Traction: F. SMITH [Trolley guard wires] 5,651/02.

Miscellaneous: A. REICHWALD (*F. Krupp, Essen*) [Sighting and firing of ordnance] 4,255/00 and 4,623/00; H. C. MICHELL [Mica insulation] 4,969-70/01; S. ROBERTS [Carbonising fibres] 4,595/05; W. H. SCOTT [Magnetic brakes for electric motors] 4,967/05.

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ELECTRICAL ENGINEERING

No. 184 [Vol. VI., No. 27] THURSDAY, JULY 7, 1910. [Price One Penny.
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Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

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A SUPPLEMENT "ELECTRICAL ENGINEERING IN MINES" IS INCLUDED (GRATIS) IN "ELECTRICAL ENGINEERING" ON THE FIRST THURSDAY OF EVERY MONTH.

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SUMMARY

OUR Monthly Supplement on Electrical Engineering in Mines is included in this issue. It opens with an article on the International Mining Congress at Dusseldorf, where a number of Papers relating to electrical mining work were read. Reports are also given of two papers read last month at the meeting of the Mining Institute of Scotland at Dunfermline, one by Messrs. Crawford & Moores on gas-driven generating plant, and the other by Mr. F. Anslow on electric power in collieries. A description of an electrical winding plant in France is also given. Attention is drawn to a recent discussion upon inspection of mines in Parliament, and a report is given of the discussion on a Paper by Mr. W. Maurice on the battery plant at the Hucknall Collieries, and a short account of a discussion on earthing of colliery apparatus at a meeting of the Association of Mining Electrical Engineers. Some notes are also included on recent electrical mining patents.

THE Wimbledon & Sutton Electric Railway Bill has passed the House of Commons Committee stage, as also have the London Tube Railway Bills providing for the amalgamation of three lines. (Page 444.)

A DEPUTATION of members of Smoke Abatement Societies waited on the President of the Local Government Board last week, and urged still more activity in the prosecution of owners of smoky chimneys. Mr. Burns gave a sympathetic reply, but considered that as much of the nuisance was due to domestic as to factory chimneys. (Page 445.)

THE Chloride Electrical Storage Co. Ltd., write to us that they supplied the batteries for the telephones for the Antarctic Expedition. (Page 445.)

A SCHEME for the construction of a goods Clearing House for London was described at the London Chamber of Commerce last week. When received at the Clearing House, the goods would be handled by a series of electrically driven moving platforms, which would be so arranged as to avoid any hand-sorting. (Page 445.)

AMONG the specifications published by the Patent Office last Thursday was one by C. O. Bastian for a tubular incandescent lamp with a number of short filaments in series.—An improved form of resonance instrument in which the vibrating reed uncovers a figure on a scale, is protected by W. H. Johns and Johnson and Phillips. Other specifications include those of the Lodge double-pole sparking plug, an improved form of cable braiding by T. H. M. Harvey and S. W. Bass, and a method of casting the conductors of squirrel-cage rotors in place. A combined arc and resistance furnace is patented by J. Härden. (Page 446.)

THE "Telewriter" Exchange was opened by the Lord Mayor on Friday. There are at present about 50 subscribers, in each of whose offices is a telewriter, enabling them to transmit written messages and sketches to one another. There are three lines to the

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Central Telegraph Office, and the Post Office has granted facilities to subscribers to send and receive telegrams on the instrument. A description of the apparatus and technical details with regard to the exchange equipment appear in an article on page 447.

AN induction motor with internal starting resistances, which are automatically switched out, is described on page 448.

THERE is a fine display of electrically-driven textile machinery at the Japan-British Exhibition. A few well-known electrical firms have stands in the Machinery Hall, but it cannot be said that British electrical engineering is well represented. (Page 449.)

UNDER Electrometallurgy is given an account of the Lindenberg Steelworks, Remshied-Hasten, which, with its important installation of Héroult furnaces, was visited by the members of the International Congress of Mining and Metallurgy at Düsseldorf. (Page 450.)

JUDGMENT has been given in the Canterbury County Court against the National Electric Construction Co., in which it is laid down that the Canterbury Corporation, having no powers to wire premises and supply fittings, equally has no powers to pay a contractor for doing such work on its behalf. They were, therefore, not liable to pay the company 1d. per unit for the hire of the wiring, which the consumer had refused to pay. (Page 450.)

THE Acton Council have decided to terminate their agreement with the Metropolitan Electric Supply Co. —Leicester Corporation have decided to separate the management of the electricity undertaking from that of the gas undertaking.—After lengthy tests, the Llandudno Corporation have decided not to substitute gas for electricity on the promenade.—Marylebone Council are recommended to abolish the standing annual charge in respect of cooking and heating apparatus.—Manchester tramway accounts for last year show a profit of £149,068. Oldham electricity accounts show a net profit of £2,203, the Luton accounts £3,066, Newport (Mon.) accounts £376, and Hammersmith £3,483. (Page 450.)

EXTENSIONS amounting to £19,872 are recommended at Islington. A turbo-alternator is required at Warrington; mains at Wednesbury; tramcar meters at Cardiff; metal filament lamps at Grimsby, and trolley wire at Manchester. Extensions are contemplated as follows:—Carlisle (£19,600); Bridlington (£2,675); Hammersmith (£15,000); Wednesbury (£327). (Page 451.)

THE whole of the shares provided for under the rearrangement of the British Aluminium Co. have been subscribed for.—The report of the Victoria Falls and Transvaal Power Co. for 1909 mentions a surplus of £50,534, and that the estimates of cost of generation have been fully justified. (Page 452.)

Wireless Telegraph Notes.—The United States Senate have passed a Bill rendering it necessary for all wireless telegraph installations in the United States to be licensed.

The delay in the arrival at Bombay of the steamer *Trieste* has given rise to complaints that more serious attention is not given to wireless telegraph installations by the shipping companies and the Government. Although the *Trieste* was on the steamer route all the time the boat absolutely disappeared from June 14th to July 1st. It is pointed out by the *Times* Bombay correspondent that public wireless stations are necessary at Aden, Karachi, and Ceylon, and that if the steamer had also been fitted it could have been in communication throughout her voyage.

It is stated that the Australian Commonwealth Government have decided to link up Australia, New Zealand, and Fiji by wireless telegraphy. The scheme provides for the establishment of high-power stations at Sydney, Doubtless Bay (New Zealand), Suva, and Ocean Island, and medium-power stations in the New Hebrides and Solomon Islands. The whole of the scheme will be under Government control.

The Bill requiring all vessels sailing from American ports with 50 or more passengers to be equipped with wireless telegraph apparatus by July 1st of next year, has been passed by the House of Representatives. The Bill has already passed the Senate.

PARLIAMENTARY INTELLIGENCE

PROGRESS OF ELECTRICAL BILLS.—The Belfast Corporation Bill and the Wemyss Tramways (Extensions) Order Confirmation Bill were read a third time and passed in the House of Commons on Wednesday.

The Dunfermline and District Tramways (Extensions) Order Confirmation Bill was read a third time and passed in the House of Commons on Tuesday last week.

The Yorkshire Electric Power Bill was read a third time and passed in the House of Commons on Monday last week, and the Leeds Corporation Bill a first time.

In the House of Lords on Wednesday, the Rhondda Tramways, Bradford Corporation, and Middlesbrough Corporation Bills were read a second time, and the Dunfermline Tramways Bill the first time.

The London County Council (Tramways and Improvements) Bill was read a third time in the House of Commons on Monday, and a first time in the House of Lords.

Electric Lighting Provisional Order Confirmation Bills Nos. 1 and 2 were read a third time and passed in the House of Commons on Monday.

In the House of Lords on Monday, the London United Tramways Bill was read a third time.

WIMBLEDON & SUTTON ELECTRIC RAILWAY.—This Bill, which has already passed the House of Lords, was considered last week by a Select Committee of the House of Commons, and finally ordered to be reported for third reading. The line will form a continuation of the existing electric railway of the District Railway Co. at Wimbleodn, and the only opposition before the House of Commons Committee was from the London, Brighton and South Coast Railway, on the question of competition. The capital powers taken in the Bill are £350,000, and the estimated cost of construction is £311,000. The estimates have been approved by Sir John Wolfe Barry. The London, Brighton and South Coast Railway Co. claimed that they had spent large sums of money in catering for the Sutton traffic, and should be left alone—the desire for the new line emanated from a few landowners. The Committee, however, passed the preamble of the Bill.

SOUTHAMPTON CORPORATION BILL.—This Bill, which provides for some tramway extensions and road widenings in connection therewith, was passed by the Local Legislation Committee of the House of Commons last week. The Corporation may borrow £10,440, repayable in 30 years, for construction, and £1,540, repayable in 20 years, for electrical equipment.

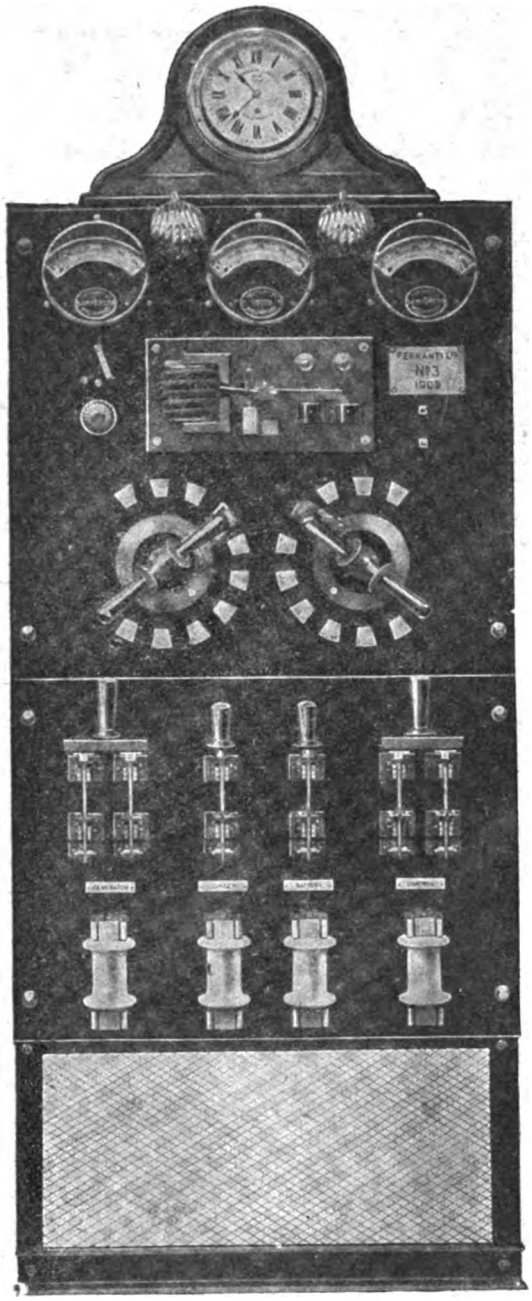
LONDON UNDERGROUND RAILWAY BILLS.—A number of Bills relating to the underground electric railway system of London were passed by the Unopposed Committee of the House of Commons on Friday. These Bills, of which we gave full particulars in our issue for April 14th, p. 252, include the amalgamation of the Great Northern, Piccadilly & Brompton, the Charing Cross, Euston & Hampstead, and the Baker Street & Waterloo Railways. A separate Bill in the name of the latter provides for some alterations to the Oxford Circus Station, including the installation of a moving stairway to carry passengers from the platform to the street level. The Bills have already passed the House of Lords.

METROPOLITAN RAILWAY BILL.—This Bill passed the Unopposed Committee of the House of Commons on Friday. The main proposals are the construction of subways at Moorgate Street, jointly with the City & South London Co. and the Great Northern & City Co.

Physical Society.—Among the Papers down for reading at to-morrow's meeting are "A Thermo-Electric Balance for the Absolute Measurement of Radiation," by Prof. H. L. Callendar, F.R.S.; "On Hysteresis Loops and Lissajous' Figures, and on the Energy wasted in a Hysteresis Loop," by Prof. S. P. Thompson, F.R.S.; and "The Energy Relations of Certain Detectors Used in Wireless Telegraphy," by Dr. W. H. Eccles.

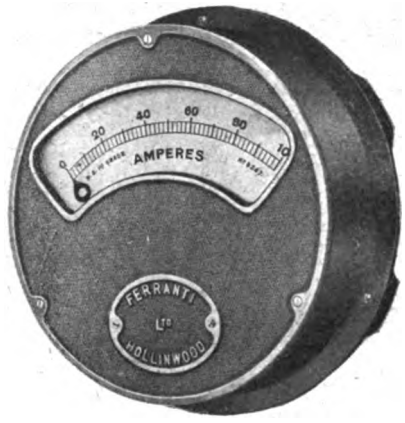
Laboratory Equipment.—A Paper by W. P. Steinthal, accepted for publication in the *Journal* of the Institution of Electrical Engineers, considers the arrangement of experimental electrical circuits for laboratories. The author points out that a battery of accumulators is essential, as it is the only means of providing a steady pressure and also a number of different pressures. The battery may consist of from 30 to 55 cells, and, as the cells will be unevenly discharged, the author recommends the use of two small charging dynamos for half the total pressure each, both coupled to the same motor. For supplying alternating current, a motor generator with a single-phase armature, divided into four sections, capable of being connected in series or parallel, is recommended. For distribution, bar conductors are advocated as being cheapest and most easily adapted to new arrangements. Various ways of arranging the circuits are described, and plug boards for supplying any circuit at any required pressure A.-C. or D.-C., are illustrated. Finally, some recent laboratory equipments carried out on these principles are described with diagrams of connections.

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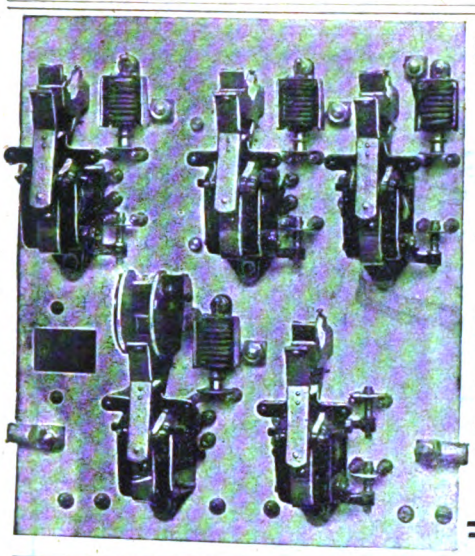


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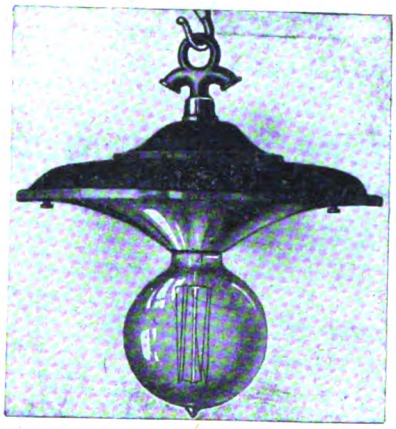
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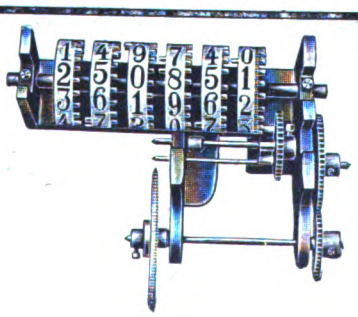
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ELECTRICAL ENGINEERING

IN

MINES

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The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

THE INTERNATIONAL MINING CONGRESS AT DUSSELDORF

THE progress of electricity as a valuable adjunct to Colliery and Iron and Steel Works equipment was emphasised at Dusseldorf from June 18th to the 23rd, when the fifth International Congress of Mining, Metallurgy, Applied Mechanics and Practical Geology was held. It included amongst its 1,400 members from all parts of the world many prominent owners of collieries and works in this country, also engineers connected with such allied industries, whose interest in the transactions will tend towards the improvement of methods of mining and the application of power thereto, besides the fostering of good fellowship between ourselves and the foreigner with similar scientific and commercial interests.

There were 104 Papers read and discussed before the four sections into which the Convention was divided, and over thirty of these contained references to the uses and applications of electricity in the several industries. At one time it was regarded that to light the workings, and drive the small machinery employed below and above ground was the special and only functions of electricity. Since then electric drills, coal cutters, pumps, and haulage gears have become too familiar to need forcing on the colliery owner, but the data and particulars of working these contained in the Papers are most valuable as being reliable information given by the users themselves. The winding engine problem is now deserving particular attention, although most sceptical ideas are still entertained in some quarters in this country regarding the design of electric winding engines and their attendant initial cost and maintenance charges. The installation of these is, however, universal in Germany in the equipment of the more recent and up-to-date collieries.

During the Convention at Dusseldorf special interest was attached to the proceedings, as practical applications of the methods referred to in the contributions could be observed during the visits to the several collieries and works in the district, which were heartily appreciated by the large attendance of members present.

A typical colliery visited was the Rhein Elbe Colliery, Gelsenkirchen. These three pits have a maximum depth of 930 yards, and employ on an average 4,123 men to handle the daily output of 3,059 tons obtained during last year. The output of bye products for 1909 was as follows: 205,234 tons of coke, 3,705 tons of sulphate of ammonia, 10,456 tons of tar, 476 tons of benzol (including tolual and solvent naptha), and 184,770,000 cubic feet of gas. As indicating the extent of the equipment at such a colliery, we give hereunder a summary of the plant installed.

The electrical power plant consists of 3,480-kw. generators with vertical steam engines, and one 3,600-kw. generators with A.E.G. steam turbo-generator. In the main ventilating plant are included two Capell fans and one Rateau fan, with capacities, respectively, of 529,700, 211,900, and 282,500 cubic feet per minute. There are also four reserve fans similar to the last mentioned.

There are two air compressors with a capacity of 317,850 cubic feet per hour each, and one Meyer compressor with a capacity of 176,500 cubic feet per hour, measured at an intake-delivery pressure of six atmospheres. The pumping plant consists of one hydraulic pumping engine with two sets of pumps, raising 660 galls. 1,510 ft. and 2,330 ft., and two electric high-pressure centrifugal pumps, raising 660 galls. 1,610 ft. and 2,330 ft.

The following winding plants are in use: One horizontal double-cylinder winding engine, raising 8 tubs (4·4 tons) 678 yards; one horizontal double-cylinder winding engine, raising 4 tubs (2·2 tons) 754 yards; one electric Ilgner A.E.G. winding engine with 2,750-h.p. motors, raising 8 tubs (5 tons) 1,095 yards; and one electric Ilgner A.E.G. winding engine with 2,840-h.p. motors, raising 8 tubs (5 tons) 875 yards.

Among auxiliary plant may be mentioned one rope-way conveyor for coking coal (875 yards long), and in the stock yard, which is capable of storing 20,000 tons of coal, a crane bridge and ropeway for loading and discharging. The central condensing plant is capable of dealing with 50 tons of steam per hour. There is also a central superheater for utilising waste steam from coke ovens, and a gas works producing 2,119,000 cubic feet of coal gas per day with a gas-holder 7,000,000 cubic feet in capacity.

The boiler plant consists of five coal-fired Lancashire boilers (each 1,076 sq. ft. heating surface), 16 eccentric gas-fired corrugated flue boilers, each of 1,076 sq. ft. heating surface; four gas-fired Lancashire boilers, each of 1,076 sq. ft. heating surface; six coal-fired Machicol boilers, each of 3,230 sq. ft. heating surface; two coal-fired Lancashire boilers, each of 1,076 sq. ft. heating surface; and one coal-fired Cornish boiler of 1,076 sq. ft. heating surface.

The bye-product plant comprises 80 bottom-fired ovens, with recovery plant for ammonia, tar, and benzol, and 80 Otto regenerating ovens, with recovery plant for coal gas, tar, and ammonia. Underground haulage is performed by horses, also by benzol and compressed air locomotives. A fully equipped rescue corps of 57 men are employed for rescue, fire extinction, sanitation, and watchmen's duties, whilst there are 39 volunteer reserve men for similar work.

Some notes on the Lindenberg Steelworks, Remscheid Hasten, with its important electric furnace equipment, which was also visited by members of the Congress, will be found in another part of this issue.

At the concluding meeting of the Congress, held at Essen, it was unanimously decided to accept the invitation to hold the next Congress in London, which will take place there in 1915, and it behoves us to make great progress during the intervening period if we are to be in a position to equal the enterprise and hospitality of our friends in Germany.

A number of the papers read referred to electrical working in mines. In the course of a paper read in Section I. by Dr. W. Kohlmann (Diedenhofen) on **The Development of the Mining Industry in the Minette District**, it was mentioned that the necessity of providing compressed air for drills was inconvenient, as it was only used for this purpose. The Siemens & Halske rotary drill had been used to some extent, but in the author's opinion the drill of the future was the electrically operated percussion drill, the majority of the Minette mines having at their disposal a cheap supply of electrical power from the adjacent smelting works, and there being no difficulty in the way of laying electric cables in the mines. However, up to the present the available forms of electric percussion drills did not fulfil the requirements of the work. In the underground haulage, which presented no difficulty, the haulage roads being wide and usually straight, electric locomotives and endless ropeways had largely replaced horse traction during the past few years. In another Paper, by Paul Nicou (Nancy), on **The Present Situation of the Mining Industry in French Lorraine**, recorded the increasing use of electric power. Most of the new winding plants in the Briey mines are electric, and electric power, derived usually from turbine driven stations, is employed on a large scale for underground pumping, haulage, and drilling. Power drills were extensively used in the new mines at Briey, and enabled the winning of the ore to be carried on at a much quicker rate than was possible with hand drilling. Up to the present, electric drills were mainly used, though pneumatic percussion drills were employed in some cases.

Electrical pumping was dealt with in a paper by Herr

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Schultze (Essen). He described a particularly compact electrically operated plunger pump of Haniel & Lueg, Düsseldorf, at work in a shaft of the Zollverein colliery. The machine, which is able to raise 138 gallons of water per minute against a total head of 1443 ft., consists of three single-action plunger pumps. The whole set is so compact, though accessible in every part, that the foundation occupies a space of only 6 ft. 6 in. by 10 ft. 6 in.

A Paper by F. Schember (Vienna) reviewed **The development of machine coal cutting.** The first coal cutting machines consisted of picks driven into the coal by means of mechanical gearing: hence their name, "hewing machines." These machines were used in England, America, and Germany. Subsequently the rotary and chain types of machines were introduced. The author classified the various machines in use in different countries, and pronounced the opinion that where longwall working is practised the "Pick Quick" bar machine of Mavor & Coulson, Glasgow, is the machine of the future, and for all other purposes where undercutting is at all possible, the Eisenbeis Universal undercutting and nicking machine of the Duisburger Maschinenbau-A. G., formerly Bechem & Keetman, Duisburg. Another Paper in the same section, by G. von Hanffstengel (Leipsic), urged the more extended use of electrically driven wire ropeways, and mentioned cases where considerable economy had been obtained by their use.

In Section III. one of the papers of interest to electrical engineers was that by F. Heym (Welter, Ruhr) on **The influence of electricity on the development and efficiency of lifting appliances in mining and steel works.** The introduction of electricity as motive power enabled the working speeds of cranes, &c., to be increased considerably and to extend the applicability of hoisting machines, owing to the convenient transmission of power and supply of the current. The result was an increase of the production and increased demands of the efficiency of the transporting appliances. By electrical driving it was possible to operate the different motions with precision and rapidity from any desired point. On account of the centralisation of the generating plant thus made possible, the working expenses were reduced, and it was feasible to adopt mechanically driven lifting appliances for dealing with work, where their application previously was not economical. Electric winders, circular waggon tips, waggon tipping devices, and loading bridges effect the transport of the material raised from the mines, almost dispensing with the attendance of workmen. Where it would not pay—owing to the small amount of work to be coped with—to adopt large loading bridges for the transport of bulk goods, telpher lines, &c., with single travelling trolleys are provided in their place. In blast furnaces the transport of the materials to the mouth of the furnace is almost exclusively carried out by means of inclined electrically driven hoists, which render no workmen necessary on the charging platform. The capacity of these hoists has already attained some 2,200 tons of coke and ore in a shift of eighteen hours. In steel works and rolling mills special types of cranes have been adopted for each sort of work. Special cranes serve for filling and transporting the boxes in openhearth plants and for charging same into the furnace. The casting cars travelling on the floor are now almost entirely displaced by overhead casting cranes running at high speeds. For stripping the ingots from the moulds and transporting same to the soaking pits and reheating furnaces, as well as for loading the half-finished and finished products, special cranes with tongs, lifting magnets, rotary and tilting grippers are now constructed. The use of lifting magnets, which obviate the necessity of sling chains or tongs, has been especially developed. By employing a lifting magnet in handling scrap and similar materials, the manual labour is almost dispensed with and consequently large savings are effected.

Papers read in the same section by Dr. Hoffmann (Bochum) and Prof. Langer (Aix-la-Chapelle) dealt respectively with the control and governing of steam engines and experience with large gas engines. K. Maleyka also read a paper in this section on electricity in metallurgical work, which was confined to the giving of a review of the forms in which electric energy finds application in metallurgy, and to the pointing out of the peculiarities of the most important branches of work without going into details.

The following is an abstract of a paper read by W. Philippi (Berlin) on **Electricity in mining**:—After a short introduction regarding the extension of the application of electrical machinery in mines in Germany, attention is first paid to the question of the most economical generation of electric energy, and the ways of reducing the generating costs in mines are mentioned. In connection with the details of electric mining machinery, the small underground installations, such as for lighting, boring, coal cutting, and, further, for small hoists, are first treated. The advantages of the electrically driven boring machines as compared with those using compressed air as motive power, are gone into to some extent. The chief part of the paper deals with pumping plants, ventilators, and large winding-engines. Under the first mentioned subject special attention is given to the sinking pumps, on account of the particular advantages which electricity possesses as motive force for these. The stationary pumps are divided into electrically driven plunger pumps and electrically driven high-pressure rotary pumps. The advantages and disadvantages of the two types are shown in detail. As regards the ventilators the chief attention is presently fixed on the problem of finding means of regulating the quantity of air, and in connection with this problem the interest centres about the method of regulating through converters, whereby the energy presently wasted in regulating by means of a resistance inserted in the rotor current is utilised. A considerable improvement in the efficiency, combined with reduced speed of revolution, is hereby obtained. The important subject, the main shaft winding machine, is viewed from the point of safe working, first cost, and running expenses. In spite of the endeavours to find other arrangements, only installations after the Ward Leonard system can as yet be regarded as in every respect irreproachable. The most important details in connection with the question of safe working are mentioned, and some particulars are given demonstrating the reliability hitherto attained in this direction. As regards the first costs, it is important that a thorough comparison be made with other systems. The points which hereby come in question are discussed to some extent, and, at the same the question of placing the winding engine in the hoisting framework is particularly treated. Under running expenses, particulars are given illustrating the degree of efficiency attained by Ilgner installations, whereby the most important facts are the average yearly results obtained on basis of reports from the managing departments of mines. The reasons of the economical superiority of the electrical winding-engines, particularly those of the Ilgner type, are pointed out and explained.

Prof. Rateau (Paris) read a paper on **Exhaust steam and mixed-pressure turbines.** The first mixed-pressure turbines were made with two bodies, one for high and the other for low pressure; the present turbines comprise, in a single body, a range of high pressure wheels and another range of low pressure wheels; the exhaust steam enters an annular port between the two ranges. The regulation of these engines is not merely obtained by the speed governor, as in that way the steam from the accumulator would flow freely into the turbine, and its pressure would fall very low for high pressure operation; moreover, this method of regulation requires speed variations that would render impossible the parallelism alternators driven by mixed-pressure turbines with those of the other groups. Prof. Rateau solved the problem by causing the speed governor to act upon both inlet valves together, the latter controlling each other without acting on the speed governor. A spring tends to hold the low-pressure valve open, and, consequently, close the high-pressure valve. On the other hand, the low-pressure valve is subjected to the pressure variations of the accumulator as soon as said pressure sinks beneath a certain value. The movements it receives are, at the same time, transmitted to the high-pressure valve, which enables one kind of steam to be replaced by the other, without the speed varying.

Prof. Rateau then points out an objection that was made regarding high pressure operation of mixed turbines, and shows that by a suitable selection of the number of wheels, an efficiency can be obtained with these turbines which is equivalent to that of high-pressure turbines.

Underground Haulage was the subject of a paper by F. Tillmann (Saarbrücken). The author said that continuous-current overhead trolley locomotives had proved their economy, and more lately single- and three-phase mining locomotives had come into use. Accumulator locomotives were not quite as economical, but rendered electrical haulage available where overhead wires were not provided. Locomotives were confined to horizontal galleries, but electrical rope haulages would be used either on inclines or on the level, and were just as economical, or, in favourable conditions, even more so.

Another paper in this section by E. Stach (Bochum) discussed various designs of heat-storage tanks for the utilisation of exhaust steam.

New Electrical Colliery Plant.—An installation, including a Sulzer steam turbine-driven generator, has been inaugurated at the Deep Navigation Colliery of the Ocean Colliery Co. at Treharris for driving underground haulages and pumping plant.

Visit to Lindal Moor Mines.—On Saturday, June 25th, the members of the Cumberland Branch of the Association of Mining Electrical Engineers took advantage of the kind invitation of Messrs. Harrison, Ainslie & Co. to visit the Lindal Moor Mines, near Ulverston (Lancashire). The party were met by Mr. Leck, H.M.I. of Mines, and Mr. Butler, mining engineer to Messrs. Harrison, Ainslie & Co., and Mr. Batstone, chief electrical engineer, assisted by Mr. Hy. G. Denham and Mr. Hampson, piloted the party through the power-house. The plant comprises three turbo-generators having an output each of 795 kw. at 3,350 volts, and is practically all used for pumping purposes at the numerous ore mines in the vicinity. After inspecting the plant the visitors were entertained to lunch by the company. The visitors then proceeded to view some of the underground pumps. The next inspection will be to the Greenside Mines on Monday, July 25th.

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GAS-DRIVEN GENERATING PLANT FOR COLLIERIES

A PAPER by Mr. R. Crawford and Mr. N. Moores entitled "Power Production at Collieries, with special reference to gas power and electrical centralisation," was read at the Dunfermline meeting of the Mining Institute of Scotland on June 11th. The authors referred to great waste of fuel which occurs at many collieries, mentioning that the amount used for power purposes at the collieries in this country averaged 7 per cent. of the total output. They spoke of the great reductions in the consumption which had already been made through the adoption of electrical pumping, ventilation, haulage, coal-cutting, &c., and the displacement of small steam units, and the work that had been done by the introduction of low- and mixed-pressure turbines so arranged as to utilise the large amount of exhaust-steam from the winding engines, and to a less extent from haulage and other engines about the colliery. They instanced the case of the Fife Coal Company, which has six mixed-pressure turbines at work, of a total capacity of 5,800 horse-power, and said that, under good conditions, assisted by a heat-accumulator, and a 29-inch vacuum, a low-pressure turbine will effect an economy of about 40 per cent. over the results obtained with a non-condensing reciprocating engine. Whilst a good deal of attention has been devoted to electrical centralisation of power at large collieries by means of exhaust-steam turbines, it is found, he continued, that much higher economies can be obtained by converting the fuel into gas for the purpose of driving gas-engine electrical-generating sets, from which energy would be transmitted at high tension to the machinery at outlying pits. It was in this direction, they thought, that colliery managers must look for the highest possible economies.

The Paper then proceeds to describe in detail various forms of gas-producer plant, including non-bituminous pressure plants, non-bituminous suction plants, bituminous pressure plants, and the more recently introduced bituminous suction plants, such as Messrs. Crossley's, with two separate fires, the first producing carbon dioxide (CO_2), containing the usual large percentage of volatile matter which would condense into tar if cooled. This gas is led off in the form of a down draught to the lower fire, which is kept supplied with coked fuel from above from which all the volatiles have been distilled. Here the carbon dioxide unites with a further supply of carbon and becomes carbon monoxide (CO), whilst the volatiles are converted by the high temperature of the second fire into fixed gases. The gases then pass on through scrubbers in the usual way, in which they are cooled and cleansed ready for use in the engine. The Mond plant was also described, with its bye-product recovery features, and was stated to be quite suitable for utilising colliery duff or gum-coal, screen-pickings, and inferior coal occasionally found stratified with the coal-seams, which in the ordinary course of the working of the seams is stowed as waste. The advantages of the flexible electric agent between the central station and the outlying collieries were too evident to be questioned, and in most instances this medium of power transmission would be preferable to the transmission of the gas in pipes to gas-engines working at the outlying pits.

The authors then proceed to work out an estimate for a 5,000-kw. gas-driven colliery generating station. Assuming coal of an average quality of 13,000 British thermal units per pound, and a gas-producer efficiency of 75 per cent., each pound of coal gasified will yield 9,750 British thermal units, available in the engine cylinder. Taking the consumption as 9,350 British thermal units, with a dynamo efficiency of 90 per cent., this is equivalent to 1·42 pounds per kilowatt-hour at the switchboard; and with duff at 2s. per ton, this shows a fuel cost of 0·015d. per Board of Trade unit. The capital outlay involved in a gas-power station of 5,000 kilowatts, comprising Mond gas-plants with ammonia-recovery apparatus, multi-cylinder gas-engines of, say, 1,000 kilowatts each, direct-coupled generators, buildings, foundations, &c., is approximately £17 per kilowatt, or a total of £85,000. Such a plant, working on a load-factor of 60 per cent., would generate 21,600,000 kw.-hours per annum, during a working year of 300 days of 24 hours each. An allowance of 15 per cent. will cover interest, depreciation, and insurance, and a sum of £4,600 has been set aside for labour, acid, stores, and renewals. The coal consumption on 21,600,000 units at 1·42 pounds per kilowatt would be 13,692 tons per annum costing £1,369. On this basis the cost of production is found to be 0·20d. per Board of Trade unit at the switchboard, from which the bye-product revenue must now be deducted. Assuming a yield of 95 pounds of sulphate per ton of coal gasified, the recovery would be 585 tons per annum. This represents, at £11 10s. per ton, the sum of £6,727, whilst the yield of tar might be expected to realise a further £584. On deducting these amounts from the gross cost, the net cost of electricity will be found to work out at the very low rate of 0·12d. per kilowatt-hour. This would be still further reduced to 0·11d. per unit if screen refuse were used instead of duff.

The Paper then deals with the utilisation of waste gas from coke ovens, and a case is worked out where not only is power obtained for nothing, but a profit, representing a return of 50 per cent. of the capital spent on the undertaking, is obtained.

ELECTRICAL POWER IN A FRENCH COLLIERY

AN account is given in *l'Electricien* of an electrical power equipment at the Portes and Sénéchas Mines at Alais, in the Gard district in France. The general arrangement of the pits in question is somewhat peculiar, and in former times the pumping was done by steam, and the boiler-house, which was at the surface, was connected to the underground pump-room by steam pipes over 1,600 ft. in length taken down an inclined gallery. The exhaust steam was also taken up the same gallery. Owing to the excessive condensation, the efficiency of system was very bad, and owing to the high temperature which the gallery attained, there were great difficulties in keeping the joints in order. It was this that influenced largely the decision in 1901 to adopt electric power, first for pumping and latterly for other services in the group of mines of which this is one.

The central station contains two 110-kw. steam-driven alternators, and a similar set for 300 kw., all generating at 1,000 volts three-phase 46 cycles. The two smaller machines are provided with heavy flywheels to assist in load equalisation. A Tirrill regulator is employed to keep the voltage constant, and it is stated that this has been very successful in screening the system from the effects of the variable demand of the winding plant. For surface lighting and auxiliary power purposes, a transformer reduces the supply pressure to 110 volts.

The principal purposes for which electric power is now used include the main shaft winder of the central pit, the underground pumps already referred to, a ventilating fan, a washing and screening plant, and an underground auxiliary winder for sinking. Transmission on the surface is partly by cable and partly by overhead lines.

The head of the main shaft of the central pit does not rise directly to the surface, but is connected to an opening at the foot of a hill, under which is the shaft, by a horizontal gallery 2,300 ft. long. There was formerly a steam winding plant at this underground shaft-head, worked by underground boilers, but afterwards on account of a serious explosion, supplied with steam through pipes along the gallery from a surface boiler-house. In 1907, however, when further sinking of the shaft was to be carried out, winding plant of increased capacity was required, and the opportunity was taken to adopt electrical working. The winder was electrically equipped by the Allgemeine Elektricitäts-Gesellschaft, and is driven by a three-phase induction motor through single reduction spur gearing. The winding drums are of the narrow form to accommodate a flat rope in a single spiral series of layers, an arrangement much favoured in France and Belgium. A normal load of 3 tons per wind is hoisted from a depth of 1,215 feet, and the rope speed is 19·7 ft. per second. No load equalising device has been thought necessary, and the speed regulation is effected by a liquid rheostat in the rotor circuit. The electrolyte is kept in constant circulation by an electrically-driven pump, and the resistance is varied by altering the level of the liquid while the plates are fixed. Cooling water pipes are provided in the electrolyte. One lever controls the supply, interruption, or reversal of current, to the stator, and at the same time regulates the speed by acting on the valves admitting the liquid to the rheostat tank, and the rate of acceleration is limited by the capacity of the pump. A second lever controls the brakes, which are applied by a counterweight, and held off by compressed air. A voltmeter, an ammeter, a pressure gauge, and a Karlik speed recorder are placed immediately in front of the driver, and the last-mentioned is fitted with alarm bells, which can be set to ring immediately the maximum speeds allowed for winding coal or men respectively are exceeded. The depth indicator carries a catch, which automatically returns the control lever to the off position when the cage is approaching the surface, and a further catch prevents overrunning by breaking a control circuit, and thus opening the main circuit, and at the same time opening the brake air valve. In case of emergency the driver can produce the same effect by means of a pedal. Failure of the current supply also applies the brake in a similar way, and another feature of the arrangement is the provision of a pedal which prevents accidents due to the driver leaving his post during a wind, as its release interrupts the current and applies the brake. A further safeguard against overrunning is found in a limit switch actuated by the cage itself. It should be remarked that in this system, the three-phase winding motor gives a braking action automatically, and returns power

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to the line as soon as there is any rise of speed above synchronism.

Electric pumping is also employed for drainage. The oldest set is a three-throw pump running at 60 r.p.m. through gearing, and a flexible coupling by a 120 h.p. 1,000-volt induction motor, which runs at 457 r.p.m. This set has a capacity of 2,400 galls. per hour, against a head of 650 ft. The other set is a Rateau centrifugal high-lift pump, capable of raising 2,500 galls. against the same head, and direct driven at 2,735 r.p.m. by a Boucherot three-phase motor with two stators. Tests have shown an overall efficiency of the older set of 79 per cent, against only 68 per cent. of the centrifugal pump and motor, but the convenience of the latter in the matter of small space occupied and light foundations required, together with the decreased cost of attention and maintenance, give it considerable advantage. Similar centrifugal pumps of slightly smaller size are used in the north and south pits.

There is a small auxiliary winding engine for sinking purposes lower down the main shaft of the central pit, and this is also driven by a Boucherot double stator motor. Further applications of electrical power comprise the driving of the main fan of the central pit by a 120 h.p. induction motor through a belt, and the plant for washing, screening, &c. In the latter case the entry of dust into the motors is carefully guarded against, and the motors are situated in separate rooms. There is also an electromagnetic separator for removing pieces of iron from the broken coal passing to the briquette factory, which used to give considerable trouble. Various other small motors are run from the 110-volt circuit, which also supplies the surface lighting. The centralisation of the power supply has been found to result in economy of a kind impossible before.

ELECTRIC POWER IN COLLIERIES

A PAPER by Mr. F. Anslow, entitled, "Some Considerations affecting the installation of Power at Collieries," was among those discussed at the meeting at Dunfermline of the Mining Institute of Scotland, on June 11th. Mr. Anslow, in dealing with existing steam plants at collieries, said that these were often destitute of condensing plant, partly on account of difficulties in running winding engines condensing, but he showed that in most cases, except where increased power is required, the cost of adding condensers to improve the economy was not justified. Where extensions are required, however, condensing plant and exhaust, or mixed pressure turbines driving electrical generators, will render considerable extra power available without extra steam being required from the boilers. Details were given of a case where an extra 500 kw. was thus made available. Even where a large proportion of steam plant is already condensing, considerable extra power can be obtained by the installation of mixed pressure turbo plant, and particulars were given of an example to illustrate this.

Passing on to speak of the electrical system to be employed, the author said that in certain parts of England and Wales some advantage might conceivably be gained by converting some of the existing direct-current systems into alternating; but in Scotland the conditions were different, and attention should rather be concentrated upon the question of rendering existing installations safer. Accidents due to the iron supports which were in common use in Scottish mines becoming live were too frequent.

Mr. Anslow then reviewed several general points concerning electrical installations in mines. The possibility of shock, he said, could be comparatively easily eliminated in all generating, motor, and other plant by earthing, with the exception of coal-cutters, which were more difficult to deal with. The greatest danger of shock, however, was from the cables, and this is particularly prominent in Scotch mines, owing to wet, and the low seams which leave little room for the cables. Armoured and unarmoured cables both possess advantages; whichever type was adopted, great care in the installation thereof, with constant supervision afterwards, was the essential and only safe manner of dealing with cables, if fatal accidents were to be avoided.

With regard to automatic protective switchgear, he thought that it was better to rely on constant supervision and the "man" element, than to be lulled into false security by devices which may fail when required. To earth or not to earth, he continued, is at present a great question, and there are many advocates both for and against. Too frequently, however, it is answered by a most unhappy compromise of partial earthing. If earthing be attempted, it must be carried out effectively, and, generally speaking, two main earth-plates should be employed, one on the surface, and one below-ground, in the shaft-sump or other suitable position. These two plates should be connected together by a main wire, which should run the full extent of the installation, and all electric apparatus and metallic work in connection therewith should be connected to it by wires of suitable section. The alternative of a number of local earth-plates is sometimes preferred. The difficulty in this system is to obtain a good earth, and the main wire would appear to offer on the whole the best solution.

Passing on to the relative advantages of continuous and alternating current, he spoke of the superiority of continuous current working for winding engines, especially in the larger sizes, where an energy equalising system was usually necessary. For fans and pumps either system is suitable, but where variation of speed is required, the former is preferable.

Haulage-gears can be operated by either system with equally satisfactory results. From a working point of view, direct-current coal-cutters are superior to those operated by alternating current, but the latter type has proved itself quite reliable and satisfactory in working. Reference was also made to the working of groups of compressed air machines supplied by an electrically-driven compressor near by.

Discussion.

Mr. R. A. Muir (General Manager of the United Collieries, Ltd., Glasgow), said that they had found exhaust steam turbines at one colliery a valuable acquisition. They were used in conjunction with winding engines, as electricity was generally most required during the hours when the winding engines were most used. Among improvements made in exhaust steam plant of late years was the addition of the impulse type of blading to the original Parsons pressure blading with the consequent reduction in length and size generally. Mr. Muir had had no experience with gas at any of his colliery works, but he was quite certain that if he had gas he would not employ a gas engine, but would burn the gas under the boilers and use steam turbo-generators. His own electrical experience had been almost entirely with three-phase work, and he agreed entirely with Mr. Nelson's preference for three-phase supply and armoured cable. He thought that for pit work the employment of good armoured cable, well earthed throughout, was the safest system to adopt. While he agreed that working in thin seams might lead to the adoption of direct-current coal-cutters in preference to three-phase occasionally, he still thought that it would soon become possible to get three-phase machines for any class of seam. Mr. Muir referred to the occasional difficulty of getting a converted private plant to fit in with the system of a supply company, especially in the cases in which the supply company had adopted an abnormally low periodicity. His experience had been that in colliery work the greatest difficulty one experienced with either D.C. or A.C. work was with the switchgear, which, as a rule, did not long stand the onerous conditions satisfactorily, and he thought that makers had still some distance to go in this respect. Controllers also were usually a source of constant trouble, and should be constructed so as to be water-tight, and yet provided with means for carrying off any heat generated in enclosed resistances.

Mr. E. Gray (Lumphinnan Colliery, Fife Coal Co.), spoke briefly on the difficulties of earthing coal-cutters satisfactorily, and Mr. Harold Moores asked a question relating to the efficiency of a combined reciprocating and turbine set.

GOVERNMENT CONTROL AND INSPECTION OF MINES

ON Thursday, June 16th, the attention of the House of Commons was occupied with the question of inspection of mines in connection with the Civil Service Estimates. The subject was introduced by Mr. E. Edwards, who urged that the number of mining accidents called for a more vigorous enforcement of the mining laws, augmentation of the number of inspectors, establishment of rescue stations in every district, and encouragement by the Government of experimental research. A number of members spoke in favour of an increase in the inspection staff, and the granting of a special sum for conducting experiments as to the causes and results of explosions, as asked for by the Royal Commission. Mr. Atherley Jones, in particular, asked that steps should be taken to allay the dangers from coal dust in mines, as this was a frequent cause of explosions. The use of electricity in mines should also be carefully watched. He enlarged upon the dangers in connection with coal-cutter trailing cables.

Mr. Winston Churchill, in replying to the debate, after referring to the Whitehaven disaster, said that the Royal Commission was still at work on the subject of coal dust. As to the recommendations contained in the reports of the Commission already issued, they would, with many others designed to secure general safety, have to await a new Coal Mines Regulations Act. A Committee was at work with a view to revising existing regulations on the use of electricity in mines. The Royal Commission was unanimous in recommending that the staff of inspectors should be strengthened. He was prepared to take steps to strengthen the inspectorate, and he hoped to announce without delay an outline of the steps to be taken in that direction.

Mr. Markham, in referring to the question of electricity in mines, asked whether legislation would be necessary to give effect to the recommendations of the Committee considering the subject, to which Mr. Churchill replied that no effect could be given to their recommendations by making new orders under the existing Act. Mr. Edwards finally withdrew his resolution.

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HUCKNALL COLLIERY BATTERY PLANT

At the meeting of the Institution of Mining Engineers in London on June 2nd last, a Paper was read by Mr. W. Maurice, general manager of the Hucknall Torkard Colliery, Notts, describing the storage-battery plant at that colliery. The battery plant is used for the supply of direct current in a pit (No. 1 Pit) in which the original small D.C. generating plant had become insufficient to cope with the load, and the power transmitted to the battery plant is the surplus from a generating plant supplying a three-phase system in another (No. 2) pit about 1¼ miles distant. The accompanying diagram shows the arrangement. The 110-kw. Rateau exhaust-steam plant, *A*, generates three-phase current at 500 volts, and supplies underground haulage gear in No. 2 Pit with a fluctuating load varying between zero and the full output of the generator. A 90-kw. transformer, *B*, steps up the pressure to 3,000 volts, and the surplus power is transmitted over an overhead line to No. 1 pit, where it is converted to direct current by means of a motor-generator set. This consists of a 3,000-volt synchronous motor, *D*, coupled to a 50-kw. 500-volt compounded D.C. generator, *E*. A Lancashire reversible booster, *F*, for automatically regulating the working of the battery, is coupled to the same shaft. The battery, *G*, consists of 240 Tudor cells with a total capacity of 400 ampere-hours on the 10-hour rate, or 236 ampere-hours on the 1-hour rate. Provision has been made for a 50 per cent increase in capacity by placing the nine plates of each cell in

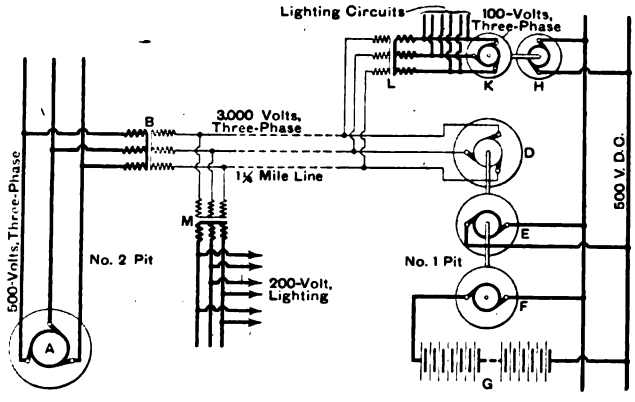


Diagram of Connections of Generating and Battery Plant.

glass boxes of sufficient size to contain 13 plates each. For the purpose of supplying the A.C. lighting loads of both pits from the battery when the generator, *A*, is shut down, a small motor-generator set, *H*, *K*, has been installed. *H* is a 500-volt D.C. motor, and *K* is a 5-kw. 100-volt three-phase generator connected to the H.T. line through a transformer, *L*. The lighting circuits at No. 2 Pit are supplied at 200 volts A.C. through the 3,000/200-volt transformer, *M*, and those of No. 1 Pit and of the adjoining offices and private houses are supplied at 100 volts A.C. from the generator, *K*, or through the transformer, *L*, when the main generator is running. The small original D.C. generating set in No. 1 Pit has been retained, and is electrically connected to the battery plant; this machine is generally used as a motor to drive a 36-in. circular saw, but it can be driven as a dynamo by the original steam engine, and then assists the battery plant.

During the time when the generator, *A*, is running—usually 16 hours per day and five days per week—the generator set, *D*, *E*, *F*, also runs, the generator supplying the power-load at No. 1 Pit, and at the same time charging the battery through the booster, *F*. Whenever the haulage-load on set *A* increases, the motor-generator tends to drop its load, and the charging-current supplied to the battery falls off. In case of a heavy overload on the haulage, the motor-generator reverses, taking current from the battery and supplying power back to the generating station to assist the generator, *A*. Any fluctuations in the power-load at No. 1 Pit are meanwhile taken care of by the automatic reversible booster, so that all the fluctuations are taken up by the battery, the output of the [illegible] current generator not being affected. Thus the gener[illegible] *A*, is kept running at or near full load; the mot[illegible] supplies power to No. 1 Pit, and any surplus is [illegible] battery. When the battery is fully charged, th[illegible] set is shut down, and the power-load at [illegible] from the battery for the remainder.

The motors on the three-phase [illegible] a 50-h.p. endless-rope haulage gear, two 30-h.p. haulage gears, a 15-h.p. saw, and several small machines; including a motor-generator for working the underground signals. There are also about 280 16-c.p. incandescent lamps. The direct-current motor-driven gear in the No. 1 Pit comprises three 15-h.p. coal-cutters, a 40-h.p. emergency winding set, a 20-h.p. haulage gear, four 10-h.p. screens, a 10-h.p. workshop motor, and six smaller motors. Some 250 16-c.p. lamps are connected. The total rated horse-power installed in the two pits is about 300. The installation has now been in daily operation for a year and a half, with entirely satisfactory results.

Discussion.

Mr. W. C. Mountain (Messrs. Ernest Scott & Mountain, Ltd., Newcastle), pointed out that credit was due to Mr. Maurice as being one of the first to introduce exhaust steam turbines. It was interesting to see that the 300 h.p. of motors installed could be supplied by the one 100-h.p. generator. The system adopted was inevitable in view of the D.C. machines already in use, and the desire to store the surplus energy. He would like to see the load-curve of the battery; he estimated that it could deliver 20 h.p. for 10 hours, 50 h.p. for three hours, or 119 h.p. for one hour. Personally, he would not care to put a battery into a colliery. Five or six years ago a battery in a German colliery, which cost £9,000, had to be scrapped after less than one year's working. The efficiency of the Hucknall plant did not seem to be very high. Assuming 15 per cent. loss in the generator, 10 per cent. in transmission, 15 per cent. in conversion, and 20 per cent. in the battery, the overall efficiency at full load came out at only 52 per cent. Finally, he asked Mr. Maurice for figures of output, input, cost, and upkeep. He doubted the benefit of using a battery unless it were in the hands of a really competent man.

Mr. D. Selby Bigge suggested that it would have been more economical to increase the turbine generating plant, providing that there was more exhaust steam available, using a motor-generator to supply the D.C. motors in Pit. No. 1. The first cost of such a plant would, he thought, be immeasurably less than that adopted, which must have a very high cost per kw. It showed, however, how the energy of exhaust steam could be stored when it was not wanted.

Mr. G. C. Allingham said that the extensive use of the three-phase system was largely a fashion, and he welcomed the Paper as it showed there were special advantages in the D.C. system. It was impossible to store electrical energy without first converting to direct current. Mr. Mountain had stated that a battery needed a highly competent attendant; he knew of many cases where small storage batteries were working very satisfactorily without skilled attention. In some cases, on A.C. systems, it had been found advantageous to convert to D.C. for storage, and back again to A.C. for use. The reason why additional turbine plant had not been put in seemed to be that exhaust steam was not available all day and on every day of the week.

Mr. W. Maurice stated that he would give the information asked for by Mr. Mountain in his written reply. He mentioned, however, that though more exhaust steam was available, he did not put in additional turbine plant, as it would have cost very much more than the battery plant, including the transmission line. He had arranged with the Tudor Co. for a ten-years' maintenance contract at a very low rate, and that fact rather disposed of the arguments against the satisfactory working of the battery. He did not think that the cost per unit generated was of much importance in colliery work.

Lancashire, Cheshire, and North Staffs of the A.M.E.E.—On June 3rd the Hulton Collieries were visited, including the new pits at Atherton. Mr. Tonge and his assistants conducted the party over the works to view the electrical plant. At the close of the visit a vote of thanks was passed to Mr. Tonge and the directors for their kindness. June 4th was set apart for visiting the Manchester Corporation electricity works (Stuart Street), and the Manchester School of Technology. Here, also, a very pleasant and instructive time was spent. A very able guide was found at the electricity works in Mr. Wallis (a member of the staff), who was always ready to explain the numerous pieces of mechanism used there. At the School of Technology, Mr. Shaw, who is one of the demonstrators in electrical engineering, took the party in hand, and explained each instrument used in the various branches of electrical engineering.



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EARTHING OF COLLIERY APPARATUS

AT a meeting of the Warwickshire and South Staffordshire Branch of the Association of Mining Electrical Engineers, on Saturday, June 4th, at the Imperial Hotel, Birmingham, Mr. J. B. ENGLISH (Walsall Wood), gave the results of some experiments in connection with the earthing of coal-cutters. The system he used was two-wire D.C., with a pressure of 440 volts between the conductors. The insulation of the positive main was 110,000 ohms, and of the negative 55,000 ohms. Between the positive and the machine frame the potential difference was 25 volts, and between the negative and frame 16 volts. With the positive terminal to frame 7·0 milliamperes passed to earth, and with the negative terminal to from 4·7 milliamperes. It was remarkable that, when a special earth wire was run to earth, the frame, no difference was found in the results given above. As a result of a further experiment it was found that a spike 12 inches into the ground afforded an earth of lower resistance than a plate. With the negative cable efficiently connected to earth, and the positive direct to the frame of the machine, the current passing to earth was 5 amps.; with the positive connected to the plate 0·05 amp. passed, and with it connected to the spike 7 amps. passed. When the positive cable was connected to the frame, the potential difference between the frame and a plate laid in the ground was 390 volts, and between frame and a spike driven into the ground, 420 volts. He drew the inference that if the insulation of a D.C. system is good there is no need for earthing, but as it is impossible to ensure good insulation throughout a mine, it is advisable to efficiently earth both portable and fixed machines. As regards the method of earthing, armoured cables were advocated by many, the armour

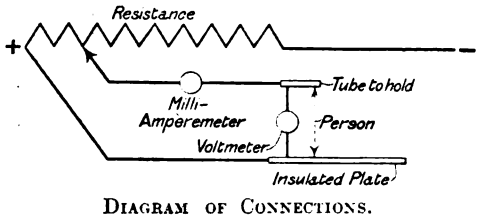


DIAGRAM OF CONNECTIONS.

being used as earth wire. In his opinion armoured cables were unwieldy and wanting in flexibility; the insulation was also liable to be pierced by the armour. He preferred providing a separate earth wire wormed up with the conductors, the whole being protected by a braiding of leather or cord. He had found cord both durable and very flexible.

Mr. W. FOSTER then read a Paper entitled "A Few Notes on Earthing." He started by describing the measurements he had made to determine the maximum pressure permissible in the earthing system. The arrangement is shown in the figure. The variable resistance had a value of 200 volts, and the pressure of the circuit was 500 volts D.C. The first reading was taken as soon as the person felt the current, and continued until the maximum was reached, which the person would stand voluntarily. Seventy-two tests were made. A few samples of these are given below :—

Volts.	Amps.	Ohms.
110	0·12	916
74	0·22	336
55	0·3	183
36	0·25	144
32	0·3	107
16	0·072	222

Each person's resistance had fallen towards the end of the test, owing, probably, to the perspiration on the hand. Seeing that a person would not stand voluntarily more than 32 volts, at which pressure he was taking 0·3 ampere, it appears inadvisable to allow of a greater potential difference between earthed metal work and earth of more than 50 volts.

The author then proceeded to discuss the earthing on different systems. In the two-wire insulated D.C. system, if one fault only occurs, the system balances itself about this fault, and no interruption is caused in the working; but should a second fault occur, there is a short-circuit across the system. With the concentric system any fault, as a rule, causes a short-circuit. A three-wire D.C. system with neutral insulated is similar to the two-wire, but a reduced pressure is applied to the short-circuit. A three-phase system, with all three phases insulated, is like the two-wire D.C. system, and a three-phase system neutral earthed corresponds to the three-wire D.C. system. He did not approve of the system of finding one good earth and making connection to it. In his opinion a well-distributed earth system was best, more especially if protective apparatus was employed to isolate faulty sections, such apparatus requiring only a small current to operate it, and inserting only a small resistance in the earth connection.

Mr. ENGLISH, in discussing Mr. Foster's Paper, agreed with his recommendation to distribute the earth connections as generally as possible. He further stated that, in his experience, 800 ohms was the lowest resistance of a human body under similar conditions to those described in the Paper.

ELECTRICAL MINING PATENTS OF JUNE

AMONG the patents published last month of especial interest to mining electrical engineers may be mentioned one of Messrs. Mavor & Coulson and S. M. Mavor (No. 11,206 of 1909), covering mechanical details of electrical coal-cutters, and one by C. F. Spery and E. F. O'Brien, both of Chicago, for rendering the caps of blasting fuses watertight by a simple species of gland. A curious specification is No. 7,556 of 1910 of Otto Böhm (Berlin), in which he describes an electric mining locomotive fitted with a device whereby the current is automatically cut off from the motor when the locomotive approaches a stationary truck or other obstacle. There is a long spring plunger or buffer projecting from the front of the locomotive, which, when driven in by contact with an obstruction, opens a switch in the motor circuit. When the obstruction is removed, the plunger springs out again, closes the switch, and restarts the locomotive. The exact means whereby the starting resistances are controlled are not described. The arrangement is evidently intended to dispense with a driver on the locomotive. Another patent for blasting appliances is No. 16,709 of 1909, by Nobel's Explosives Co. This covers improvements in the construction of magneto or dynamo shot-firers of the class actuated by a travelling nut, which causes a threaded spindle to rotate. The improvements lie chiefly in the method whereby the circuit is only closed when the armature has nearly completed its movement. In specification No. 23,144 of 1909 a miner of Gwaun-cae-Gurwen, Glamorgan, named David Lewis, patents an electric ignition apparatus for safety lamps, in which contacts are arranged on the sliding door of the lamp chamber to prevent the ignition circuit being completed before the door is closed.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during June.

June 2nd.—Supplement on "Electrical Engineering in Mines," opening with an article by a colliery electrician on signals and telephones in mines. Reports are given of meetings at some of the branches of the Association of Mining Electrical Engineers, including an abstract of a Paper on "Colliery Cables," by Mr. W. J. Richards, discussed at Cardiff. Other Papers read before societies include an account of the electrical equipment of Murton Colliery, and an interesting description of a large exhaust steam turbine plant at a German colliery. Notes are also given on the causes of some recent colliery accidents.

June 9th.—Notes on the electricity supply systems of Glasgow and Edinburgh, a Paper on the development of high-tension switchgear.

June 16th.—An interesting letter on high-tension switchgear.

June 23rd.—Discussion at the Glasgow Convention of the Incorporated Municipal Electrical Association on exhaust and mixed-pressure turbines. Notes on the prevention of electrical accidents in factories from the report of H.M. Electrical Inspector of Factories.

June 30th.—Account of some of the Electrical Engineering Exhibits at the Brussels Exhibition. Description of a new system of low-speed electrical drive without mechanical gearing.

Newcastle Branch of the Association of Mining Electrical Engineers.—A diversion from the usual proceedings of the Association of Mining Electrical Engineers was made on Saturday, June 25th. A large party of the members of the Newcastle Branch and their lady friends took part in an excursion to Ripon and Fountain's Abbey. Luncheon was held at the Unicorn Hotel, Ripon. Dr. Thornton (in the chair) expressed a few encouraging remarks concerning the objects and work of the Association.

Recent Colliery Accidents.—An inquest was held early last month into the death at Glamorgan Colliery Llwynypia, of E. Abbott, Tonypandy. The accident was due to a horse drawing two trams at the brickyard fouling two stay wires supporting a derrick, thereby causing the breakage of an insulation on the derrick, so that the stay wires became live. Not only was the horse killed, but it appears that the trams also became live, for the deceased, who was holding on to the last tram, received a shock which proved fatal. The man driving the horse also received a shock, but recovered from its effects. The rubber covering of the cable is reported to have been defective, and it is believed that there was sufficient surface leakage over the insulator to cause the horse to plunge and fall across the stays, finally breaking the insulator. A verdict of accidental death was returned. Another electrical mining fatality about the same time occurred at Newland Collieries, Normanton, when H. Colburn was killed by a shock from a haulage rope which had apparently become live through leakage from a coal-cutter working in a very damp place.

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SMOKE "NUISANCE"

ON Wednesday of last week a deputation, principally under the auspices of the Smoke Abatement League of Great Britain and the Coal Smoke Abatement Society, and including representatives from some nineteen towns, was received at the Local Government Board offices by Mr. John Burns.

The memorial which was presented dealt in rather extravagant language with the effects of smoke and its resultant gloom upon the inhabitants of cities. It even attributed the evils of drink and gambling to this cause, and claimed also that the spread of consumption was facilitated by the prevalence of smuts preventing the sufficient opening of windows.

It was asked that the provisions of the control of smoke embodied in the recently introduced London County Council's Bill—which, by the way, have not been accepted by the House of Commons Committee considering the Bill—should be made applicable to the whole country, and that fines should be made high and cumulative, as they are in Leeds and London. The creation of a special Smoke Department of the Local Government Board, with "competent" inspectors, whose duties should include advice and assistance, and not merely instigation of prosecutions, was also suggested. Although chiefly directed against the works chimney, the memorial also dealt with domestic smoke, and proposed official inspection of all new fireplaces and the encouragement of cheap gas supply by the prohibition of "the pernicious practice of selling gas dear to relieve the rates."

Mr. Burns, in his reply, expressed sympathy with the objects of the deputation. He believed that a smoky chimney was a sign of waste, an evidence of defective combustion, and a proof of bad stoking. He believed that much improvement could be accomplished if employers would give practical and technical instruction to their stokers, and afterwards some little encouragement in the shape of a shilling or two a week in extra wages. Legislation as it at present existed, with the exception of Nottingham, struck only at the factory, the workshop, and large undertakings. He agreed that legislation should be made possible in many of the directions indicated, but in the matter of domestic houses—the chief cause of the nuisance—he anticipated more from general progress than from legislation. He looked to the increasing use of electricity and gas for heating and cooking to reduce the smoke nuisance in London, and expressed the hope that the day was not far distant when manufacturers would be able to obtain power for their factories and workshops from some central institution, where combustion could be much more easily controlled than it now is in the smaller units.

With Mr. John Burns' suggestion that electricity should be used for heating in place of the domestic grate we cordially sympathise, but we have no sympathy with the cranks of the Smoke Abatement League and the Coal Smoke Abatement Society, who insist, in season and out of season, on the persecution of the owners of works chimneys. It is to the interest of manufacturing firms for economic reasons to effect perfect combustion in their furnaces, but a time when the engineering industry is endeavouring to emerge from a period of slackness of trade is the wrong moment to choose to force manufactures to incur heavy expenditure on the rebuilding of their furnaces. The campaign against electricity work is little short of ridiculous. It is the existence of these works, and not the activity of the smoke abatement societies, that has done the most to mitigate the smoke "nuisance" during the past decade. Much of the coal which would otherwise still be burned inefficiently and smokily in numerous factories, locomotives, and even private houses is now being consumed at electricity works which furnish them with power; it is obviously consumed with less total smoke, and the smoke is not spread over so wide an area. The Smoke Abatement League, the Coal Smoke Abatement Society, and also the municipalities who are said to support their proposals, should realise that the harassing of electricity works by more regulations and control, and by the imposition of heavy fines, will have the effect of keeping up the price of electrical energy and so impeding the "electrification," which, as we have said, does more to further the objects of the League than its own actions.

National Electrical Manufacturers' Association.—A Committee Meeting will be held at Balfour House, Finsbury Pavement, London, on Tuesday next, July 12th, at 2.30 p.m.

CORRESPONDENCE

TELEPHONES FOR THE ANTARCTIC EXPEDITION.

To the Editor, ELECTRICAL ENGINEERING.

DEAR SIR,—In reference to the interesting account appearing in your issue of the 30th ult., entitled "Telephones for the Antarctic Expedition," we may mention that the 24-volt batteries referred to in the article are of the "Exide" type, and were supplied by us. It is interesting to recall that a previous Antarctic vessel, the *Discovery*, carried a battery of "Chloride" accumulators, and one of the cells can be seen on our stand at the Japan-British Exhibition.

Yours faithfully,
THE CHLORIDE ELECTRICAL STORAGE CO., LTD.
W. S. NAYLOR,
General Manager.

Pendlebury, near Manchester, July 1st, 1910.

AN ELECTRICALLY OPERATED GOODS CLEARING HOUSE

AT the London Chamber of Commerce on Wednesday last week, Mr. A. W. Gattie, Chairman of the New Transport Co., explained his scheme for the erection of a goods clearing house for London, on the principle of the bankers' clearing house. Mr. Gattie proposes to acquire a large slum area in Clerkenwell at a cost of £1,500,000 and to construct a few miles of railway, so that all railways could run into the Clearing House. The total cost of the scheme is put at £6,000,000. The electrical interest of the scheme is in the equipment of the proposed building, which has been reported upon favourably, after an examination of the drawings and details, by Sir William Preece and Messrs. R. Waygood & Co., Ltd. A system of distributing the goods in the Clearing House has been designed by Mr. Gattie, in conjunction with Mr. A. G. Seaman, of the British Westinghouse Co., Ltd., and is described in specification No. 17,344 of 1908. A trench, forming a sub-basement beneath the railway lines serving the Clearing House, is furnished with a number of slow moving, electrically driven platforms, each of which is set apart for a particular company. Encircling these moving platforms is a faster travelling main platform. The parcels to be conveyed to any particular receiving company of the depôt are placed in small trays mounted on castors, which are placed upon the main platform. Every link of this platform is provided with electrically driven rollers placed at an angle, which can, at the desired moment, be magnetised so as to adhere to the bottom of the tray, and at the same time start rotating, thereby shooting the tray bodily off the main platform on to the slower moving distributing platform which serves the particular company required. In like manner any tray can be shot off the distributing platform into the division of the company required. The selection of the points at which the tray leaves each platform is governed by a somewhat intricate controller, which is set by the attendant to the number corresponding to the bin to which the parcel is to be sent. The remaining operations will be performed by electric cranes. A controller is fitted to each working section of the conveyor. This conveyor has been successfully made by Messrs. Reason & Co., Ltd., of Brighton, and has been tested by Mr. Christopher Silver, chief of the Testing Department of Faraday House.

The Constantinople Telephone Contract.—The telephone concession for Constantinople and district granted to Mr. H. L. Webb of London has now been ratified. The concession is for 40 years, but the Government has the right to purchase at the end of 10 years. The undertaking is to be completed within two years. It will be remembered that the National Telephone Co., the American Bell Co., the British Thomson-Houston Co., and the Western Electric Co. are interested in the scheme.

The Electrical Committee.—The Hon. Arthur Stanley, M.P., has accepted the position of President of the Committee for the Protection of Electrical Interests. Mr. R. Hammond has agreed to act as Vice-President, Mr. A. H. Preece as Honorary Treasurer, and Mr. R. Borlase Matthews as Honorary Secretary. The following additional members have been elected: Messrs. Chas. Bright, F.R.S.E., J. Connolly, E. Manville, J. H. Rosenthal, and F. Ince. A meeting was held yesterday, and it has been arranged that for the present the Committee shall hold fortnightly meetings on alternate Wednesdays at Faraday House, 66 Southampton Row, W.C. Endeavours are to be made for the formation of a Parliamentary Party in the House of Commons to represent the electrical interests. The Committee wish to work in co-operation with other existing associations and societies, and all questions which, in their opinion, can be dealt with by other associations are referred to them. A number of subjects have been brought before the Committee for consideration, and further suggestions are invited.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published June 30th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

13,080/09. **Meters.** EVERSHED & VIGNOLES and S. EVERSHED. In these watt-hour meters of the motor type, freedom from errors due to stray magnetic fields is secured by an astatic arrangement of the main current coils, which act upon a flat shunt-wound armature. Internal connections are minimised by the use of the metal coil formers as terminals, and easy means of adjusting the constant of the meter is provided by shifting the positions of the coils. Five claims, five figures.

13,228/09. **Tubular Incandescent Lamps.** C. O. BASTIAN. The tubular lamps described may be of considerable length, and have a terminal cap at each end. The filament is made up of several short lengths in series, connected together with springs capable of keeping the filament tight, in spite of expansion. Each spring has its central convolutions of nearly the internal diameter of the tube, so that, although not attached to, it touches the glass. Support is thus given to each section of the filament without sacrificing freedom for longitudinal movement. Three claims, ten figures.

13,237/09. **Resonance Instruments.** W. H. JOHNS and JOHNSON & PHILLIPS, LTD. In these instruments the indications are rendered clear by providing each vibrating end with a shutter or flag which normally covers a figure on a fixed scale. When a reed is thrown into vibration, the figure is intermittently uncovered and becomes visible. An auxiliary magnet can be employed to catch the reed which has moved, and hold it permanently deflected with the corresponding figure uncovered. Five claims, seven figures.

13,265/09. **Stage Arc Lamp.** T. FRANCIS. A hand-regulated stage arc lamp in which the carbons are held at the long ends of bell-crank levers; the short ends of the levers overlap, and are pressed against the point of a screw by a spring. The screw can thus be employed to move the carbons together and apart. An important feature of the arrangement is that the lengths of the short overlapping ends of the levers can be proportioned in accordance with the relative rates of burning away of the two carbons, so that approximate focussing is secured. One claim, one figure.

13,576/09. **Cable Covering.** T. H. M. HARVEY and J. W. BASS. Additional locking strands are run longitudinally in a more or less zig-zag fashion over and under the strands of the ordinary helical braiding to prevent unravelling. Five claims, two figures.

13,827/09. **Heating Appliances.** C. O. BASTIAN. This specification covers the use of a number of short heating elements, consisting of conductors enclosed in short tubes, sleeves, or beads of quartz, all in series. One claim, four figures.

14,965/09. **Excess Voltage Indicator.** V. ARCIONI. This is an alternating-current induction relay in which a spring-controlled metal disc is acted on by shunt magnets connected between each phase or side of the system and earth. The form of the instrument is such that the torque due to the magnets being out of phase is negligible. The disc has a gap opposite, but unsymmetrical to each magnet pole. Each magnet exerts its own torque on the disc independently, so that excess voltage between phases or between any one phase and earth will have effect. Four claims, two figures.

15,251/09. **Sparking Plugs.** F. B. LODGE and A. M. LODGE. Sparking plugs with both poles insulated for use in series with ordinary plugs to obtain more than one point of simultaneous ignition in each cylinder. Two claims, four figures.

16,811/09. **Rotors of Induction Motors.** SIEMENS BROTHERS DYNAMO WORKS, LTD., and E. O. KIEFFER. The bars and end rings are cast in a piece in place in the core by a special alloy. The end rings may have fan blades cast upon them to improve ventilation. Insulation between the conductors and the core can be obtained by asbestos linings to the slots or by dipping the core before casting into a mixture of clay and water. Special distance-pieces can be employed to prevent the metal running out when there are axial ventilating ducts. Seven claims, five figures.

22,302/09. **Combined Arc and Incandescent Lamp Circuits.** A. HEIMANN and W. SHÄFFER. The incandescent lamps form the series resistances of the arc lamps, but are protected from current variations by suitably proportioned "variators," or iron wire resistances with positive temperature coefficient. An independent resistance is used to take the rush of current on starting the arc lamps. Two claims, four figures.

26,251/09. **Electric Furnaces.** J. HÄRDÉN. These furnaces are particularly adapted for heating large quantities of material. The charge is heated, not only in the ordinary way by arcs from suspended carbon electrodes, but also by terminal plates of ohmic resistance in the furnace walls. Three claims, three figures.

28,475/09. **Driving Axles of Electric Cars.** D. BALACHOWSKY and P. CAIRE. This is an arrangement of gearless motor drive in which the outer member of the motor, which is usually the stator, is free to revolve, and is connected to a sleeve on which are mounted the driving wheels. The inner member, usually the rotor, is fixed to a central spindle, prevented from revolving through more than a small angle by springs, which give a certain elasticity to the drive. Ten claims, three figures.

1301/10. **Composite Conductors.** SIEMENS BROTHERS & Co. and W. DIESELHORST. A process of manufacturing conductors of high tensile strength by covering a central core of steel with a sheathing of copper in two or more turns, sweated together solidly and arranged so that each comes opposite to, and is protected by, an unseamed or continuous portion. One claim, two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Names in italics indicate communicators of inventions from abroad.

Arc Lamps: RIDINGS, 13,842/09; SIEMENS BROS. & Co., HIRD and GRIMSTON [Projectors] 14,010/09; KÖRTING & MATHIESON A.-G., 26,706/09.

Dynamos, Motors & Transformers: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Rotary converters] 17,564/09; SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke-Ges.*) [Regulation of frequency converters] 6,125/10.

Electrometallurgy and Electrochemistry: KELLER [Bleaching] 13,790/09.

Heating and Cooking: BELL and PLETTS [Air heater] 5,777/09; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [heating devices] 13,961/09; PREISS [Radiators] 14,040/09.

Incandescent Lamps: KRAUSE [Elastic supports for metal filaments] 22,458/09 and 350/10.

Switchgear, Fuses and Fittings: DONOVAN [Starting and regulating switches] 13,590/09; GEORGI and A. REYROLLE & Co. [Protective devices] 14,352/09; FASSLER [A.-C. current rectifiers] 14,980/09; THOMPSON [Pendant light fittings] 17,711/09; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Electrolytic condensers for lightning arresters, &c.] 21,480/09; DÉNÉRÉAZ [Plug and socket] 22,029/09; DENNY [Tumbler switches] 26,570/09; SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Damped relays] 1,428/10; JACKSON and SCHEIBE [Control gear for vapour rectifiers] 1,482/10.

Telephony and Telegraphy: VON LEPEL [Wireless apparatus] 28,452/09; FESSENDEN [Wireless system for airships] 29,481/09; BLOS [Automatic telephone exchanges] 29,801/09.

Traction: WHITING [Rail crossings] 2,014/09; BENTHAM and BARDSLEY [Brakes] 19,140/09; BURNET and TUDOR ACCUMULATOR Co. [Rail joints] 21,649/09; McKENZIE & HOLLAND, LTD., HAYWOOD and BEAUCHAMP [Signalling] 25,579/09; MITCHELL and DUDGEON [Overhead construction] 26,444/09; PIEPER [Propulsion and control of vehicles] 28,082/09; WILLIAMS and TORTORICE [Rail joints] 2,377/10.

Miscellaneous: WILSON [Spark coils] 13,509/09; COOPER [Packing boxes for metal filament lamps] 16,146/09; HUGUENIN [Magnetic belts and pulleys] 19,527/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: ALLGEMEINE ELEKTRICITÄTS-GES., 14,125/10.

Telephony, &c.: NEUHOLD [Automatic telephone exchanges] 8,228/10.

Traction: SIEMENS & HALSKE A.-G. [Signalling] 10,087/10.

Miscellaneous: DU BELLE [Electrically-operated mechanism for typewriters] 13,910/10.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., Schenectady*) [Insulation] 5,370/05.

Dynamos, &c.: H. R. STUART [Transformers] 5,071/04.

Electric Ignition: A. HERZ [Magnetos] 6,316/03.

Instruments, &c.: W. B. DUDDELL and T. MATHER [Resistances] 5,171/01.

Switchgear, &c.: C. PORTILLO [Connectors for branch circuits] 13,759/02; E. F. MOY & P. BASTIE [Switches] 5,232/05.

Telephony, &c.: E. BENNETT [Erection of overhead wires] 6,488/02.

Traction, &c.: E. FREUND [Tramcar brakes] 5,350/05; BRITISH THOMSON-HOUSTON Co. [Aerial ropeways] 5,584/05.

Miscellaneous: A. B. BROWN [Electric steering gear] 4,826/00; D. PERRET [Electromagnets] 25,218/04; H. R. ARTHUR [Electric signal for starting races] 5,486/05; A. HEIN [Electrically-driven vacuum cleaners] 26,355/05.

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THE "TELEWRITER" EXCHANGE

BY means of the "telewriter" exchange, formally opened by the Lord Mayor on Friday, subscribers are enabled to send written messages and sketches to one another in the same way as subscribers to a telephone exchange are able to converse.

The "telewriter" is the name given to the latest improved pattern of Ritchie's "telautograph." This instrument, which has been on the market for some years, is an ingenious application of the principle of the d'Arsonval galvanometer or syphon recorder. The pencil of the

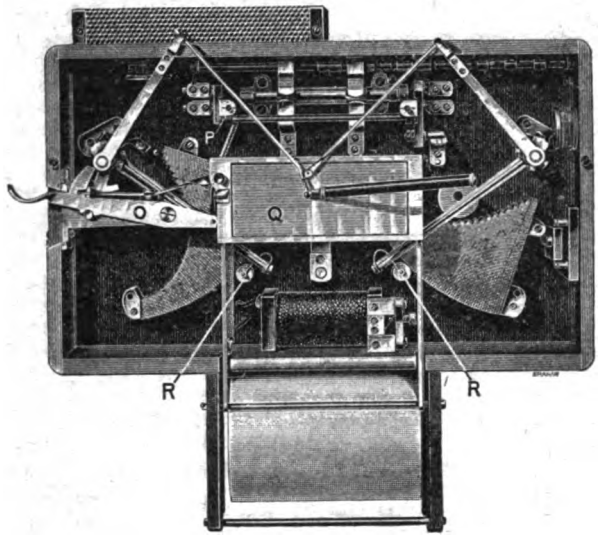


FIG. 1.—INTERIOR VIEW OF TRANSMITTER.

transmitter (Fig. 1) is at the end of two levers, which, as the pencil is moved, cause a roller contact *R* to travel over two quadrant-shaped rheostats. These rheostats are connected through a battery between each of the two lines and earth, and at the far end of the line a pen is geared in a similar manner to the spindles of the two coils connected between the lines and earth, and free to rotate in a magnetic field on the d'Arsonval galvanometer principle. (See Fig. 2.)

It is necessary to provide a device which prevents the pen at the receiving end from touching the paper when the pencil at the transmitting end is being moved without touching the surface of the paper. This is effected by an intermittent current sent by an induction coil, and superposed on the main line currents when the pencil presses on the paper platen on which the sending subscriber writes. This current passes through a differentially-wound coil at the receiving end, which operates a vibrating reed, opening and closing a contact shunting a coil which causes the pen to press against the paper. Normally the pen is held away from the paper by a spring, but when the reed vibrates the shunt to the coil is rapidly intermittent, and the coil is energised by a local circuit, which also serves to excite the electro-magnets between which the moving coils rotate. The slight vibration caused by the shunt being intermittent instead of being removed altogether has the advantage of easing the passage of the pen over any roughness that there may be in the paper. The receiving pen, when not in use, is held in an ink-well by the rod *I*.

The paper exposed on the plates *Q*, both at the sending and receiving end, is sufficient for writing about three lines. It is fed on to the platen from a roll by means of a ratchet worked by the subscriber at the sending end. Each movement of the ratchet-lever *Q* opens and closes a circuit which sends a current through the line and works a relay operating a paper shifter at the receiving end. The paper-shifting device at the transmitting end is marked *P* in Fig. 1.

The above describes generally the principle upon which the machine works. Needless to say, there are a number of details not mentioned here; the apparatus is a marvel of ingenuity, and represents most excellent workmanship. The parts of the instrument are manufactured by the British L. M. Ericsson Co., Ltd., and are assembled at the National Telewriter Co.'s works.

In the instruments connected to the exchange, resistances are inserted in each circuit so that the total resistance of each line is 500 ohms. It is essential that this should be the same on every subscriber's circuit, as the action of the instrument depends on variations of the transmitted current by adding and subtracting resistance as the pencil-levers move.

A telephone is hung on each instrument and is in circuit in place of the telewriter when removed from the switch-hook. The exchange switchboard is a small standard multiple board with hand-restoring indicators, equipped for 300 subscribers, the ultimate capacity of the multiple being 1,000. The calling subscriber asks for the wanted subscriber through the telephone in the ordinary way, and the operating is as for an ordinary telephone connection. A lamp is provided opposite each pair of cords, however, which glows when either subscriber is writing, and warns the operator not to cut into the circuit. This is essential, as not only would she receive the intermittent current of the pen-lifting circuit in her receiver, but the shunting of her instrument across the line would alter the value of the line currents and interfere with the writing.

There is a local battery of 18 secondary cells at each subscriber's instrument for operating the instrument and the various electro-magnets in the local circuit. These are kept constantly charged by a secondary battery of 3 cells in the exchange which is permanently on every subscriber's line when the line is not

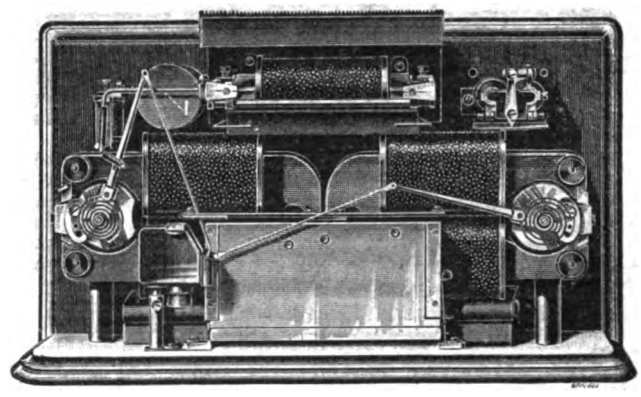


FIG. 2.—INTERIOR VIEW OF RECEIVER.

in use. When two subscribers are connected, their two batteries are in opposition, and the one who switches over to send a written message reverses his battery. Everything depends on the actual value of the current, as has already been explained, and it is therefore necessary that the voltage on the line terminals is maintained constant. The E.M.F. of the battery varies, of course, with the state of charge, and a delicate voltage regulator is included in the battery circuit. This is also employed on private telewriter lines which utilise the local electric lighting circuit for charging their batteries. On internal private lines the battery is dispensed with, and the electric lighting circuit is employed.

The exchange is at the offices of the National Telewriter Co., Ltd., at 20 Bucklersbury, London, E.C., and just over fifty subscribers are connected at present. Three lines go to the Central Telegraph office at St. Martin-le-Grand, and arrangements have been made

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with the Post Office enabling subscribers to send telegrams to the office for transmission, and also, if they desire it, to have their own telegrams sent them on their telewriter.

There can be no doubt that the telewriter has a wide range of application, as not only written messages, but also sketches and diagrams can be transmitted, for although there is a certain amount of distortion of the writing or diagram if the adjustment of the instrument is not perfect, this is not serious. For engineering firms, the possibility of transmitting a sketch over a telephone wire to a correspondent is of considerable advantage, and the gain would be greater still if it were possible to use the telephone at the same time as making the sketch. We would suggest, therefore, that, if the exchange system develops to larger proportions, it would be advantageous to give subscribers the option of having a separate line for the telephone, so that the two instruments can be used simultaneously.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

MOTOR-STARTERS.—Particulars are given in a leaflet from George Ellison (17 Warstone Lane, Birmingham) of a series of totally enclosed starters for slip-ring and squirrel-cage induction motors with no voltage and overload releases. These starters comply with the Home Office rules and recommendations, and the nature of the enclosing cases renders them particularly suitable for mills and factories.

BALL BEARINGS.—We have received from Messrs. Harris & Samuels (10 Dean Street, Oxford Street, W.) a very complete list of ball, journal, thrust, and cone bearings for all purposes manufactured by the Maschinenfabrik "Rheinland" A.-G. (Düsseldorf). This is accompanied by a pamphlet on the theory of the ball bearing, written by one of the managing directors of the firm, which should prove of great interest to those designing machinery to which ball bearings may be applied.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

MOTOR SWITCHGEAR.—A leaflet from Messrs. Siemens Brothers' Dynamo Works, Ltd. (Caxton House, Westminster), describes a series of cast-iron weather-proof switch-boxes and motor-control pillars. The double- or triple-pole switch is contained in the same case as a set of "Zed" cartridge fuses, the latter behind a separate hinged window. A water-tight ammeter can be mounted on the top of the case, and the whole can be arranged together with an enclosed starter upon a wall frame or pillar.

MOVING COIL WATTMETERS.—Messrs. Siemens Brothers & Co., Ltd., have issued a list in which is described a new and more compact form of their "Precision" wattmeter, of the deflectional dynamometer pattern. These are now similar in external appearance to the firm's well-known continuous-current test-room instruments, and are made for a great variety of ranges both with pivotted and suspended coils. They are equally applicable to continuous and alternating currents, and a special series of transformers is provided for use with the latter.

METAL FILAMENT LAMPS.—The Foster Arc Lamp and Engineering Co., Warple Road, Wimbledon, are issuing a new folder calling attention to their metal filament lamps and auto-transformers. These can be printed with any dealer's name and address, and are intended for distribution over the counter or for inclosure in correspondence.

FANS AND SMALL MOTORS.—A new supplementary leaflet from Simplex Conduits, Ltd., deals with fans and small motors both for continuous and for alternating currents. The motors range down to $\frac{1}{6}$ h.-p., and are suitable for sewing machines, polishing, &c.

Birmingham Tramways Dispute.—In the Chancery Division, last week, before Mr. Justice Swinfen Eady, an action was brought by W. Neale and Mark Lyons, shareholders in the City of Birmingham Tramways Co., Ltd., to restrain the company from paying back to them out of the accumulated profits of the business £4 per £5 share in respect of certain fully paid ordinary shares of the company, by way of reduction of capital. At the recent annual meeting it was decided to pay back £4 per share on 6,047 ordinary shares, in order to bring all the ordinary shareholders upon the same level. It was contended that the directors had no powers to repay this sum. His Lordship, in giving judgment, held that there was legal power to return the amount in question, and so leave all the ordinary shares at £1 paid up, and upon which, of course, dividends would only be paid.

A SELF-STARTING INDUCTION MOTOR

THE Electric Construction Co., Ltd., has been experimenting for some time past with a new type of three-phase motor, the principal points of which are the absence of brushes, slip rings, rotor cables, or outside starter, and which has all the well-known good characteristics of the wound rotor type without its drawbacks. The peculiar features of this new machine (which has been designed and patented by N. Pensabene-Perez) are the method of fixing the resistances to the rotor, and the arrangement for cutting them out while the machine goes up in speed at starting. When the machine works at full speed there are no rubbing contacts whatever, so no lifting or short-circuiting plugs or similar complicated arrangements are necessary. The revolving resistances are very compact and of very strong mechanical construction, are totally enclosed in a cast-iron case, and they are cut out, either by hand or automatically. A very important feature of the machine is that, being started through a large number of steps (from 20 to 30 per phase), there is no jumping of the current at starting, but it gradually varies by small steps from the starting to the running value. The automatic type, considering the simplicity of its construction, is an important step forward in the development of induction motors. A long-distance control, as found necessary in the many applications of electrical drive, is thus accomplished at very little expense, and with the most reliable means by the simple operation of closing the stator main switch. The automatic type, being controlled by the speed, lends itself to a simple solution of the problem of preventing a rush of current during the starting period. In fact, by a rational choice of spring-tension, frictional resistance, and value of centrifugal forces, it is possible to keep the current approximately constant while the machine is speeding up, thus accomplishing what many complicated devices, in the case of hand control, are supposed to do. This motor is less expensive than the ordinary slip-ring type, and no starter or rotor cables are necessary.

A WIRING HANDBOOK

EVERYONE of our readers who has anything to do with electric wiring, should not fail to obtain from Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.), a copy of the new edition of their handbook, "Conduit Wiring." Although it is only in pocket-book size, it is undoubtedly the most complete exposition of the subject in any publication of its kind. Particulars are given of the various methods of wiring in conduit, which are well illustrated with drawings and diagrams. At the beginning of the book are some useful tables of the gauges of conduits and wires, and the wiring capacity of conduits, and the book also includes descriptions of fittings and accessories, detailed instructions for fixing and wiring, notes on "Some Causes of Breakdown," and other useful notes and memoranda. Among the alternatives to conduit wiring described is a lead-covered system, which appears to have some excellent features, especially as a substitute for flexible systems of surface wiring. No price is marked on the book, and we believe that the firm will be pleased to present copies of it to any of our readers.

Electric Lighting at the Army Pageant.—During the evening performances the grounds of Fulham Palace were lighted by arc lamps, metal-filament lamps, and searchlights, as follows:—The arc lamps consisted of twenty British Westinghouse "Arcturus" flame arcs, 10-ampere size, burning four in series on a 200-volt, 50-period, A.-C. circuit. Six of these were fixed at the back of the Grand Stand, suspended from the roof in such a manner as to illuminate the grounds at the back of the stand, as well as the stand itself. Fourteen of these lamps were carried on wooden poles between the Grand Stand and the entrance, lighting the grounds generally. Metal-filament lamps were used for lighting the Grand Stand, and two 40-ampere searchlights were used for the purpose of illuminating the performances. The "Arcturus" lamps and the searchlights were supplied by the British Westinghouse Co., through their Supply Department, 3 West Street, Charing Cross Road, W.C.

The Junior Institution of Engineers.—Sir J. J. Thomson, F.R.S., Cavendish Professor of Experimental Physics of the University of Cambridge, has been elected President of the Junior Institution of Engineers, in succession to Sir Henry J. Oram, K.C.B., Engineer-in-Chief of the Fleet. The summer meeting in Ireland will commence on Saturday, 16th July, with a reception at Trinity College, Dublin, by the Provost and Professors of Engineering, followed by a visit to the Ringsend Power House of the Dublin United Tramway Company. In the evening there will be a reception by the Institution of Civil Engineers of Ireland, and on Monday the visits will include the Dublin Corporation Electricity Works. At Belfast, on Friday, Messrs. Harland and Wolff's shipbuilding and engineering works will be inspected; the Institution summer dinner will be held in the evening at the Grand Central Hotel, the President, Sir Henry J. Oram, K.C.B., in the chair. Various other visits and excursions have been arranged for.

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ELECTRICAL EXHIBITS AT THE JAPAN-BRITISH EXHIBITION

THROUGH the courtesy of the Chairman of the Mechanical Engineering, Electricity, and Textile Machinery sections of the Japan-British Exhibition, a party of press representatives were on Monday last given a special demonstration of the objects of interest in these sections of the Exhibition. Electrical engineering cannot be said to be well represented in the British Section of the Exhibition, but there are a few exhibits to which attention may be called.

One of the most interesting features of the Machinery Hall is the collection of textile machinery in operation, following out the whole process of cotton spinning, and it is not too much to say that their combined display of the leading British manufacturers of textile machines is one of the finest exhibition demonstrations of this class of work that has been given. Naturally, the whole is electrically driven, and this is not the least interesting feature. The first stand that the visitor arrives at is that of Messrs. PLATT BROTHERS & Co., LTD. (Oldham). On one side of the passage-way are shown a series of openers, gins, bale-breakers, scutchers, lap machines, &c., while the later processes through which the cotton passes are exemplified on the other side by a series of machines, including a carding machine, a sliver lap machine, a comber, a drawing frame, a slubber, an intermediate frame, and a rover; examples of warp, weft, and doubling ring frames, a mule, and two looms. This part of the exhibit forms an example of group-drive through ropes and shafting, and is driven by a 40 b.h.p. three-phase motor by Messrs. J. & P. Hall, Ltd. (Oldham). A little further on a series of gassing frames, doublers, winders, and other textile machines shown by Messrs. JOSEPH STUBBS, LTD. (Manchester), exemplifies individual drive by small continuous-current 250-volt motors affixed to each machine. Electrically driven textile machinery of a heavier class, including a carpet loom, is represented on the stand of Messrs. R. WALL & Co. (Bury).

Perhaps the most imposing display, however, is that of Messrs. DOBSON & BARLOW, Oldham, where practically every class of cotton preparing and spinning machinery is to be seen at work. This whole exhibit is arranged for individual drive, and a good idea of its extent is obtained from the statement that it includes no less than twenty-seven motors, aggregating some 130 b.h.p. These, together with their starting-gear, &c., were all supplied by the British Westinghouse Co. The larger motors run on the 500-volt continuous-current exhibition power circuit, and the smaller motors from a 250-volt circuit supplied by a motor-generator on another stand.

Messrs. GREENWOOD & BATLEY (Leeds) have a stand in the textile section, on which they show some electrically driven silk machinery and a complete de Laval 6½-kw. turbo-generator of very compact proportions.

Turning now to the purely electrical exhibits, we are first struck by the fine stand of the GENERAL ELECTRIC Co., devoted almost entirely to Osram Lamps. A description and illustration of this stand was given in ELECTRICAL ENGINEERING, June 2nd, p. 363. The larger candle-power Osram lamps, up to 1,000 c.p., for street lighting, are particularly interesting, and no one can pass the stand without admiring the skill of the glass-blower who demonstrates the making of special shaped bulbs.

Another most effective stand is that of the INDIA RUBBER, GUTTA PERCHA, AND TELEGRAPH WORKS Co., LTD. (Silvertown), which at first sight appears to have a magnificent marble floor. A closer inspection, however, reveals that the flooring is the "mosaic india-rubber tiling," which the company are now making a speciality of. The surface is an excellent imitation of marble mosaic, and the material is both watertight and insulating, being specially suitable for generating station and switchboard gallery floors. The rubber is so treated as to be unaffected by oil, and we were told that even ink can be dropped upon it without making a permanent stain. A show case of cable samples, various ebonite goods, and a display of telegraph instruments, are to be found among the exhibits on the stand, which, by a happy coincidence, is opposite the fine loan collection of historic and modern telegraph apparatus of the Post Office, much of which also comes from Silvertown.

Storage batteries of all kinds are shown by the CHLORIDE ELECTRICAL STORAGE Co. (Pendlebury, Manchester). These range from the smallest "Exide" ignition cells to a 72-plate 6,120-ampere hour cell, similar to those composing the new stand by excitation and auxiliary battery at the Lot's Road Station of the Underground Railway Co. A 2,100-ampere hour cell as supplied to Shanghai, is also shown. Opportunity is given to study the construction of the well-known Chloride and Exide plates, and at the back of the stand is a marble switchboard containing the complete switchgear, including the variable carbon rheostat, which is used in the "Entz" reversible battery booster system, with which the company has had so much success.

Near this stand is a fine display of telephones and telephone apparatus by the WESTERN ELECTRIC COMPANY (North Woolwich), which may be said to speak for itself.

Mention has already been made of the motor-generator set which supplies the 250-volt power circuit in the Machinery Hall, and this is to be seen running on the stand of Messrs. ELECTRO-MOTORS, LTD. (Openshaw, Manchester), together with representative examples of their well-known continuous-current machinery arranged as motors, dynamos, balancers, &c. Small steam- and petrol-driven generating sets, electrically driven fans, and an automatic switch system for controlling pump motors are also shown.

Considerable interest attaches to the stand of Messrs. NEWTONS, LTD. (Taunton), who have specialised in continuous-current machinery upon the Zone system designed by Mr. J. W. Burleigh, in which, by a special arrangement of the main and auxiliary pole systems an extremely light field system is obtained with very slight magnetic leakage, excellent ventilation, and favourable conditions of commutation are secured enabling large overloads to be negotiated. The 140-kw. multipolar machine shown has a number of interesting points in its design, as well as the smaller machines shown embodying the same principle. It may be mentioned that the London agents for these machines are Messrs. Baxter and Gaunter, 86 Charing Cross Road, W.C.

The MAXIM LAMP WORKS, LTD. (Shernhall Street, Walthamstow), show flame and enclosed arc lamps of various patterns, including the special enclosed lamp, of which some 400 are in use throughout the Exhibition, and a twin arc lamp for continuous current to burn singly or 200/250-volt circuits. Several transformers are shown, and a good deal of interest attaches to the examples of the Maxim London-made metal filament lamp, particularly as regards the high-voltage lamps, with bulbs no larger than the ordinary carbon lamp, and including some very effective fancy bulbs. The compactness of these lamps is mainly due to the way in which the constituent sections of the filament are arranged with the plane of each radial, instead of circumferential to the axis of the bulb.

Several new designs of flexible and extending fittings are shown by J. DUGDILL & Co. (Failsworth, Manchester), including some in which the movement up and down of the fitting itself works an automatic double-pole switch within the fitting, and turns the light on and off. Several special hospital and works fittings are shown.

Attention should also be drawn to the primary battery hand lamps of the FLOAT ELECTRIC Co., LTD. (Adam Street, New Kent Road). These include miners' and other lamps, the chief feature of which is that when placed upside down, the electrolyte is not in contact with the electrodes, so that local action is absolutely prevented. An advantage claimed for the miner's lamp over accumulator lamps is that in the event of damage to a lamp by a fall, even a short circuit in the leads cannot produce a dangerous heating, as the cell is of such internal resistance as to prevent even a momentary output of more than about two watts. It is interesting to note that Captain Scott's Antarctic expedition is provided with an equipment of this lamp, with sufficient recharging materials to last two years, divided into three lots, one for the base, one for the intermediate depôt, and the third for Captain Scott's final dash to the Pole itself. The firm also show a dry battery with a gelatinous electrolyte from which the zinc rod can be entirely removed when not in use, and the cell kept for long periods without deterioration.

The DOWSING RADIANT HEAT Co., LTD. (24 Budge Row, E.C.), exhibit some new patterns of their electric "sun" baths, electrically actuated vibrators for massage and hair dryers, as well as their well-known patent lamp radiators. They have also a novelty in a very cheap form of electric hot-plate covered with a special non-metallic material.

Messrs. T. and J. JACKSON (14 Park Road, N.W.) show a combined electric light and pumping equipment for country houses, driven by a single-cylinder paraffin engine, with a particularly simple rotary combined inlet and exhaust valve. They also show several electrical specialities, including water heaters, an automatic battery cut-out, and a special controlling switch for regulating the voltage from a battery in a country-house installation by switching an additional cell in or out in either direction.

In conclusion, we should express our appreciation of the trouble taken by Mr. F. B. Converse, Electrical Engineer to the Japan-British Exhibition, in conducting our representative round the stands.

Municipal Wiring at Leicester.—In connection with the recent decision of Mr. Justice Neville that the Leicester Corporation have been illegally carrying on an electric wiring and fittings department, the Corporation, before giving notice of appeal, are communicating with other Corporations similarly placed. The Corporation have three weeks from June 20th in which to give notice of their intention to appeal against the decision of the Chancery judge, *i.e.*, until July 11th.

The National Telephone Transfer.—In answer to Mr. Devlin in the House of Commons on Tuesday, the Postmaster-General said that arrangements are being made with the National Telephone Co. to ensure the transfer of the system to the Post Office on or as soon as possible after the date of purchase. The preparation of an inventory of the company's plant has been discussed with the company, and it is hoped that it will shortly be put in hand, and that it will be found possible for the Post Office check on this inventory to proceed concurrently.

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"FREE WIRING" AT CANTERBURY

JUDGMENT has been given in the Canterbury County Court in an action against the Canterbury Corporation concerning "free" wiring. Some years ago the National Electric Construction Co., Ltd. (then the National Free Wiring Co., Ltd.) entered into an agreement for the "free wiring" of premises, the Corporation to pay them 1d. per unit upon all energy consumed in the premises so wired.

The action in question was for the payment of £25 13s. 9d. in respect of particular premises, the present occupier of which is not the person who agreed to the installation to be put in, and who, moreover, refuses to pay an extra 1d. per unit to the Corporation. The Corporation argued that, as they had no powers to supply fittings and to wire premises, they equally had no power to employ contractors for this purpose and to pay them. The agreement between the Corporation and the company, it was said, only applied to consumers agreeing to pay an extra 1d. per unit, which was collected by the Corporation on behalf of the company, and handed over to them. The moment this particular consumer left the premises and a new one came in who refused to enter into an agreement to pay an extra 1d. per unit, then, it was argued, they were under no liability to pay that amount over to the company. No provision was made in the agreement in the event of the original consumer leaving the premises.

Deputy Judge Haigh, who heard the action, has now given judgment in favour of the Corporation, and upholds the contention that if the Corporation were not, as obviously they were not, empowered to undertake the wiring and fitting of premises themselves, they were equally not empowered to pay the company for doing such work.

This judgment is interesting in connection with the case of the Attorney-General *v.* the Leicester Corporation (see ELECTRICAL ENGINEERING, June 16th and 23rd, pp. 397 and 409), in which it was laid down by Mr. Justice Neville that a Corporation has no right to wire consumers' premises unless it has powers to do so under a Special Act. Unless the present judgment, and that of Mr. Justice Neville, are reversed on appeal, it follows that a Corporation working under an ordinary Provisional Order is not entitled either to wire consumers' premises itself or to have them wired through a wiring contractor, whether on a "free-wiring," hire-purchase, or sale outright agreement.

ELECTROMETALLURGY AND ELECTRO-CHEMISTRY

AMONG the works visited by the members of the International Mining Congress at Dusseldorf (an account of which is given in our supplement on ELECTRICAL ENGINEERING IN MINES) was the Lindenberg Steel Works, Remsheid-Hasten. These works were established in 1864, and have similar establishments at Berlin and New York, and the share capital being only £150,000 they are typical as representing the prevailing conditions in such undertakings throughout the country. The Remscheid works are used for the manufacture of high-grade tool steel and high-speed cutting steel, for motor cars and other special requirements. All the steel is rolled and forged in the works, the annual output of crude ingots of such high grade electro-steel being about 5,000 lbs. There are installed a steel plant, a Wellman open-hearth furnace, and two Heroult electric smelting furnaces, the latter of which have a capacity of 1½ and 3 tons respectively, and are used for refining the high-grade steel during the latter stages of manufacture only, by the acid and basic processes. These electric furnaces receive their charges from the open-hearth furnace, where the steel has been refined to a certain grade. They are of the Heroult type, with carbon electrodes entering the furnace from the top, and automatically adjusted by electric motors, so that the arcs may be kept uniform whilst current is supplied at 50 volts. The electric furnaces at these works are the first of their kind to have been installed in Europe, and although none have yet been used in this country, we understand that their installation is now being considered here, as they are essential for the refining of high-grade steels in the latter stages of manufacture, although rather costly in operation for the carrying through of the complete refining process. The power house generates 2,600 h.p., and a further 800 h.p. are produced at the works, which also supply electrical energy for operating plate mills, forge section rolling mills, and machines at the magnet works. Only 300 men are employed, as the entire works are well provided with up-to-date labour-saving appliances and conveniences for the workman's comfort, whilst the wages earned are less than prevails in this country.

LOCAL NOTES

ACTON: *Agreement with Supply Co.*—The Council decided at a special meeting on Thursday to give the necessary notice for terminating the agreement with the Metropolitan Electric Supply Co., for the supply of electricity in bulk. The agreement expires in December, 1913.

ARGENTINA: *Buenos Aires Tramways.*—The extension of the Buenos Aires tramways to the Avellaneda district will shortly be opened. This extension amounts to some thirteen miles.

BATH: *Electricity Deficit.*—When the accounts of the Electricity Department were first made up the deficiency was put at £1,334. The figures have now been revised, and the actual deficit is shown as £580. The reduction in price is mainly due to matters of accountancy, but, in addition, it is now recommended that the amount of the reserve fund shall be applied towards reducing the deficit.

BIRMINGHAM: *Tramway Extension.*—The Birmingham Trades Council have passed resolutions strongly supporting the proposed tramway service to Harborne.

BRAY: *The Maximum Demand System.*—The Electrical Engineer recommends abandoning the maximum demand system of charging and adopting flat rates.

BURNLEY: *Electricity Accounts.*—The net profit on the electricity undertaking for the past year was £4,148, against £4,169 in the previous year. Of this £3,000 have been applied to relief of rates, and the remainder has been transferred to depreciation account. The number of units sold was 3,249,387, against 3,148,875 in the previous year.

CLECKHEATON: *Electricity Accounts.*—There was a net loss on the electricity undertaking last year of £14.

HULL: *Tramway Accounts.*—The revenue from the tramways last year was £136,985, whilst the working expenses amounted to £96,098. After meeting capital charges, income tax and contribution towards street widenings, there is a net surplus of £22,942, of which £16,000 is transferred to relief of rates, and the balance to reserve fund.

ILFORD: *Electricity Accounts.*—The net profit for the past year upon the electricity undertaking was £1,562, compared with a deficit of £300 in the previous year.

LEEDS: *Tramways to Otley.*—The Otley Council have again considered the proposal to extend the Leeds tramways to that district. The construction of tramways has been abandoned as too expensive, and estimates have now been prepared for an installation of trolley omnibuses. The overhead equipment is estimated to cost £10,000, and seven cars £5,600. The capital charges upon the total expenditure would be £1,812 per annum, which the Leeds Corporation would expect the Otley Council to guarantee. On these figures the Council feel that the expense would still be too great, as it is not thought likely that the requisite number of passengers would be carried to meet these charges.

LEEK: *Increased Electricity Charges.*—The Council have passed a recommendation of the Lighting Committee to increase the flat rate charge for electricity supply by ½d. per unit.

LEICESTER: *Management of Electricity Undertaking.*—At the meeting of the Council last week it was decided to separate the control of the electricity department from that of the gas department. The question of combining the two electricity works is to be reported upon by an outside engineer.

LLANDUDNO: *Street Electric Lighting.*—About two years ago the question of replacing the arc lamps on the promenade by gas was discussed at some length, and an experiment was embarked upon to show the relative advantages of gas and electricity in this connection. A Special Committee have now reported in favour of electricity, and the Council, acting upon their recommendation, have ordered the removal of the experimental gas lamps.

LONDON: *Hammersmith: Electric Lighting Accounts.*—The gross revenue for the past year, namely, £53,433, shows a decrease compared with the previous year. After meeting capital charges the net profit amounts to £5,483. The number of units sold was 7,054,926, compared with 6,198,339 in the previous year, and the total maximum supply demanded was 4,653 kw. This total includes the sale of current to the Imperial International Exhibition, but the units consumed there were less than during the previous exhibition.

Marylebone.—The General Manager has advised that in future the annual charge in respect of the use of electricity for all domestic purposes (other than lighting) should be discontinued,

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as the annual charge for lighting is now considered sufficient to cover all uses of electricity. The proposed reduction will only apply to private consumers who adopt the "telephone" system of charging, and the Electricity Committee are satisfied that though there will be a trifling decrease in revenue the increased business that will be obtained will amply recoup the concession. It will appeal to people who use electricity for other purposes than lighting, and who object to the present small charge per piece of apparatus, and is, of course, another step towards simplification.

Street-Lighting.—The Lighting Committee report that a further forty-two lamps have been converted from gas to electricity, making a total of 2,262 lamps now lit by electricity.

LUTON: *Electricity Accounts.*—The accounts for the electricity department for the past year show a net profit of £3,066 after meeting capital charges. The sum of £908 has been transferred to relief of rates, and £658 to reserve fund, the balance standing to the credit of appropriation account now being £2,606 10s. The charges for electric supply have been revised, and represent approximately a reduction of 20 per cent. for power, 16 per cent. for lighting, and 50 per cent. for heating and cooking. In view of the satisfactory nature of the year's working, the Electricity Committee recommend that every employee in the Department should receive a bonus of one week's wages.

MANCHESTER: *Tramways Accounts.*—The Corporation tramway accounts show a profit of £149,068 after meeting capital charges. It is proposed to distribute this as follows:—Reserve, renewal and depreciation, £70,020 10s.; contribution to rates, £75,000; street improvements, £4,047.

NEWCASTLE-UPON-TYNE: *Tramways.*—The net income from the tramways last year was £197,612, which is only slightly worse than in the previous year. The balance on the year's working is £15,516, which is to be carried to reserve and renewals fund, making this £75,272.

NEWPORT: *Electricity Accounts.*—The net profit on the electricity undertaking for the past year was £376.

Tramway Accounts.—The net profit on the Corporation tramway undertaking for the past year amounts to £2,322.

OLDHAM: *Electricity Accounts.*—The net profit for the past year on the electricity undertaking was £2,203. Under the Oldham Corporation Act of 1909, the area of supply has been considerably increased, with the sanction of the various Local Authorities and the Lancashire Electric Power Co. Experiments have been carried out during the year with lighting Union Street by arc lamps.

SALFORD: *Charge for Tramway Energy.*—Sub-committees from the Electricity and Tramways Committees have concluded the following arrangements as to the charge for current used for traction purposes: (1) The Tramways Committee to guarantee a minimum annual consumption of seven million units of electrical energy, the price to be 1·30d., the present charge; (2) all current consumed by the Tramways Committee in excess of seven million units per annum to be charged for at the rate of 1d. per unit.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

AUSTRALIA.—Port Pirie (South Australia) Council have adopted a report in favour of electric lighting. A Consulting Engineer is to be appointed.

BLACKPOOL.—The scheme for the electric lighting of Bispham district, under the Bispham-with-Norbuck Electric Lighting Order, 1908, prepared by Mr. J. W. Speight, of St. Anne's-on-Sea, has been approved.

BRIDLINGTON. The Local Government Board have sanctioned the borrowing of £2,975 for electrical purposes.

CARLISLE.—An inquiry was held yesterday concerning a loan of £19,600 for electrical extensions.

DENMARK.—The British Consul at Copenhagen reports that large electrical works are at present being planned in Jutland in the district between Aarhus and Randers. The scheme includes an electric railway between these two places, and the establishment of electricity supply.

FLEETWOOD.—The Council require a low-tension switchboard and a 300-kw. steam dynamo. Particulars from the Borough Electrical Engineer, and tenders by July 15th.

IRELAND.—A scheme of electric lighting prepared by Messrs. Coates & Son, Ltd., of Belfast, has been approved, and a public meeting is to be called to consider the matter.

LONDON: *Hammersmith.*—The Highways Committee of the L.C.C. have sanctioned loans of £10,665 and £5,236 for electrical purposes.

Islington.—Sir Alexander Kennedy has reported upon the desirability of increasing the capacity of certain electrical mains. He is of opinion that the present high-tension feeders to four areas are seriously overloaded, and that certain extensions proposed by Mr. Gay, the Borough Electrical Engineer, are absolutely necessary to provide sufficient capacity to meet the probable increase in demand. Sir Alexander further advises the adoption of sub-stations for present and future extensions, in order to obtain satisfactory regulation of the supply pressure. The extensions are estimated to cost £19,872, and the Electricity Committee recommends that tenders be invited.

The Electrical Engineer has also reported that it is necessary, in order to comply with the Home Office electrical regulations, to provide a new main switchboard, at an estimated cost of £3,000.

St. Pancras.—The Chief Electrical Engineer has been instructed to prepare a scheme for a temporary boiler for the coming winter, and tenders are to be invited for same.

NORWAY.—A company has been formed in Norway for the purpose of utilising the water power of the Gullfoss and Sog Falls in Iceland. The name and address of a gentleman who might be communicated with in the matter is on file at the Board of Trade, 73 Basinghall Street, London.

RUSSIA.—H.M. Consul at Moscow reports a great demand in Saratoff for electrical apparatus of all sorts. British firms desirous of doing business there should communicate in German, quoting in marks or roubles.

WARRINGTON.—An Impulse Turbo-alternator of 1,000 kw., with condensing plant, a 750 kw. reversible rotary converter, and the necessary high- and low-tension switchgear, are to be installed at the Corporation's electricity works.

WEDNESBURY.—Mains are to be extended to the King's Hill district at an estimated cost of £327.

Miscellaneous

CARDIFF.—The Borough Electrical Engineer and Tramways Manager has been instructed to obtain tenders for 130 tramcar meters, and to report upon the advantages to be gained from their use.

GRIMSBY.—The Corporation require a supply of 50 c.p. metal filament lamps. (See an advertisement on another page.)

ITALY.—The Italian Minister of Posts and Telegraphs is promoting a Bill providing for an expenditure of £30,000 upon new telephone lines.

MANCHESTER.—The Tramways Committee invite tenders for hard drawn copper trolley wire. Particulars from the Manager, and tenders by July 19th.

SOUTHAMPTON.—The Corporation have decided to construct tramways to the Northern district.

SWANSEA.—The Harbour Trustees require three two-ton electric transporters and overhead travelling cranes. The Clerk, Harbour Board Office. Tenders by July 15th.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

E.C.—Warehouses, City. J. F. May, 249½ High Holborn, W.C.

W.C.—West London Mission Institute, Kingsway. W.C. Architects, Gordon & Gunton, Finsbury House, Blomfield Street, E.C.

N.E.—Rebuilding pavilion at Hackney Infirmary, High Street, Homerton. Builders, C. Wall, Ltd., 4 Lloyd's Avenue, E.C.

S.E.—Offices, &c., Southwark Park Road. Architect, E. K. Purchase, 20 and 22 Maddox Street, W.

PROVINCES.

ACCRINGTON.—Works, Grange Lane (£4,700). Architects, Grimshaw & Cunliffe, Bank Buildings, Accrington.

ASHTON-UNDER-LYNE.—Bank for Ashton Savings Bank. Architects, Wm. H. George & Son, Ashton.

BARNET.—The Guardians have decided to invite tenders for installing electric light in the workhouse.

BIRMINGHAM.—Factory. Architect, T. Silver, Soho Hill, Birmingham. Builder, T. Gregory, Olton, Birmingham.

BISHOP AUCKLAND.—Remodelling of block of infirmary (£1,200). S. Adams, Clerk, Board of Guardians.

BOLTON.—Extension, workhouse (£1,500). Builders, J. C. & F. Woods, Bolton.

BRISTOL.—Extensions, Corn Exchange (£2,000). H. Faraday Proctor, City Electrical Engineer.

BURTON-ON-TRENT.—Theatre. Architect, T. Jenkins, Burton-on-Trent.

BURY.—Mortuary at Infirmary (£1,600). Architect, J. H. Nuttal, 20 Market Street, Bury.

CHESTER.—Fire Station. Builders, T. Meyes & Son, Chester.

DARLINGTON.—School (£4,000). G. Winter, Borough Surveyor, Town Hall, Darlington.

DEVONPORT.—School, Camel's Head. Architects, Thornley & Rooke, The Crescent, Plymouth.

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DOVER.—Paper mills for Wiggins, Teape & Co.
DUBLIN.—New pavilion at Royal Hospital for Incurables. The Governors.
DUDLEY.—Theatre. Architects, Bishop & Smith, Wednesbury.
EAST HAM.—Cinematograph Theatre, 189 High Street North. J. W. Lohden.
EDINBURGH.—Tenders are invited by July 12th for the electric wiring of the workshops at the Tynecastle Supplementary School. Clerk, School Board Offices, Castle Terrace, Edinburgh.
GLASGOW.—Picture Palaces for the Scottish Electric Picture Palaces, Ltd. (£10,500). Architects, Neil & Duff, 155 Wellington Street, Glasgow.
HORNSEY.—Tenders are invited for the wiring of the Stroud Green School. Particulars from the Borough Electrical Engineer, and tenders by July 9th.
ILFORD.—Premier Electric Theatre, High Road. Architects, Emden, Egan & Co., 3 Lancaster Place, W.C.
NORTHAMPTON.—Theatre, Abington Street, for W. T. Simmons.
NOTTINGHAM.—Bank, High Street, for the National Provincial Bank of England, Ltd.
SWANSEA.—Bank (£8,000). Architects, Waller & Son, Gloucester.

TENDERS RECEIVED AND ACCEPTED

ACCRINGTON.—Two Brush double-deck cars at £740 each are to be purchased.
ECCLES.—The Council have accepted the following tenders in connection with the electricity undertaking:—Stewarts & Lloyds, Ltd. (Manchester), steel steam pipework, £14 12s.; H. J. & A. Coulthurst (Darwen), cast-iron condensing water pipework, £25 10s.
KINGSTON-ON-THAMES.—The Council have accepted the tender of Prestwich & Burt for extensions to the main high-tension switchboard, at £334 19s.
LEYTON.—The Council have accepted the tender of Fraser & Fraser, at £70 10s., for an ash elevator at the generating station.
LONDON: *London County Council.*—The tender of the Brush Electrical Engineering Co., Ltd., at £3 7s. each for 180 destination indicator-boxes has been accepted.
Southwark.—The Council have received the following tenders: Turbo-generator, Parsons, £4,265; Willans & Robinson, £3,604; Howden, £4,412; Westinghouse, £3,170; General Electric Co. (provisionally accepted), £3,130; Mitchell, £3,192; Bellis, £3,372; British Electric Plant Co., £3,950; Musgrave, £4,498; Brush, £3,375; B.T.-H. Co., £3,200; The Union Electric Co., Lancashire Dynamo Co., and E.C.C. tendered for the generators only.
The tender of the Davenport Engineering Co. at £1,327 has been provisionally accepted for the cooling tower, and that of the Worthington Pump Co. at £1,888 for the condensing plant.
Woolwich.—The Council have accepted the tender of Sanders, Rehders & Co., at £34 10s., for a "Sarco" recorder for the electricity works. They have also accepted the tender of Carter & Wright for a 15-in. centre lathe with accessories, for £135.
SALFORD.—The Council has accepted the tender of P. R. Jackson & Co., Ltd., at £39 15s., for the supply and delivery of one spare armature, complete with commutator and shaft.

MISCELLANEOUS CITY NOTES

NORTHAMPTON ELECTRIC LIGHT & POWER CO.—An issue of £50,000 debentures of £50 each is to be made at par.
DIVIDENDS ANNOUNCED.—National Telephone Co., 6 per cent. per annum on the deferred stock for the June half-year, placing £175,000 to reserve, and carrying £15,000 forward.
Mexico Tramways Co.: Quarterly dividend at the rate of 7 per cent. per annum.
RIVER PLATE ELECTRICITY CO.—Notice has been given of the conversion of 120,000 ordinary shares of £1 each into £120,000 of ordinary stock, and of 100,000 preference shares of £1 each into £100,000 six per cent. non-cumulative preference stock.
MORTGAGES AND CHARGES.—Railless Electric Traction Co.: Particulars of £3,000 debentures, created April 7th, and secured by trust deed dated June 14th, 1910, the amount of the present issue being nil. Property charged: certain inventions and patents and the company's undertaking and other property, present and future, including uncalled capital. Trustees: Sir Charles D. Fox and W. G. F. Nelson.—Anglo-Argentine Tramways Co.: Trust deed, dated June 15th, 1910, to secure £1,500,000 five per cent. debenture stock, with power to issue further debenture stock ranking *pari passu* therewith, not exceeding in all £6,000,000, and certain other moneys. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to indentures dated January 9th, 1905, June 2nd, 1908, and January 22nd, and July 1st, 1909. Trustees: Law Debenture Corporation, Ltd., 41 Threadneedle Street, E.C.

COMPANIES' MEETINGS AND REPORTS

ELEKTRICITATS GES. VORM. W. LAHMEYER & CO. (Frankfort-on-Main).—The net profit for the past year is 1,454,472 mks. (approx. £72,700), slightly less than the previous year. A dividend of 5 per cent. is recommended, as against 6 per cent. for the previous year. The capital of the company now amounts to 25 million marks (approx. £1,250,000).
GLOBE TELEGRAPH AND TRUST.—The report for the year ended May 31st, gives the net revenue as £209,118, making, with the balance brought forward, £236,432. The available balance, after payment of interim dividends, is £105,336, and a final dividend of 3s. on the preference shares, making 6 per cent. per annum, and 5s. 9d. per share on the ordinary shares, making 5¾ per cent., is recommended. £27,681 is carried forward.
J. G. WHITE & CO.—The net profit for the year was £64,802, the highest earned since the formation of the company. The company is engaged upon important work in Brazil, Argentina, and other places abroad. After meeting the dividend on the 6 per cent. cumulative preferred shares, a dividend of 10 per cent. is declared upon the ordinary shares. The sum of £32,975 is applied in reduction of "purchase of business" account, and £19,404 is carried forward. At the annual meeting it was pointed out that the profits for the past year were larger by more than 50 per cent. than in any previous year. The reserve fund amounts to £100,000, and the Company now has more business in hand than at any time for several years past. After paying dividends this year, the position of the Company is strengthened by nearly £40,000 in net available assets, and the assets are now more than twice the Company's total paid-up capital.
KALGOORLIE ELECTRIC TRAMWAYS.—The net profit for 1909 was £16,573, compared with £15,400 in the previous year.
RIO DE JANEIRO TRAMWAY, LIGHT & POWER CO.—The report for 1909 states that the net profit for the year amounted to 1,149,607 dol. Quarterly dividends of 1 per cent. are being paid. The company had contracts for the supply of 25,719 h.p. on December 31st, against 15,619 h.p. in the previous year. Some interference with the tramway traffic is still being experienced, but all the lines are being rapidly converted to electric traction. The number of additional telephone subscribers secured during the year was 572, making the total 3,991.
GREENWOOD & BATLEY.—The accounts for 1909 show a net sum available, including the amount brought forward, of £12,239. The sum of £3,000 is added to depreciation, and a dividend of 7 per cent. declared on the cumulative preference shares. A balance of £2,211 is carried forward.
CORDOBA LIGHT, POWER & TRACTION CO.—It has been decided to increase the capital of the company to £800,000 by the creation of 300,000 new £1 shares. The new capital is required to complete the works now in hand for all three branches of the company's business.
BOMBAY ELECTRIC SUPPLY & TRAMWAYS CO.—The accounts for 1909 show an increase in revenue of £19,972 compared with the previous year, whilst the expenditure increased by £4,343. After meeting the 6 per cent. preference dividend, £6,000 have been transferred to sinking fund for capital redemption, and £15,000 to depreciation, carrying forward £4,567. The Bombay Corporation have sanctioned certain alterations in the fares, which, in some cases, were unremunerative. The maximum demand system of charging for electrical energy is being abandoned, and a flat-rate tariff instituted, which experience has shown to be better adapted to Oriental conditions.
ELECTRIC TRACTION COMPANY OF HONG KONG.—The Board propose to raise an additional £30,000 of 5 per cent. mortgage debentures, and to write down the 325,000 £1 shares to 5s. each. The existing debenture-holders are opposed to this proposal, as they do not believe that the position of the Company warrants this course of action.
BRITISH ALUMINIUM CO.—The statutory meeting of the reconstructed British Aluminium Co. was held last week, when it was stated that the whole of the shares provided for under the re-arrangement were issued and allotted, and that an issue had also been made of £800,000 5 per cent. prior lien debentures. The total capital of the new Company is £2,420,581, made up of the 5 per cent. debentures mentioned above; £720,398 debenture stock; and £299,570 non-cumulative £1 preference shares and £600,613 ordinary shares. The Company has now sufficient funds to complete the Loch Leven works and their other works. Mr. A. W. Tate, who presided, said that if the present demands for aluminium continue, they should be able to get rid of the whole of the output from the various works, at a price which would yield a reasonable profit.
MARCONI INTERNATIONAL MARINE COMMUNICATION CO.—The report for 1909 states that the business has now reached the stage when the revenue exceeds the heavy standing expenditure, and the directors are confident that the business will continue to show considerable extension.
VICTORIA FALLS & TRANSVAAL POWER CO.—The report for 1909 states that the year has again been mainly occupied in construction work, and, therefore, a profit and loss account has not been prepared. A revenue and expenditure

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account, however, is incorporated in the balance sheet, and shows a surplus of £50,534, which, with the surplus brought forward from the two previous years, makes the total of £135,397, which is carried forward. In consequence of the increasing demand, the directors deem it wise to carry forward this sum instead of distributing dividends upon the preference shares. It is hoped to pay such dividends after May next, when the new station at Rosherville will be in operation. The demands of the various mines have been in excess of the output of the new stations at Brakpan and Simmer Pan. The capacity of the latter station has now been increased to 27,400 h.-p., and the former to 9,700 h.-p. The estimates of the consulting engineers with regard to coal consumption and cost of production at Brakpan and Simmer Pan have been justified. Extensions are being made to the overhead supply in the various mines. The total capacity of the various power stations when completed will be 155,100 h.-p., in addition to 16,000 h.-p. steam turbine-driven air compressors. This plant will enable the Company to supply 500,000,000 units per annum, with sufficient reserve plant. Mr. Bernard Price has been appointed the Company's Engineer-in-Chief in South Africa.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 5s. to £57 15s. per ton (last week, £57 5s. to £57 15s.).

HENLEY'S NEW TELEGRAPHIC ADDRESS.—The telegraphic address of Messrs. W. T. Henley's Telegraph Works Co. Ltd., is "Henletel," London. This word is also registered for use in connection with the firm's branches at Glasgow, Newcastle, Manchester, and Birmingham.

DISSOLUTION OF PARTNERSHIP.—B. Shaw and E. H. Pickford, mechanical and electrical engineers, 264 and 266 Eccleshall Road, Sheffield, have dissolved partnership. Debts, &c., by E. H. Pickford.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—Mr. H. Wilson, 23 Devereux Court, Strand, London, has been appointed trustee in the bankruptcy of J. P. L. Donlevy, consulting electrician, 123 Tulse Hill, Surrey.

In the Liverpool County Court last week an application was made for the discharge from bankruptcy of Mr. A. H. Gibbings, Electrical Engineer, of Liverpool. On behalf of the debtor, it was stated that, but for the action of the House of Lords in inserting the clause in the Electric Lighting Act of 1909, prohibiting supply by non-statutory undertakings, the North British Electrical Power Syndicate would have been formed, from which Mr. Gibbings would have received £15,000 in fees alone, and a large income, as years went on. Most of his debts had been incurred in conducting negotiations and securing wayleaves for that scheme. The discharge was granted, subject to a few minor conditions.

In the Chancery Division last week, before Mr. Justice Swinfen Eady, an application on behalf of the first debenture-holders of the Sunderland District Tramways for the appointment of a receiver and manager was granted. There is already a receiver and manager for the second debenture-holders.

OSRAM LAMPS AT A SKATING CARNIVAL.—At a fancy dress carnival held at the Long Eaton Skating Rink on June 14th, Mr. Albert Burns, a local electrician, obtained the first prize for his representation of "Electricity," in which Osram lamps, supplied from two small batteries, played a prominent part.

APPOINTMENTS AND PERSONAL NOTES

Foreman wanted for electrical repair shop. Well up in A.C. and D.C. work. (See an advertisement on another page.)

The salary of Mr. L. Johnston, Borough Electrical Engineer at Gloucester, is to be increased to £350 per annum.

Mr. F. T. Olding, Traffic Superintendent of the Bournemouth Corporation Tramways, has been presented with a pair of prismatic binoculars on the occasion of his leaving to take up an important appointment in Queensland.

Mr. John Wood, Junior, has been admitted a partner in the firm of Messrs. Mosses & Mitchell, of Golden Lane, London.

The appointment of Mr. C. H. Yeaman, Borough Electrical Engineer at Hanley, as Chief Electrical Engineer to the new County Borough of Stoke-upon-Trent, at a salary of £500 per annum and £10 per annum for local travelling expenses, has been confirmed by the Council. Mr. Yeaman was presented last week with a silver fountain pen by the students to whom he has delivered a course of lectures on electricity supply at the Municipal School.

Mr. W. Fennell, Electrical Engineer to the Wednesbury District Council, has entered into a new agreement at a salary of £275 per annum for two years, and £300 for the third year.

Mr. C. J. Habgood, of Bristol, has been appointed Shift Engineer at Wednesbury in place of G. Garratt.

Salford Town Council has appointed Mr. H. J. Roscoe, of London, superintendent of their hired-motor department, at a salary of £120 per annum.

Mr. G. Bartholomew, Charge Engineer in the Woolwich Electricity Department, has resigned his appointment to take up a similar position with the Electric Supply Corporation, Ltd.

The salary of Mr. Jos. Boyce, Assistant Electrical Engineer to the Darwen Corporation, has been increased from £123 10s. to £130 per annum.

The Warrington Tramways Committee have increased the salary of Mr. John Telfer, Tramways Manager, from £208 to £234 per annum.

NEW COMPANIES

PEARSON & COX, 1 Tudor Parade, Beckenham Lane, Shortlands, Kent. Capital £2,500. Electrical and mechanical engineers.

TRANSIT CO.—Atherton, Lancs. Capital, £2,000. To construct or acquire tramways and light railways in Great Britain.

"CEDES" ELECTRIC TRACTION, 15 Cockspur Street, London. Capital, £2,000. Electricians, electrical engineers, and manufacturers of motor-cars, &c. Subscribers: G. F. Underwood, director, and K. D. Bowers, electrical engineer, Sutherland House, Surbiton.

HARPER ELECTRIC PIANO (1910) CO., 258-262 Holloway Road, London. Capital, £30,000 in 28,000 participating ordinary £1 shares, and 20,000 deferred shares of 2s. each. To supply electric pianos, &c., to cinematograph theatres and other places of amusement, and to erect an "electric" theatre at Islington.

NEW LIVERPOOL RUBBER CO.—Registered by Jordan & Sons, Ltd., Chancery Lane, London. Capital, £150,000 (52,000 5½ per cent. cumulative shares). To take over the business of the Liverpool Rubber Co., incorporated in 1894.

LEAKE-SUMNER GUN FIRE CONTROL SYNDICATE.—Registered June 9th, capital of £1,500, to carry on the business of engineers, manufacturers of and dealers in apparatus used in connection with electric signalling, &c., and to acquire from H. C. Leake and O. Sumner and turn to account certain inventions relating to gun fire control and improvements therein, &c. Private company. Registered office: 39 Victoria Street, Westminster.

J. H. WALLACE & CO.—Registered by Surtees, Phillpotts & Co., 4 Bishopsgate, London, E.C. Capital, £5,000. Manufacturers of and dealers in electrical and other machinery.

NEW AFRICAN CONCESSIONS SYNDICATE.—Registered by Hollams, Sons, Coward & Hawksley. Capital, £50,000. To acquire African Concessions, Ltd. (registered in 1895), and carry on business as suppliers of electricity, &c.

DE LAVAL IGNITER CO., 64a Broad Street, Birmingham. Capital £1,500. Manufacturers of and dealers in dynamos, motors, switchboards, controllers, resistances, &c.

Telegraph Traffic.—The cable between Fort de France, Martinique and Paramaribo, Dutch Guiana, failed on the 25th ult. Telegrams for French and Dutch Guiana must now be sent *viâ* Salinas. On the 27th ult. the cable between Bonny and Duala was only working intermittently, and was put in order the same day.—The Gibraltar-Tangier cable has once more given out; there have been several interruptions to this line during the present year.—Lastly, the line between Bagdad and Bassorah succumbed on 4th inst.—A new cable from Waterville, Ireland, to Weston-super-Mare has been opened for traffic by the Commercial Cable Co. This company has also renewed a considerable section of their cables from Waterville westward with a heavier type of cable in view of damage from trawlers.

After-Effects of an Electric Shock.—At the Shoreditch County Court on Tuesday an action was heard under the Workmen's Compensation Act, before Judge Bray. The applicant, F. S. Sharpe, was formerly employed at the Shoreditch Borough Council electricity works, and received a shock in December, 1908, by his rule coming into contact with a live conductor when measuring up cable. He had also been badly burned and laid up for fourteen weeks by a previous shock in 1904. It appears that the Insurance Co. stopped payment of compensation in April last, but the man was still suffering from traumatic neurasthenia, and was not able to do regular work. He therefore brought the action for continuance of payment of compensation. He was now in receipt of 9s. 4d. a week from his sick club. The Judge suggested that the Insurance Co. should send him away for a month, and then the Shoreditch Borough Council might try the experiment of giving him light work. The hearing was adjourned for that purpose.



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General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

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Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.

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"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

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Stannah (J.), Skin Market Place, Bankside, S.E.
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Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
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Lecoche & Cattaneo, 39, Victoria St., S.W.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Phœnix Dynamo Manfg. Co., Ltd., Thornbury Works, Bradford.
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WIRING CONTRACTORS. See page iv

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ELECTRICAL ENGINEERING

No. 185 [Vol. VI., No. 28] THURSDAY, JULY 14, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

Official Notices and Technical College Announcements are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, *Tuesday first post*
Small Advertisements and Official Announcements, *Wednesday first post.*
Displayed Advertisements, *Tuesday first post.*
Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

The North-East London Railway Bill, which applied for an extension of time in which to construct the line, has been rejected. The line will probably be abandoned. The London Electric Supply Bill has been passed by a Committee of the House of Commons. (Page 456.)

The list of awards at the Japan-British Exhibition has been announced. A number of prizes and medals are given in the Electrical Engineering Section. (Page 456.)

An article by Mr. L. H. Walter gives a detailed description of the equipment of the new wireless telegraph station of the French post-office at Boulogne. A directive equipment on the Bellini-Tosi system is provided, as well as a non-directive arrangement. With a wave length as short as 600 metres, communication is kept up daily with Algiers with an expenditure of only 500 watts. The directive system is found to give much greater range than can be obtained with the non-directive aerial and to enable interference of other stations in the neighbourhood to be largely avoided when receiving. (Page 457.)

The subscribers to the main Copenhagen Telephone Exchange have been transferred to a new exchange on the central battery system. Previously to the change-over, condensers were added to the subscribers' instruments, but were left short-circuited with a copper wire, which the subscribers were directed to cut themselves on the day of the transfer. (Page 459.)

The Council of the Austrian State Railways have passed a resolution in favour of discontinuing the use of gas lighting on passenger trains and the universal adoption of electric train-lighting. (Page 460.)

An electric steel furnace, combining the advantages of the arc and resistance types, is described in a Paper by Paul Girod. The electroplating plant of the National Cash Register Co., of Ohio, and the processes employed there are described, and some notes are given on the new plant installed by the Consolidated Nickel Co. of America, for the manufacture of nickel silicide by the direct reduction of ores in the electric furnace. (Page 460.)

A method of fault localisation, described in a recent Paper by Mr. W. A. Toppin, at Glasgow, consists of pushing a carrier containing a voltmeter and two brushes along the surface of the ground over the cable. One terminal of the voltmeter is connected to a steel rod driven into the earth a few yards from the route, and the other terminal is connected to the brushes. The Paper also dealt with the arrangement of a testing panel for a three-wire network, and both subjects were discussed by several speakers. (Page 461.)

Our Monthly Article on new electrical supplies and accessories includes illustrated descriptons of a new flame arc lamp, a new metal filament candle lamp, and a rainproof cap for incandescent lamps. A new inter-

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locked ironclad switch and fuse is also described, and further novelties dealt with include a new toaster and an electric fountain. (Page 462.)

THE latest form of tramcar controller manufactured by the General Electric Co. is described and illustrated on page 464.

A PATENT by Mr. D. B. Morison, of Messrs. Richardsons, Westgarth & Co., Ltd., for a method of automatically regulating the admission of steam into heat accumulators used in conjunction with low-pressure turbines supplied with exhaust steam from intermittently working engines, has been granted in spite of the opposition of the French company owning the Rateau patents for heat accumulators. (Page 465.)

IN the Chancery Court, before Mr. Justice Neville, an action is being heard against the West Ham Corporation, at the instance of the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., in respect of the financial management of the electricity undertaking. It is alleged that certain overdrafts at the Bank have been made in the absence of sanction from the Local Government Board, and are therefore illegal, and consequently the interest which is being paid to the bank is recoverable. It is further complained that the statutory provisions in regard to sinking fund is not being complied with. (Page 465.)

A NEW memorandum of requirements regarding tramway equipment has been issued by the Board of Trade. (Page 465.)

AMONG the specifications published by the Patent Office on Thursday last was one by Siemens Bros. & Co., Ltd., F. Hird, and G. S. Grimston for double-barrelled searchlight projectors.—A form of rotary converter with unwound commutating poles, energised by the armature reaction, is protected by the British Thomson-Houston Co.—S. K. Thompson patents a counterweight pendant with separate pulleys for the different conductors.—Another specification published is that of the Denny tumbler switch with overload release. (Page 466.)

BRADFORD Corporation are giving a trial to the "Norwich" system of charging.—Glasgow tramway accounts for last year show a net profit of £53,028, the Manchester tramway accounts £133,321, and the Sheffield tramway accounts £39,252.—There is a loss of £2,035 upon the Sheffield electricity accounts for last year.—Torquay Council have refused to sanction the overhead system of tramways in substitution for the Dolter surface-contact system.—Arbitration is to be resorted to at Winchester in connection with the purchase of the local electric supply company, and at West Hartlepool for the purchase of the tramway company.—Worcester wiring contractors protest against the Electricity Department selling heating and cooking apparatus. (Page 467.)

AN electric lighting scheme has been reported upon at Sevenoaks; mains are to be extended at Hove; extensions to generating plant are contemplated at Poplar, York, and Aldershot. Generating plants are to be installed at the Leith Docks and at Barnet Workhouse. Tramcars are required at Walthamstow. The L.C.C. are purchasing some electrical vehicles for Fire Brigade purposes. (Page 468.)

THE net profit of the General Electric Co. for 1909 was £55,904.—The Electric Construction Co.'s accounts for last year show a net profit of £10,811, and complaint is made that the works have not been fully occupied during the year. No dividends are paid on the ordinary shares.—The half-yearly dividend of the City and South London Railway Co. is 1¼ per cent., against 1¾ per cent. last year.—A scheme of capital reorganisation is under consideration by Edmundson's Electricity Corporation. (Page 470.)

PARLIAMENTARY INTELLIGENCE

HANDSWORTH DISTRICT COUNCIL BILL.—This Bill was before the Local Legislation Committee of the House of Commons last week It confers further powers upon the Handsworth District Council in reference to the tramways, among other things. The cost of the tramways proposed is £67,000, and for street widenings and new streets the sum of £17,000 is included. The Birmingham Corporation opposed the Bill in view of the proceedings in connection with the Birmingham extension scheme, which will include Handsworth. After some discussion and private deliberation, the Committee decided to postpone consideration of the Bill for a fortnight, or until a decision has been come to on the Birmingham Order.

NORTH-EAST LONDON RAILWAY BILL.—This Bill was before a House of Lords Committee last week, and during the proceedings the promoters asked leave to withdraw it on the ground that they found themselves unable to raise the necessary capital. The Great Eastern Railway Co., who opposed the Bill, asked the Committee not to allow it to be withdrawn, but to reject it. Mr. Freeman, K.C., for the Great Eastern Co., said he would then ask for costs on the ground that the company had been unreasonably and vexatiously put to expense, in accordance with the Standing Orders of the House. After a little discussion the Committee took this view, and declared the preamble not proved; they further decided that the Great Eastern Railway Co. were entitled to their costs in respect of the opposing Bill.

The North-East London Railway was authorised in 1905, an important condition in the Bill being that half the capital should be raised within twelve months. This, however, was not possible, and the promoters of the Bill have been granted four extensions of time. The present Bill applied for a further extension of time. The proposed line is from Shoreditch to Waltham Cross, and runs through the populous district of north-east London, where it would be in competition with the Great Eastern Railway.

PROGRESS OF ELECTRICAL BILLS.—The Metropolitan Railway and the Reading & District Electric Supply Bills were read a third time in the House of Commons on Friday.

The L.C.C. (Tramways and Improvements) and the Southampton Corporation Bills were read a second time in the House of Lords on Tuesday.

Leeds Corporation Bill was read a third time in the House of Commons on Wednesday last week.

Belfast Corporation Bill was read a second time in the House of Lords on Thursday.

London Electric Railway Amalgamation Bill was read a third time in the House of Commons on Monday.

LONDON ELECTRIC SUPPLY BILL.—This Bill, which provides for the purchase by the London County Council of the five West End electric lighting companies, was passed by a Select Committee of the House of Commons on Tuesday. There was no opposition.

AWARDS AT THE JAPAN-BRITISH EXHIBITION

THE Jury of the Japan-British Exhibition have made the following awards in the Electrical Engineering section:—

Grand Prizes.—The Dowsing Radiant Heat Co., Ltd. (medical baths and heating appliances); Electromotors, Ltd. (balancer set, motors, &c.); India Rubber, Gutta Percha & Telegraph Works Co., Ltd. (telephone apparatus and rubber goods); Osram Lamp Works, Ltd. (metal filament lamps and fittings); Western Electric Co., Ltd. (telephones and cables); the Chloride Electrical Storage Co., Ltd. (cells and accessories).

Diploma of Honour.—Newtons, Ltd., Taunton (direct-current generators and motors).

Gold Medals.—John Dugdill & Co. (moving and extending fittings); the Maxim Lamp Works, Ltd. (flame and enclosed arcs and metal filament lamps; Bertram Thomas (electric cooking appliances); the Float Electric Co., Ltd. (mining lamps and small batteries).

Silver Medals.—P. & J. Jackson & Co. (small house-lighting set and appliances); Lambie, Wrigley & Co. (fans, switchboard, and accessories).

The distribution of the awards will be made in the Congress Hall at the Exhibition on July 15th at 3.30 p.m. H.R.H. Prince Arthur of Connaught will preside.

Electric Traction in Victoria.—In the speech made by the Governor on the opening of Parliament on July 6th, reference was made to the appointment of a Royal Commission to consider the future of the Melbourne tramways, which are on the cable system and are privately owned. The proposed conversion of the suburban railways is also to be thoroughly inquired into again.

The Leicester Fittings Case.—The Sheffield Electric Light Committee propose to contribute £25 towards the cost of an appeal against Mr. Justice Neville's recent judgment that a Corporation carrying on an electric lighting undertaking is not entitled to wire premises and supply electric fittings without special Parliamentary powers.

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DIRECTIVE WIRELESS TELEGRAPH STATION AT BOULOGNE

By L. H. Walter

THE new station of the French Administration des Postes et Télégraphes at Boulogne, which has recently been completed, is of special interest in that it represents the first example of a new departure in commercial radiotelegraphy. All other stations, on whatever method equipped, only differ in what are really minor matters of detail. This station has a nominal range of 300 kilometres, but actually much greater distances are covered. It is one of a chain of stations which the French Government recently decided to erect with a view to ensuring regular communication in the event of further possible trouble, such as was caused by the recent strike of telegraphists. Since the stations can be occupied by the military in case of need, the Boulogne station has, further, a strategic value.

As the result of exhaustive trials with the Bellini-Tosi directive system, the engineers decided to equip

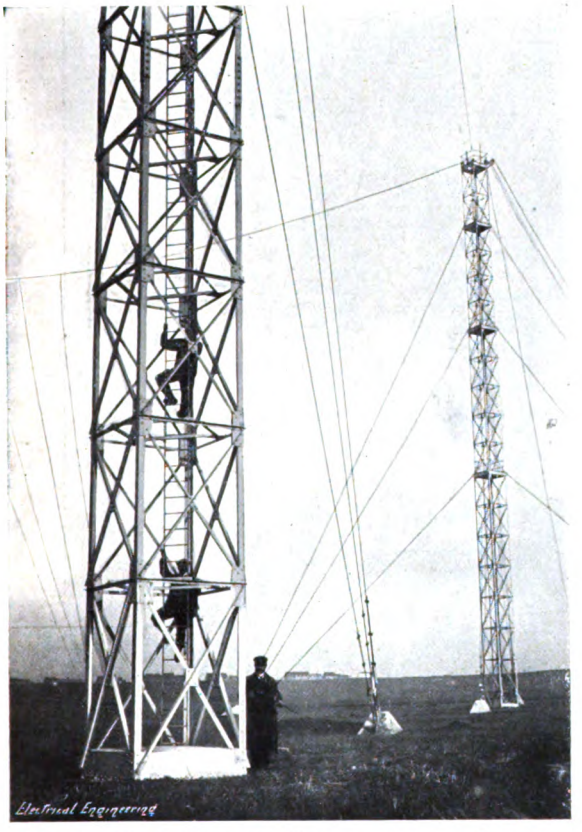


FIG. 1.—VIEW SHOWING CONSTRUCTION OF TOWERS.

the new station not merely with an installation on the ordinary system, but also with the directive method, as by this means they would be able to secure all the advantages which recent advances in radiotelegraphy have made available. The development of the Bellini-Tosi method has been traced at length in the columns of ELECTRICAL ENGINEERING from the first experiments onward (Vol. II., p. 771, Vol. III., pp. 348 and 507), and as the system is now well known, it is unnecessary to refer to the principles involved. The writer having recently had an opportunity of inspecting the station is enabled to describe the chief features, and also to refer to the practical results and the methods of working adopted. As already noticed in ELECTRICAL ENGINEERING, the station is situated on the cliff about 2 km. inland, on the high ground known as La Warroquerie; the distance from the river Liane leading to the harbour is, however, much less. The station comprises an aerial structure of four latticework towers, whose construction is shown in Fig. 1. The towers are each 46 metres in height, and spaced at the corners of a square of 80 metres side (see Fig. 2); they support the vertical antenna of the ordinary system, as well as the directive aerials of the Bellini-Tosi system. There are three buildings, one for the generating equipment, one used as stores, and one for the station itself. The generating plant consists of a vertical oil engine coupled to a dynamo, which is used for charging a secondary battery of 60 Tudor cells capable of giving about 25 amperes at 120 volts. These cells are used as the source of current for the transmission.

The station proper consists of a brick building located at the centre of the aerial system. Fig. 3 gives a view of the interior of the operating room, with Dr. Bellini standing on the right and Capt. Tosi on the left. The vertical antenna of the ordinary system is a roof aerial in the form of a horizontal X (see Fig. 2), supported from the tops of the towers. A vertical wire from the mid-point of the cross is led directly into the building, through a vertical tunnel insulator. This latter consists of a vertical tube about 25 cm. in diameter, having a thick glass disc at each end,

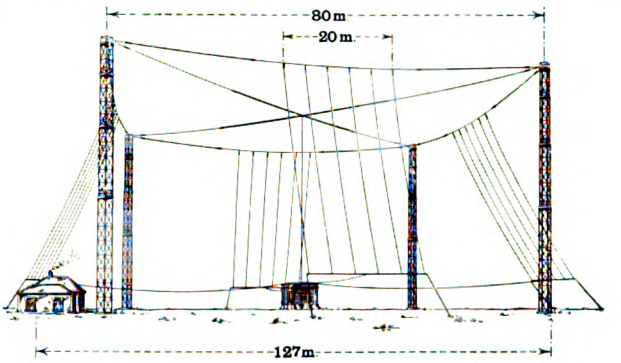


FIG. 2.—SKETCH SHOWING ARRANGEMENT OF AERIAL.

through the centre of which the ebonite insulator is passed. The earth consists of a surface of zinc sheet buried in the ground beneath the station. The directive aerials comprise two Brown aerials set at 90° to one another in the well-known way. The vertical part of each Brown aerial consists of a harp of six wires, each suspended from insulators at the top, attached to a cable strung between the tops of the towers. The wires are hung at the central part of each span, and are spaced 4 metres apart. The lower ends of these wires are joined, and are connected up by a single conductor leading to the station. There are thus four wires which enter the station, and these are led in through tunnel insulators symmetrically spaced around the centre one, which brings in the vertical antenna. The distance between the upper ends of the harps is 81 metres, and at the lower ends 127 metres, the connecting wires leading to the station being supported 8 metres above the ground and thus well out of reach. The transmitting equipment consists of two (one spare) vertical spark coils of the Gaiffe-Rochefort type with motor-driven mercury break, the actual break taking place under water, and being operated by a relay key. In front of these spark coils are the Moscicki condensers, of which there are 14, of the large size, but as three or four of these would suffice, they are connected up in a series-parallel arrangement which allows of finer adjustment. The condenser

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battery can discharge across either of two spark-gaps—one for the ordinary system and one for the directive system, a simple change-over switch operated by a cord being fitted for this purpose. Two gaps are employed in order that the connections, which are of strip copper, should be as short as possible. The sparking electrodes are in the form of discs about 10 cm. in diameter, with projecting rims, and are perforated; the periphery being so extensive, cooling is facilitated, and it is found that the discs never get overheated.

The arrangement of the ordinary system presents no special feature, it being on the usual lines, direct excitation being employed for sending, according to the usual French practice. For the directive method the spark-gap is connected up to the radiogoniometer (which can be seen high up in the centre of Fig. 3), by means of thin copper strip. In this case the excitation is effected inductively. The change-over switch enables the change from the directive transmission to the ordinary system, and *vice versâ*, to be quickly effected. For receiving, the ordinary and directive systems are combined and made interchangeable in an ingenious manner, so that it is possible, by merely turning a switch handle, to change from (1) ordinary system, direct coupling, to (2) ordinary system, inductive coupling, or to (3) directive system—and this without change of wave-length. Diagrams of connections are given in Fig. 4, these being in the order of increasing selectivity of the circuits, corresponding to the numbers given above. As only detectors of the crystal type are employed, there is a great saving of complication owing to the absence of batteries, potentiometers, &c. The kind of crystal used is iron pyrites, upon which a brass point is pressed.

The wave-length chosen is 300 metres; the vertical antenna is adjusted so that its natural wave-length has this value. The directive aerials were constructed before this short wave-length was decided upon, and so the natural wave-length of each, about 600 metres, is brought up to 900 metres by a special means which does not involve the use of a large and costly inductance. The directive aerial system is caused to operate with a wave-length of 300 metres by exciting on it the harmonic overtone of triple frequency. The results obtained are excellent, however, in spite of what might be considered an undesirable mode of excitation; this point will be referred to later on.

Some interesting quantitative measurements have recently been carried out by Messrs. Bellini and Tosi, which serve to confirm their theoretical prediction that the directive system should, for equal primary energy, have a greater range than the ordinary system, although the inverse view has generally been expressed.

A Duddell thermo-galvanometer, set up at the Column de la Grande Armée, 3 kilometres distant from the station (and thus 10 wave-lengths away), was used to obtain diagrams of the energy radiated in different directions by the Bellini-Tosi system, and for making a comparison of the energy radiated by this system with that emitted by the ordinary vertical antenna. A long series of experiments has shown that, using a single harp of one directive aerial as an ordinary antenna, connected to earth through the radiogoniometer, the mean deflection obtained was 35 mm., with a current of $K \times 0{\cdot}24$ ampere in the antenna. With the complete directive aerial, not earthed, the mean deflection obtained was 113 mm., the current in the aerial being $K \times 0{\cdot}17$ ampere. For equality of current in the aerial systems the deflections work out at 19 mm. with the ordinary antenna, and 113 mm. with the directive aerial. The latter system, therefore, radiates a much greater amount of energy than the ordinary antenna does, the range of the directive system being about 1·8 times that of the ordinary system. This result is attributed to two causes: Firstly, the current loop is completely detached and free in the directive aerials, and is, on

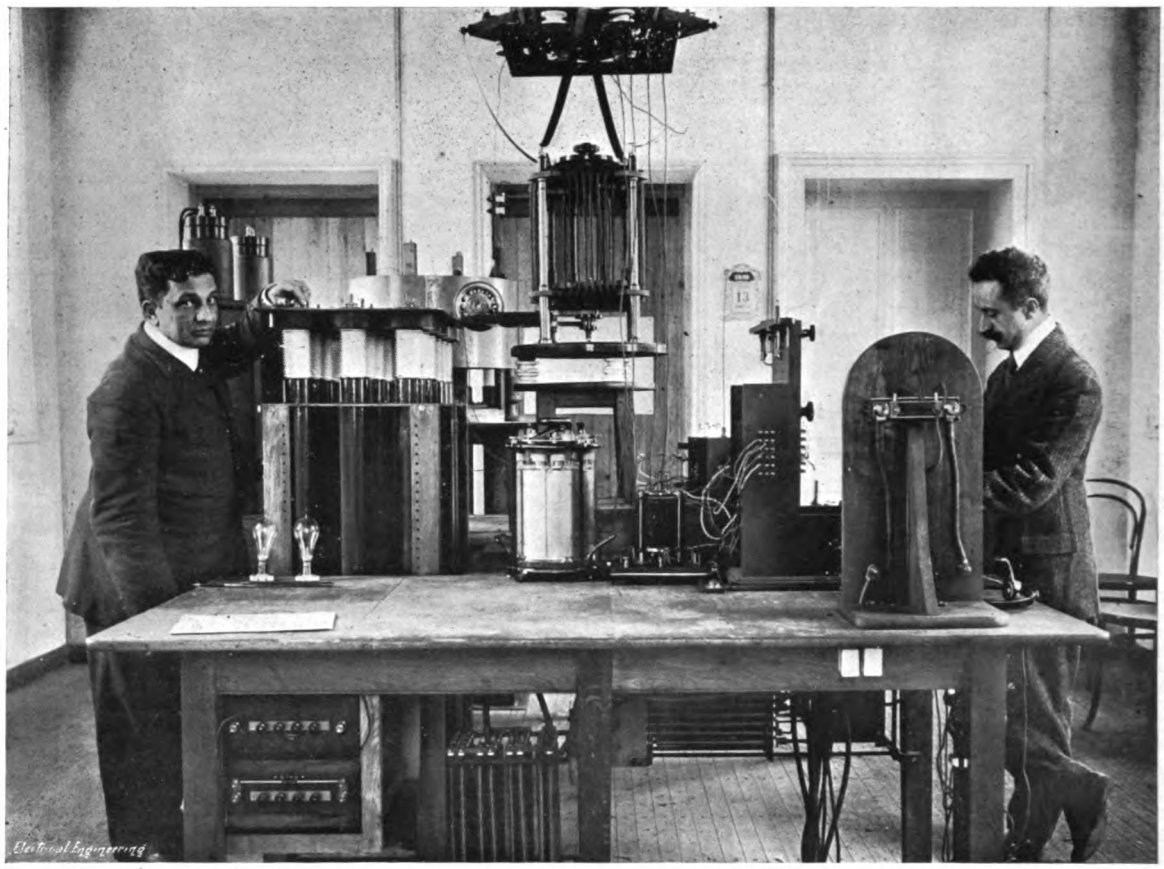


FIG. 3.—INTERIOR OF STATION.

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the contrary, shut in the station in the case of the vertical antenna. Secondly, the Brown aerials do not require the earth connection, so that the resistance of the earth connection, and the consequent absorption of energy thereby, is eliminated. A further experiment was carried out to meet the possible criticism that a single harp oscillating at the triple frequency was not the best type of vertical antenna to make comparisons with the directive system. For this reason, the single harp was compared (for equal antenna currents and coupling) with the ordinary vertical antenna of the station, excited in the usual manner. It was found that the deflections were 35 mm. and 7 mm. for the harp and for the vertical antenna respectively. Thus the radiation of the harp is unquestionably superior; in fact, had the comparison been made between the complete non-earthed directive aerial and the ordinary antenna, it is seen that the deflections obtained would be in the ratio 113:7. It must be borne in mind that even here the most favourable conditions are not quite realised, since the distance between the two harps of each directive aerial is less than 150 metres, the half wave-length.

Turning now to the practical results achieved, the station has been used for ship to shore and long-distance communication. Using only 500 watts of primary energy, regular communication is maintained nightly with Algiers (1,600 kilometres, 1,100 of which are over land), which for the short wave-length used may be considered very good. Even at this great

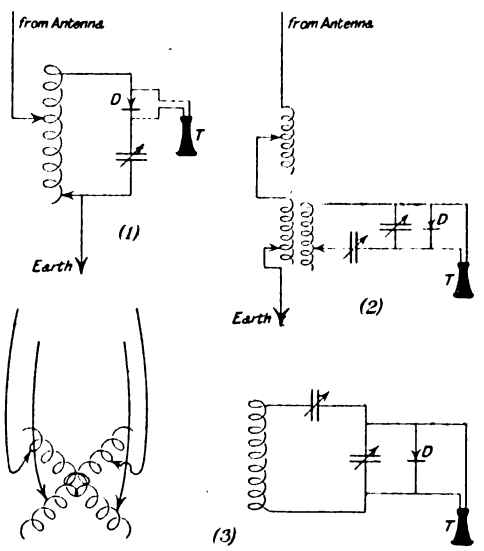


FIG. 4.—DIAGRAMS OF CONNECTIONS.

distance the signals from the directive system are always found to be notably stronger than from the ordinary system; in the usual method of estimating the strength of signals, the directive signals were, for instance, found to be No. 6, while those from the ordinary system were No. 4.

For ordinary purposes, such as listening for messages, the ordinary system is, of course, employed, unless it is desired to pick up signals from a known direction only; in practice, however, it is found that the operators almost invariably change over to the directive method so soon as they have picked up the message. This is only natural, for anyone familiar with the conditions in this part of the Channel knows that there are often too many signals about simultaneously for reception to be comfortable, or even possible. The directive method, besides enabling the direction of the incoming messages to be ascertained, serves to cut out, independently of tuning, a great number of signals which it is not desired to hear while another message is proceeding, if these come from quarters which are not nearly in the line of communication. It has, however, further selective properties which depend upon the wave-length. Thus the Scheveningen station, which is very powerful and only 240 km. distant, although it uses a wave 600 metres long, gives strong signals on the ordinary system receiver, although this is tuned to 300 metres; but it has been found impossible to hear the Scheveningen signals when using the directive system. Similarly the Dunkirk station (600 metres wave-length), only 70 km. distant, gives very strong signals in the ordinary receiver, while with the directive system it is practically only just possible to hear them.

In conclusion, although it is somewhat early to judge, there seems little doubt that the results obtained at this station are bound to have a marked effect upon the future of radiotelegraphy. Hitherto the directive method has not been favoured, solely because in the early days the range appeared to be less than that of the ordinary system. Now that this fallacy has been exposed its advantages should soon make themselves felt.

NEW TELEPHONE EXCHANGE IN COPENHAGEN

ON Saturday night, June 18th, the Copenhagen Telephone Co. transferred the subscribers on its main exchange in Yorks Passage to a new exchange in Nörregade. The old exchange was on the magneto system, with local batteries at the subscribers' stations, but in the new exchange the common battery system, with lamp signalling, is employed. It is interesting to note how far behind London Copenhagen has been in adopting the most modern methods in telephony, although so much is spoken in ill-informed quarters of our backwardness in telephony compared with Scandinavian countries. The Copenhagen Telephone Co. has moved slowly and cautiously, as a smaller exchange, the "Byen" exchange, was first equipped on the C.B. system—in the present building in Nörregade. It has been in operation for some time, and the two exchanges now occupy the same building. The new central exchange is equipped for 18,000 subscribers. An interesting feature of the change over was that condensers were first added to the subscribers' instruments in the usual way to render them suitable for C.B. working, but these were left short-circuited with a copper wire. The subscribers were directed to cut the short-circuiting wire themselves on the day of the transfer, and, according to *Ingeniören*, some of them, in their endeavour to do this thoroughly, severed all the wires leading to their instruments.

The Post Office Electrical Engineers' Journal.—The July issue of this magazine contains, amongst other matters of interest, some photographs of the laying of the new Channel telephone cable with Pupin coils. No particulars are given of the cable, but our readers will remember the illustrated details which appeared in a special article in ELECTRICAL ENGINEERING, March 17th, page 179.

The London County Council and the Imperial College of Science.—On December 21st, 1909, the London County Council decided to make, as in the previous year, a maintenance grant of £8,000 to the Imperial College of Science and Technology, South Kensington. In return for this grant it secures the privilege of nominating 25 students for one year's free instruction at the College. These nominations are now to be made for the first time. The instruction will be of an advanced nature, and, therefore, only advanced students who are qualified to enter on the fourth year of the course should apply. There is no restriction as to income, but intending candidates must be ordinarily resident in the administrative county of London, and must be students at an institution aided, maintained, or approved by the Council. The free studentships do not entitle the holders to any maintenance grants, but cover all ordinary tuition fees. No examination will be adopted for the final selection of the students from the applications received. The free studentships will be awarded on consideration of the past records of the candidates, the recommendations of their teachers, the course of study they intend to follow, and generally upon their fitness for advanced study in science applied to industry. It is quite possible that, in special cases, the free places may be extended to two or more years. Application should be made without delay, as entries will not be considered after July 23rd, 1910. Application forms can be obtained from the Education Officer, London County Council, Victoria Embankment, London, W.C.

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ELECTRICITY v. GAS FOR TRAIN LIGHTING

OUR attention has been directed to the movement which is being made in various quarters to secure freedom from the liability for serious fires in railway accidents by the suppression of gas lighting on trains and the universal adoption of electric train lighting. It will be remembered that only last month it was reported from Paris that the express train, which met with the bad accident at Villepreux, was gas-lighted, and that the gas tanks were the cause of the burning of the cars.

Energetic action is being taken in Austria, and, according to the Vienna papers, the following resolution, moved by Director M. Krassny, was passed recently by the Council of the Austrian State Railways: The Imperial and Royal Ministry for Railways are requested to discontinue the use of gas light in passenger trains, and to use electric lighting in future for all passenger cars, including those at present on order. In the discussion, the success of electric train lighting systems was enlarged upon, and it was mentioned that the Italians were gradually doing away with gas for train lighting. Among the accidents in which fires caused by the gas have led to loss of lives of passengers uninjured by the accident itself were those at Marburg and Herlishein in November, Tenton, Missouri, in December, the shocking accident in Uhersko on Christmas Day, 1909, and the accident on the Canadian Pacific Railway in January. It was reported that the Administration of the Northern Railway of Austria has finished a series of tests, which have shown that, taking into consideration recent improvements, the system of lighting by electricity now presents economic advantages. Owing to the introduction of the metallic filament lamp, the consumption of electrical energy is reduced to nearly one-third of the previous value. They have decided, as a result of these tests, that not only should old cars be converted, but that for the 110 new cars to be supplied in 1911, electric lighting should also be used. In his *résumé*, Mr. Krassny gave a comparison of the costs of the electric and gas lighting, and mentioned that all Swiss railways, and the great French railways, have decided to adopt in future electric lighting exclusively.

ELECTROMETALLURGY AND ELECTRO-CHEMISTRY

At the last meeting of the Faraday Society, a paper was presented by Paul Girod—"Studies in the Electrometallurgy of Ferro-Alloys and Steels." Girod is so well known as the pioneer in the manufacture of ferro-alloys in the electric furnace, that a paper by him is always interesting. The chief interest in this paper is his contribution to the subject of electric steel. The furnace which he has designed is of the oscillatory type, so that it can be tipped for pouring or cleaning. Inside the furnace are rods of iron embedded in the fire-brick for carrying the current, in such a way that they penetrate the lowest part of the metal charge. The other electrode passes through the roof of the furnace. When the Girod furnace is freshly charged with cold matter, the resistance of the charge is sufficiently great to convert almost the whole of the energy into heat; short circuits are thus avoided. Even when the metal is melted the charge always offers sufficient resistance to absorb 10 to 15 per cent. of pressure across the furnace, this resistance still being sufficient to prevent short circuiting. Girod considers that the methods adopted tend to unite all the advantages that can be gained from the arc and resistance furnaces.

The second paper was by Mr. E. F. Law on "The Failure of Light Engineering Alloys, particularly the Aluminium Alloys. The author described how some of the alloys, after being made and remaining apparently in good condition for some time, would spontaneously crumble to a fine powder.

The third paper was by Dr. F. Mollwo Perkin on "Quartz Mercury Vapour Lamps." He first described one of special design which he had made to investigate the effect of ultra-violet rays on gases or mixtures of gases. This lamp is a double tube, the inner one being evacuated and has the mercury arc struck within it. An outer mantle is fused over this, and has a tube fixed into it at either end, so that gases may be passed through and afterwards collected for examination. Mention was made of the union of sulphur dioxide and oxygen to form sulphur trioxide, which can then be passed into water to form sulphuric acid; this has, indeed, been patented in Germany. Dr. Perkin also referred to the extraordinary sterilising action of the ultra-violet rays. In Paris water is actually being sterilised on a large scale by means of these rays. One of the lamps was shown in operation; even on the 100-volt circuit this showed extreme brilliancy, although it had been made for a 200-volt circuit.

Metallurgical and Chemical Engineering of May contains a description of the modern electroplating plant of the National Cash Register Co., Dayton, Ohio. The plating room has a floor space of 540 by 60 feet. There are 105 plating tanks, which are separately equipped with ammeter, voltmeter, and rheostat, so that each tank may be separately controlled. Ninety-three of the tanks are for "wire work," that is, the plating of comparatively large pieces, plates, rods, &c., which are suspended in the bath by wires twisted round the cathode bar. The 12 other tanks are fitted with wicker-work baskets, each basket having a capacity of from two to three pailfuls of bolts, nuts, and other small parts. During the operation of plating the baskets are slowly rotated in the electrolyte. The cleaning of the iron and steel articles before plating is electrolytic. The articles are made the cathode in an electrolyte (probably caustic soda, the material of the electrolyte is not given), and the vigorous evolution of hydrogen loosens and carries away the impurities. Bronze castings are cleaned with soapy water and caustic soda. The acid dipping room is 20 by 60 feet, but there are special pickling tanks for hydrochloric, hydrofluoric, and nitric acids in a separate room, from which the acid fumes are carried away by fans. As showing the size of the plant it may be mentioned that 30,000 gallons of the nickel-plating solution are in use, 4,000 of zinc solution, 6,000 gallons of copper sulphate, 800 gallons of silver solution, beside others. For current purposes six direct-current motor-generator sets are used. They are run from a 225-volt circuit, the speeds varying from 450—850 revs., and have outputs from 400 to 4,000 amperes, at 6 to 12 volts. Some are shunt and some are compound wound.

The Consolidated Nickel Co. have just put down a new electric plant for the manufacture of nickel silicide, at Webster, Jackson County, N.C. The processes previously tried were leaching, but they all had to be abandoned owing to excessive cost. The new process is an electric furnace one, devised by Dr. Charles T. Hennig, of Brooklyn. The ore consists essentially of hydrated nickel-magnesium silicides, and contains from 1·5 to 7 pe cent. nickel, in rare cases 12 per cent. Dr. Hennig has found that this low grade ore can be successfully converted into a marketable product by direct reduction with coke in the electric furnace. The ore is crushed and mixed with 10 per cent. of crushed coke, this is then smelted in the furnace, and various grades of nickel silicide, from 10 to 30 per cent. nickel, can be obtained. The furnace is made of a sheet steel shell $\frac{5}{8}$ in. thick, and 6 ft. in diameter, and 5 ft. high. This is bolted on to a $\frac{3}{4}$ in. plate, which is connected to one pole of the electric circuit. The bottom of the furnace thus acts as one electrode; it is formed of a number of iron rods cast into the base plate to act as conductors, around which carbon is rammed to form the hearth. The interior of the furnace is lined with fire brick, so that its internal diameter is 4 ft. A cap covers the top of the furnace, and through this the second electrode, a carbon block, is suspended. The generators have six poles and are wound to give a current of 6,800 amps, at 50 volts. They are guaranteed to maintain an over-load of 100 per cent. for two hours, and of 150 per cent. for 10 seconds, without undue heating. As a sudden load of 50,000 amps. is liable to occur, all the 'bus-bars, circuit-breakers, &c., were designed accordingly. The machines were built by the Western Electric Co.

Under "Electrometallurgy and Electrochemistry," on p. 450 of ELECTRICAL ENGINEERING of last week, the annual output of crude ingots of the Lindenberg Steel Works was given as 5,000 *lbs.* This should, of course, have been 5,000 *tons.*

National Telephone Co.'s Staff.—According to the *Daily News*, the position of many of the higher-paid officials of the National Telephone Co., after the transfer of the business to the Post Office, is assured. It is common knowledge that the company is largely interested in the Constantinople telephone concession which has been negotiated by Mr. H. Laws Webb. Our contemporary states that the company which will be formed to work this concession will have its headquarters in Paris, and that those members of the National Telephone Co.'s staff in receipt of over £700 per annum will be offered employment there.

Boiler-Furnace Patent Litigation.—In the Chancery Division of the High Courts on Thursday, Messrs. Babcock & Wilcox, Ltd., sued Messrs. E. Danks & Co., of Oldham, for alleged infringement of the patent No. 20,779 of 1898, which relates to a certain furnace, the invention of a Mr. Harrison, of Middlesbrough, used in connection with blast-furnace gas. The case was a curious one, for no actual infringement took place, action being taken on the strength of a letter sent to the Kettering Coal & Iron Co., in which Messrs. Danks offered to sell them a latest improved Harrison furnace. It appears that although Mr. Harrison is taking royalties from Messrs. Babcock & Wilcox, Ltd., in connection with patent No. 20,779 of 1898, he has also been designing furnaces for Messrs. Danks, a fact which, when it came out in evidence, caused some surprise to the representatives of Messrs. Babcock & Wilcox. Mr. Justice Warrington, without calling on counsel for Messrs. Danks to put their case, decided that there had been no infringement, and gave judgment for defendants with costs. A counterclaim for the revocation of the patent in question, on the ground of anticipation, was abandoned by Messrs. Danks.

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MAINS TESTING AND FAULT LOCALISATION

At the May meeting of the Glasgow Section of the Institution of Electrical Engineers, a Paper on mains testing and fault localisation was read by Mr. W. A. Toppin (Assistant at the Greenock Burgh Electricity Works). He expressed the opinion that more interruptions of supply were occasioned by faults on the mains than by all other causes combined, and deprecated the practice of allowing earth leakages to develop to a pronounced stage before adopting remedial measures, as his experience is that 90 per cent. of mains faults originate in earth leakages, which can be located and removed before they reach the critical stage.

The Paper next indicated the arrangements recommended for a pair of testing and earthing panels to meet the Board of Trade requirements on a three-wire system. The middle 'bus-bar is connected to an earth-plate of ample dimensions through an indicating ammeter, a recording ammeter, and a circuit-breaker, which acts when the current flowing from the middle 'bus-bar to the earth-plate exceeds 25 amperes. Across the circuit-breaker is a 10-ohm resistance to limit the current when a dead earth occurs. When the circuit-breaker opens, a circuit is also made through an indicating lamp, and a relay on the recording ammeter which actuates a needle, and records the time during which the cut-out is open. This constitutes the arrangement of the earthing panel. On the panel for testing the outers, either the + or − 'bus-bars can be connected by means of a throw-over switch to the earth-plate through a central zero ammeter, a circuit-breaker, and a resistance, divided into three steps, and thus allowing the passage of maximum currents of 50, 100, and 150 amperes respectively. This panel can also be used to burn out a fault on either main by disconnecting the middle wire earth and earthing the other mains through the resistance regulating switch.

A record of the faults which have come under the author's notice during the last few years have shown that fully 80 per cent. of the earths occurred on the negative side. In almost every case of breakdown in a negative conductor the core was found saturated with moisture for four or five feet on each side of the fault, while the bitumen covering, which under normal conditions was unaffected by moisture, was converted into a spongy state. In cases of faults affecting both outer conductors, the positive core was found to be quite dry, while the surrounding bitumen was in its normal state, or only affected by the heat generated by the leakage current.

The author advocated the division of the network into sections with disconnecting links in convenient pillars, and the fusing of each distributor cable at its feeder pillar, so that, in the event of a short circuit, the faulty section is automatically isolated from the system. He is also of the opinion that all feeders should be provided with ammeters on each conductor, to aid the observation of momentary faults of too short a duration to melt the fuses.

In conclusion, the author described a method which he had found of service in locating earth leakages without interrupting the supply. When an earth leakage occurs, the earth in its vicinity is charged to a potential above normal earth potential. This potential will diminish with the distance from the fault. A voltmeter, calibrated to read down to very small pressures, is employed. One terminal is connected to a good earth connection, such as a steel rod pushed into the ground at a distance of two or three yards from the cable route. The voltmeter is attached to a light carrier, to which two steel brushes connected to the other terminal are attached, so as to make a continuous contact with the surface of the earth, and this is pushed over the ground above the cable route and the fall of potential between the earth connection and the ground in contact with the brushes is shown on the instrument. In addition to the voltmeter, the carrier is fitted with a small revolving drum which winds or unwinds the earth lead as required. To obtain more accurate measurements a centre zero low-reading voltmeter with multiplier is connected between the two brushes—insulated from one another—when the exact location of the fault may be effected by moving the carrier until the voltmeter reading becomes zero. In the case of a two-wire supply, it is necessary to earth the unaffected conductor to give the required potential difference surrounding the fault.

DISCUSSION.

Mr. D. M. McLEOD (*Resident Engineer, Clyde Valley Electrical Power Co.*) was of opinion that this system of localising faults would not prove successful if used with lead-covered mains, and that granolithic and wood paving would also tend to make the readings obtained so small as to be of negligible value. His own company's mains are divided into easily tested sections, and each section has allocated to it a card on which the records are inscribed from time to time. In this way a completely continuous record of the mains insulation is obtained, and it is easy to prevent incipient faults from developing. To illustrate his point, Mr. McLeod had brought to the meeting a section of three-core E.H.T. lead-covered cable, which had been very badly twisted and damaged to the extent of having had some of the lead removed owing to a subsidence on the cable route. This fault had been discovered in its incipient stage in time to prevent serious trouble. Mr. McLeod also mentioned that he found that testing the telephone and relay cables proved a useful guide, as the lead covering on this class of cable is so much thinner that any trouble which tended to affect the lead made itself more readily felt than was the case on the main cables.

Mr. W. W. LACKIE (*City Electrical Engineer, Glasgow*) found himself in agreement with the author as to the proportion of trouble developing on the mains as compared with other parts of the system. One of the difficulties which was most exasperating was that when a fault did occur it often burnt out the only evidence of what caused the trouble. In Glasgow they found their recording ammeters on each feeder of great value in warning them of possible trouble. He was not in favour of linking up the distributing networks between feeder pillars, as although it was claimed in theory that by accurate fusing one was able to isolate faulty sections and to maintain supply, he was of opinion that, in practice, the system only introduced further complications when faults did occur, and at the same time there was no saving of copper.

Mr. WILLIAM MCWHIRTER (*Messrs. William McWhirter & Son, Glasgow*) thought that the success of the method of fault localisation described was due in no small degree to the prevailing wetness at Greenock.

Mr. W. D. MORGAN (*late of Coatbridge & Airdrie Electricity Supply Co.*) was of opinion that the testing panel described was not altogether satisfactory, as a careless switchboard attendant might make a dead short through the earth connection. Raising the voltage of the outer cable which was not affected, to, say, 480 to 500 volts above earth, might land the supply concern into trouble if fire or accident occurred on consumer's premises. He agreed with Mr. McLeod in thinking that lead-covered cable, or cable in the vicinity of iron pipes or tramway rails, could be very faulty without the method described, enabling one to find the fault very quickly.

Mr. J. ROBERTSON (*Chief Electrical Engineer, Greenock*) also thought that the fault localiser described would probably fail with a lead-covered system; in Greenock practically all the cables were laid solid in wood troughing. For Mr. McWhirter's information he might say that a large portion of Greenock was under high water level, and the earth was therefore well saturated with salt. The result was that they had many small faults of, say, one or two amperes capacity, and the only practical method of dealing with them was that described. He did not agree with Mr. Lackie's statement regarding the economy of copper with a closed end distributing system.

Mr. G. AUSTIN (*Messrs. W. C. Martin & Co., Glasgow*) asked if the author had ever tried the compass method of localisation. He, Mr. Austin, had found this method very useful in testing for faults on ship circuits.

Mr. J. CAMPBELL MCMILLAN (*Electric Control, Ltd.*) thought that similar apparatus must have been used when the system of the Chicago Supply Co. was revised some time ago. The whole city was divided into districts, and tests were taken throughout with a view to deciding what additional cable should be put in, the result being that a considerable number of auxiliary conductors were installed on the negative side of the system.

Mr. F. C. RAPHAEL (in a written communication) explained that while Mr. Toppin's method of fault finding would doubtless be extremely useful for V.B. cables, it would be liable to give misleading results on lead-covered cables, as the higher potential might occur, not by the fault itself, but at the nearest point where the lead of the cable was making a good or a fair earth. Return currents from running trams would also interfere with the method. He mentioned that a similar principle had been used in Berlin to notify automatically at the station, by means of indicators, the district in which the potential of the earth near the mains had risen. He also described the "shocked boy" method of finding bad faults in rubber cable in the factory. A few hundred cells of an earthed battery were connected to the cable, which was wound on to a drum, and guided by a boy standing on an earthed metal plate, and holding a wet cloth. When the fault came through the boy's hands he could invariably be relied on to notify the fact, the intensity of his signal depending upon the number of cells employed.

Mr. P. F ALLAN (*Clyde Valley Electrical Power Co.*) commented on the Board of Trade testing panel described. He drew attention to the fact that according to the new Home Office Regulations it was permissible to run for prolonged periods with one outer of a three-phase or three-wire D.C.

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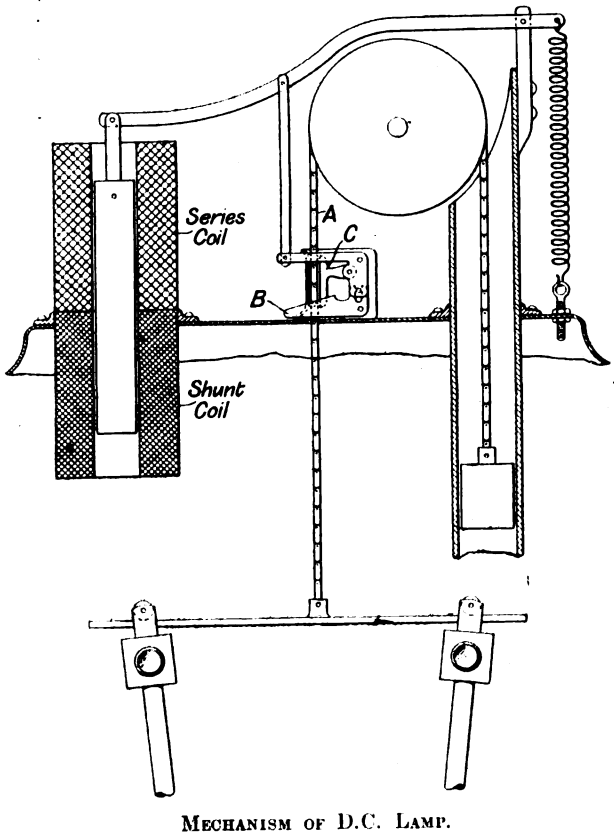
system earthed. He agreed with Mr. Morgan, however, that if this was done on a town network, and trouble resulted due to the faulty condition of some of the consumers' wiring, the Board of Trade officials might not look with favour on the method adopted. With regard to osmosis, Mr. Allan said that it was becoming increasingly common to make the outer core of a concentric positive. He was further of opinion that the method of localisation described would be very unsatisfactory in dry localities, especially where there is a sandy subsoil.

Mr. TOPPIN, in reply to Mr. McLeod and Mr. Raphael, said that he had not tried the method of localisation he described with lead-covered cable. He had, however, tried it with cable running through an iron pipe under the tramway rails, and although the tramway system was in operation at the time, he found it quite easy to differentiate between the voltage of the earth return of the tramways, which did not exceed 7 volts, and that due to the fault which approached 18 volts, and was steady. In reply to Mr. McWhirter and others, Mr. Toppin said that he had tried the method on a dry summer day with a surface of road setts, and had got a reading of 70 volts. He did not agree with Mr Morgan's criticism of the testing panel; the only accident that could happen would be if the middle wire circuit-breaker were left in whilst one of the outers was being earthed, but the breaker would come out and prevent damage.

NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Arc Lamps.

Two new flame arc lamps for alternating and direct current respectively have been placed on the British market by the Braulik Engineering Co. (8 Lambeth Hill, Queen Victoria Street, London, E.C.). The A.-C. lamp has a controlling mechanism on the Ferraris motor principle, with series and shunt wound electromagnets acting on a thin aluminium disc. The disc is geared through a train of wheels to a drum, over which are passed the chains supporting the carbons. These are balanced, and there is a positive feed. A feature of the mechanism is the way in which the parts are arranged so as to facilitate adjustment and cleaning. The shunt coil is of ample dimensions, and, it is claimed, does not get overheated. The carbons have a straight line motion, and do not swing.



MECHANISM OF D.C. LAMP.

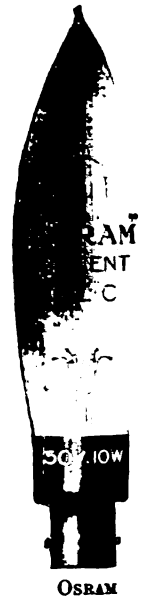
They pass through small metal plates in insulated slides let into the roof of the economiser. These slides are adjusted and fixed by screws. When the lamp is switched on, the shunt magnet induces eddy currents in the aluminium disc, and this rotates and lowers the carbons. Directly the carbons touch a current flows, and the series magnet generates eddy currents in the disc. The torque produced by the series magnet being the larger, the wheel reverses and draws the carbons up until the arc is the proper length, when the torques of the two magnets balance. As the carbons burn away, the shunt magnet becomes the stronger, and causes the disc to rotate in the feeding direction. A very sensitive and delicate adjustment of the arc is thus obtained. The blower comprises two vertical iron cores with their extremities on a level just above the carbon tips, and wound with four turns each in series with the arc. A split fire-clay economiser is supported in the brass bottom plate. A shunt cut-out is operated automatically when the carbons are fully consumed. This lamp is supplied in various sizes and for different burning hours, and burns "Excello" carbons.

The continuous-current lamp is of a novel design, with gravity feed and a clutch feeding mechanism without clockwork. As shown in the accompanying sketch, both carbons are hung from a common cross-arm sliding on a central guide rod. A chain of a special smooth link construction is attached to the cross-arm and passes over a pulley, a counter-weight moving in a tube being attached to the other end. The chain passes through an ingenious clutch, which is worked by a differential solenoid. The carbons fall together by gravity, and a device is fitted so that when the lamp is switched off, the shunt circuit is open. When the lamp is switched on, the series coil only is energised at first, and this draws the plunger up. The clutch is lifted and the arm *B* falls, bringing the shoe *C* into contact with the chain *A*. This causes the chain to be lifted, and the arc is struck. The shunt coil is now in circuit, and as the carbons burn down, the shunt coil pulls the plunger down and lowers the carbons. Ultimately, the arm *B* is let down upon the top plate of the lamp; this lifts the shoe *C* from the chain, which drops slightly. Owing to the delicate construction of the clutch and the small inertia of the moving parts, the chain is said to be dropped only about $\frac{1}{16}$ in. at each feed, so that the feed is as gradual as in a clockwork lamp. Air dash-pots are provided. Both carbons pass through holes in the roof of the economiser without any means of adjustment, as this is unnecessary in this case.

In view of the recent litigation with regard to arc lamp patents, it may be mentioned that the above lamps do not come into contact with any existing patents, the sliding collar and swinging carbon adjustment of the Bremer patent not being employed.

Incandescent Lamps.

The GENERAL ELECTRIC CO. (67 Queen Victoria Street) have recently modified the design of their Osram candle lamps, and are now able to supply the standard 10-c.p. candle-shaped lamp for 25, 33, 50, and 55 volts in bulbs 26 mm. in diameter. The new lamp is illustrated herewith; the shoulder measures 23 mm., and it is thus suitable for use in practically all designs of candle fitting. The shape and size renders it very attractive, and, being of one size, these are all interchangeable. No alteration has been made in the price.



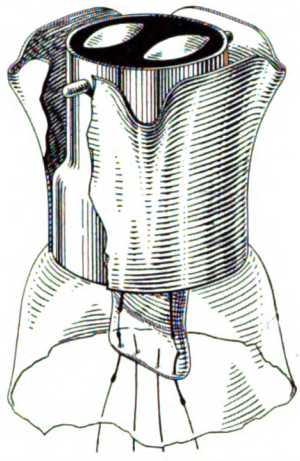
OSRAM CANDLE-LAMP.

Other new sizes of Osram lamps recently introduced include miniature lamps for use with dry batteries, for pocket-lamps, torches, hand and miners' lamps, with accumulators, &c., and a special line of lamps for motor-car head-lights, &c. The miniature lamps are listed in no less than twenty-seven styles, ranging from 0·5 to 1·8 c.p., and for voltages from 1·25 to 5·5. The new motor-car lamps have been designed after careful consideration of the requirements. The filaments are arranged to focus the light to the best advantage; all wording is stamped on the caps, and the bulbs are pipeless, so that no shadows are cast. They are made for 4, 6, 8, and 12 volts, and range from 8 to 25 c.p.

The form of rainproof lamp-cap illustrated opposite, with a sort of protecting umbrella, has been brought out by Messrs. F. WILKINS & BROTHER, LTD. (54 Whitechapel, Liverpool), with a view to allowing greater freedom in the arrangement of

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lamps for outdoor illumination purposes. The hood renders it quite impossible for rain-water to enter the holder when the lamp is in an upright or upwardly inclined position, and even

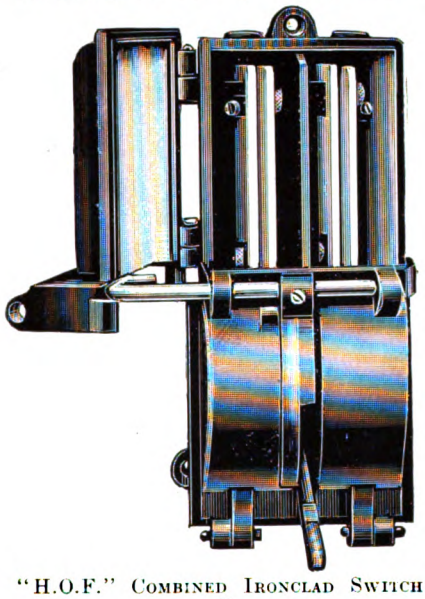


WILKINS' PATENT RAINPROOF LAMP CAP.
Full Size.

when the lamp is hanging down the spouts drain the water off, so that it cannot reach the contacts.

Fittings, Switches, and Accessories.

A design of ironclad combined switch and fuse which has been put on the market during the past month by Messrs. H. O. FARRELL & Co. (Sewerby Street Electric Works, Moss Side, Manchester) is illustrated here. The most interesting feature is the substantial locking arrangement, whereby the



"H.O.F." COMBINED IRONCLAD SWITCH AND FUSE.

switch cannot be put on till the fuse-cover is closed and fastened; nor can the cover be opened unless the switch is off. No live metal is exposed when replacing fuses, and the whole fitting can be connected up in much less time than can separate fuses and switches.

Messrs. VERITYS, LTD. (Hardman Street, Deansgate, Manchester) are calling attention in a new list to some new and recent designs of switchgear and circuit-breakers. These include the latest form of the Crawley battery cut-in and cut-out, and a new inexpensive straight-line form of battery-regulating switch for small installations. A number of varieties of circuit-breakers are dealt with. One is a fixed handle breaker of cheap price, suitable for use in place of fuses on motor circuits and the like. There is also a cheap horizontal type for small circuits, with the advantage of a free handle; while the heavier standard edgewise breaker is constructed for all sizes, single, double, and triple pole for alternating current as well as for continuous current. These circuit-breakers can be arranged if desired in cast-iron boxes, and can be provided with magnetic blow-outs.

Heating and Cooking Apparatus.

A new electric toaster has been put on the market at a particularly low price by Messrs. F. A. WILKINSON & PARTNERS, LTD. (Harpenden, Herts). This comprises an earthenware frame in which are suspended bare wire coils by means of springs to take up the expansion of the wire when heated. The coils, which work at a bright-red heat, are protected by means of expanded metal guards, the whole being contained in a polished aluminium casing. The toaster is made for any standard voltage, and has a consumption of 700 watts. Two pieces of bread can be toasted at once, and the apparatus is instantly ready for use when switched on.

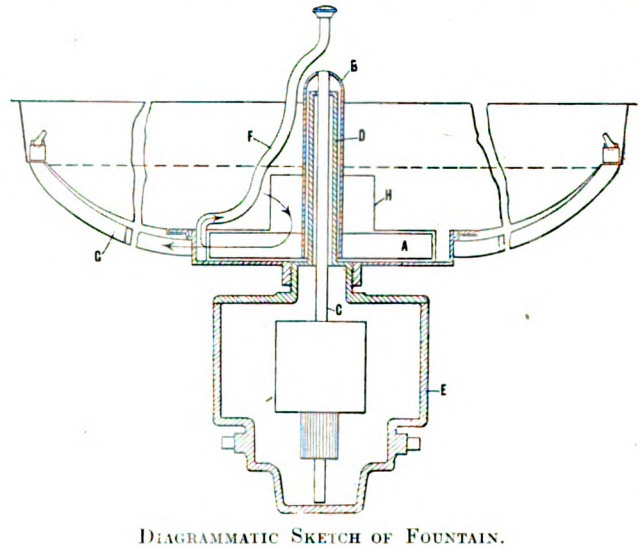
Miscellaneous.

A novel design of electrically operated fountain suitable for decorative purposes in conservatories, halls, and reception rooms, and, in the smaller sizes, for use on dining-tables or sideboards, is being introduced by the ELECTRIC FOUNTAIN CO., LTD. (188 Blythe Road, Hammersmith, London). A handsome example in bronze, with a basin 23 in. diameter, is shown in the accompanying figure, while the diagrammatic sketch below illustrates the design of the apparatus. A small centrifugal pump in the bottom of the basin is driven by a vertical motor mounted immediately underneath. The blades, *A*, of the pump are attached to a brass tube, *B*, closed at the top, where it is fixed to the spindle, *C*, of the motor. This spindle is supported in a special bearing at its foot, and the upper portion runs in a long brass tube, *D*, extending from the motor casing, *E*, to above the highest possible water level. It is thus impossible for water to reach the motor armature. The space between the spindle, *C*, and the tube, *D*, is filled with grease, and the spindle runs centrally in the tube without touching it.



BRONZE FOUNTAIN.

The water is drawn into the pump through a gauze filter, *H*, and expelled through three openings in the pump case. One opening leads to the tube *F*, supplying the central rose jet, and the other two tubes, *G*, pass under the basin up to the tube on the circumference of the basin to which are attached 18 or more jets. These latter are ball-jointed, and can be adjusted to any desired angle. The basin and tubes are of nickelled



DIAGRAMMATIC SKETCH OF FOUNTAIN.
$\frac{1}{6}$ Scale.

copper, or, in the case of the table fountains, electroplate. For conservatories, a special design with a pillar and basin of terra-cotta, marble or stone-ware is supplied. The fountains are

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self-contained, portable, and require no water-pipe connections. As the same water is used over and over again, it may be perfumed or coloured. Ice may be placed in the basin, and the water may be illuminated at night.

The motor employed is of the Crypto Electrical Co.'s manufacture, and was especially designed for the purpose. In order to render it noiseless, the armature runs at the comparatively slow speed of 550 r.p.m., and has skewed slots. Motors for both A.C. and D.C. circuits are supplied, and the consumption is 60 watts for the larger fountains, and only 15 watts for the smallest table fountains. These latter have specially designed motors running at 780 r.p.m., and are supplied at present for D.C. circuits only. The table fountains are provided with two metal discs on the under-side of the base, and a special form of contact plate with contact pins pressed upwards by springs is placed under the table cloth. On account of the very low consumption, these fountains can be worked off any lighting circuit by means of an adapter or wall-plug. We inspected one at the works of the company on Monday, and can vouch for the practically silent working of the motor, which, of course, is a very important feature, especially in the case of the table fountain.

THE LATEST G.E.C. CONTROLLER

THE accompanying illustrations show the latest design of tramcar controller developed by and manufactured at the Witton Works of the General Electric Co., Ltd. In its design the aims have been kept in view equally of mechanical strength as well as accessibility and ease of dismantling and reassembly.

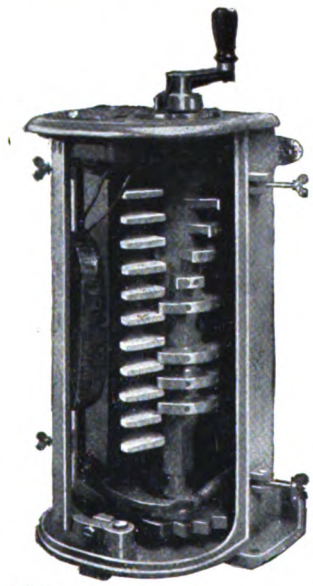


FIG. 1.—CONTROLLER IN POSITION WITH COVER REMOVED.

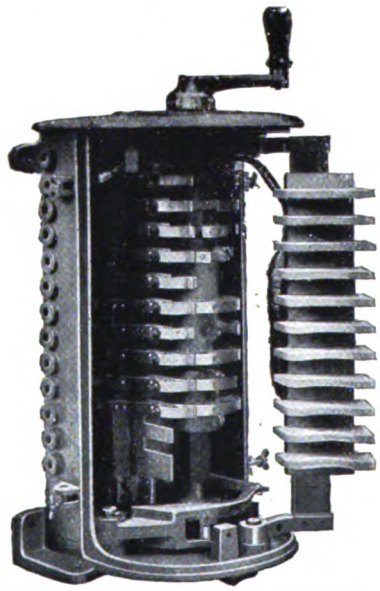


FIG. 2.—CONTROLLER WITH THE BLOW-OUT COIL AND SPARKING DIVISIONS SWUNG OUT.

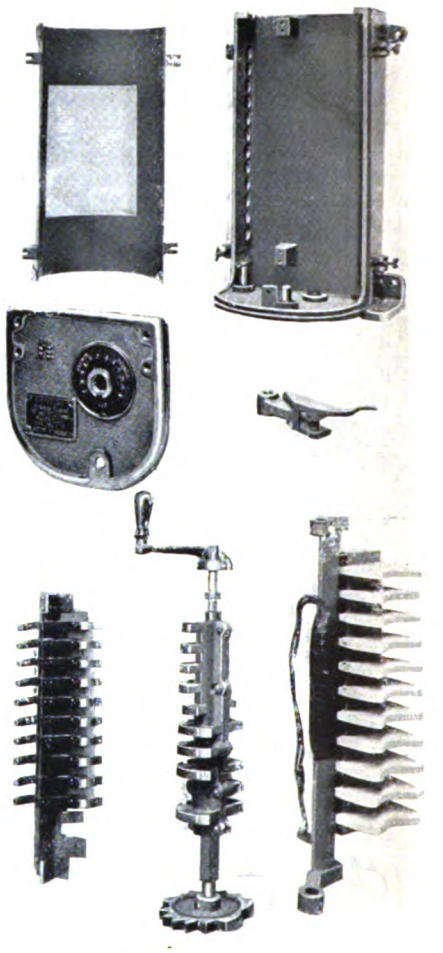


FIG. 3.—COMPONENT PARTS OF DISMANTLED CONTROLLER.

Fig. 1 shows the controller in the working position with the cover removed. Attention may be called to the large blow-out coil, the extra heavy Uralite sparking divisions, and the strong panel and cam-wheel. Fig. 2 shows the blow-out coil and sparking divisions swung clear from the controller, and leaving every part accessible. This illustration also shows the special ebonite clamps which are provided to hold the blow-out coil leads in position, which in many controllers are left unsupported and form a source of trouble. The controller can be wired up very easily, as the terminals are directly opposite the cable entry holes, and are provided with sweating sockets of the same external diameter as the cable. Fig. 3 shows the component parts of the dismantled controller.

The case is made of cast-iron, machined where necessary, and provided with a sheet-iron cover, held on with the usual fly-nut fastening. On the back of the carcass near top and bottom are two projections with V-shaped machined slots into which are fitted the ends of a square mild steel bar, micanised all over except at the extreme ends. The wrought-iron stamped finger-carriers are clamped to the micanised part. The spark shield between the finger bar and drum is also attached to the finger bar by small angle pieces clamped under the fixing screws at both ends. Each finger can be removed separately without taking the finger bar out of the controller.

The drum consists of four castings clamped to a micanised square mild steel shaft, with projections turned true in place on the shaft, to which the interchangeable copper contact segments are screwed. The two ends of the square shaft are turned round. To the lower end is keyed the substantial cam-wheel. The handle is cup-shaped to prevent rain-water from getting through the bearing of the shaft. Provision is also made to prevent the handle being taken away in any but the "off" position.

The pole-piece, which carries the blow-out coil, has fitted to its face and reaching over the whole length of the drum a heavy piece of fireproof insulating material. The sparking shields of Uralite are cemented into slots in this piece, no screws being employed, and therefore a breakdown to earth due to the splitting of one of the Uralite pieces is made practically impossible. The controller is suitable for motors up to 50 b.h.p. on 500-volt circuits, or for a maximum current of 75 amps. on lower voltages.

Electrical Exhibits at the Japan-British Exhibition.—In our article on the above in last week's ELECTRICAL ENGINEERING on page 449, the name of the firm who supplied the three-phase motor driving one of the exhibits of textile machinery was not given quite correctly. The correct title of the firm in question is Messrs. J. P. Hall & Co., Ltd. (Blackriding Iron Works, Werneth, Oldham).

Death of Mr. H. W. Cox.—On Saturday last, the death occurred of Mr. Harry W. Cox at his residence in Clapton. Mr. Cox commenced his research work with the Röntgen rays some 14 or 15 years ago, and contracted, in consequence of continual exposure to the rays, X-ray dermatitis. He made a large number of improvements in X-ray apparatus, and took out no fewer than 80 patents. Seven years ago he was obliged to retire from business, and he underwent three operations, losing successively the fingers of his left hand, his right hand, and his right arm. Ultimately the disease reached the throat, chest, and face, and a further operation was to have been performed last year, but was not attempted owing to his serious condition. Mr. Cox was most patient in his terrible sufferings. He leaves a widow and four sons. Last year the Government made a grant to Mr. Cox of £200 in recognition of his work, and Sir William Treloar was successful in raising a sum of £2,600 by public subscription. The funeral will take place to-day at Abney Park cemetery.

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SERIOUS CHARGES CONCERNING THE WEST HAM ELECTRICITY UNDERTAKING

A CASE of considerable interest and importance to municipal authorities owning electricity undertakings is being heard by Mr. Justice Neville in the Chancery Division. The action, the hearing of which commenced on Tuesday, is brought by the Attorney-General, at the relation of certain large ratepayers in West Ham, principally the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., of Silvertown (who have their own power house, and do not take their electricity supply from the Corporation).

Some time ago the West Ham Corporation applied to the Local Government Board for further borrowing powers for its electricity undertaking. It was then alleged by an organised opposition by certain sections of ratepayers that the Corporation were supplying power in some cases at a loss, and the Board postponed its inquiry for the production of details of these power contracts, which, however, the Corporation refused to furnish. After considerable delay, the deadlock was removed by the contracts being produced for the inspection of the Board without their being made public. In the meantime, however, the Corporation needed further capital to carry on its undertaking, and made overdrafts at the London County and Westminster Bank. It is now contended that the payment of the interest on these overdrafts is illegal, but the further serious charge is made that the Corporation, instead of investing the sinking fund for repayment of its previous loans, as it is bound to do, has been using the money set aside for this purpose as a set-off against the new capital borrowed from the bank, as already explained, without the sanction of either Parliament or the Local Government Board.

Sir Alfred Cripps, K.C., Mr. Macmorran, K.C., and Mr. Scholefield, appear for the Attorney-General, and Mr. Danckwerts, K.C., Mr. Morten, K.C., and Mr. Tomlin appear for the West Ham Corporation. The London County & Westminster Bank are also cited as defendants, and are represented by Mr. Buckmaster, K.C., and Mr. Methold.

Sir ALFRED CRIPPS, in opening the case, said the allegation was that the West Ham Corporation were illegally and improperly borrowing in respect of the electricity undertaking; the sums so borrowed had been used both for capital and revenue purposes without any authority whatsoever. The total at one time amounted to nearly £150,000. He contended that it had already been held in the Courts that overdrafts by municipal bodies upon their bankers were illegal except for mere temporary purposes. The position was aggravated by the fact that in order to get these overdrafts from the bank, the Corporation had given the security of its general borrowing powers, irrespective of the purpose to which the particular overdraft was to be applied. For instance, when the Corporation wished to borrow for the electricity undertaking, in respect of which no sanction had been received, they used the borrowing powers of the Tramways Department as security, and applied the money for electricity purposes. After mentioning incidentally that the Town Clerk, Dr. Hilleary, was also adviser to the bank, Sir Alfred contended that as the security given to the bank for the overdrafts was illegal, they could not recover any of the outstanding overdrafts against the Corporation, and further that the payments to the bank by the Corporation for interest must be refunded. The interest paid to the bank up to the present amounted to £14,000. None of the provisions for the security of the sinking fund, he continued, had ever been complied with at all. At the end of March, 1908, the sinking fund should have amounted to £90.000, but as far as he could understand not one penny of this had been invested in outside securities, and the amount had really been used as a set-off against overdrafts which had been obtained from the bank from time to time. Such methods were wholly wrong and improper, for it placed the security of a large amount of the ratepayers' money in the hands of a bank which might be jeopardised had they been unfortunate enough to select a bank less stable than the London County & Westminster Bank.

Sir Alfred Cripps then dealt with the revenue account of the electricity undertaking, and said that, from their investigation of the Corporation's books, there appeared to be a deficiency of £44,000 upon the electricity undertaking, which had never been made up, and by the system of overdrafts which had been made use of, the ratepayers were unable to ascertain that they were losing money on the electricity undertaking at all; in fact, the ratepayers did not know the real state of the electricity finances. The deficiency standing in the books had been secured by overdrafts, whereas the Corporation was under statutory obligation to pay their debts from year to year and so meet the deficiency.

Dealing in detail with the accounts of the Corporation since 1905, Sir Alfred Cripps alleged that a portion of the Consolidated Loans Fund, which ought to have been invested in outside trustee securities, had been placed in the hands of the bank as security. This amounted at one time to £82,147, and in the system of book-keeping adopted, the amount of interest which the sum should have earned had it been invested was taken into account, whereas it had not earned any interest at all.

Mr. DANCKWERTS, for the Corporation, said this was all a fairy tale of Sir Alfred Cripps' clients.

Sir ALFRED CRIPPS was still making his opening speech when we went to press.

HEAT ACCUMULATORS FOR EXHAUST STEAM PLANT

AN important case in connection with a patent covering improvements in heat accumulators for exhaust steam plant has just been decided. The patent in question is No. 22,025 of 1907, by Mr. D. B. Morison, managing director of Messrs. Richardsons, Westgarth & Co., Ltd., of Hartlepool, and relates to a method of utilising the exhaust steam from an intermittently working engine for supplying a low-pressure turbine. Excess of exhaust steam is passed automatically into a steam and water reservoir or heat accumulator, from which steam can be drawn continuously for working the low-pressure turbine when the supply of exhaust steam in insufficient. The water is withdrawn for use as boiler-feed. The claims of Mr. Morison's patent cover the use of an automatic valve to pass any excess of exhaust steam into the accumulator, and a special construction of the accumulator. After acceptance and publication of the complete specification in October, 1908, the grant of a patent was opposed by the Société d'Exploitation des Appareils Rateau, of Paris, on the ground that the invention was covered by a prior British patent, No. 3,608 of 1901, granted to Rateau. The opponents asked for the insertion in Morison's specification of a reference to this patent, which they considered to be a master patent for a heat accumulator receiving exhaust steam intermittently and delivering steam continuously to a low-pressure engine exhausting into a condenser. The Chief Examiner of the Patent Office decided to grant the patent, however, without any amendment, holding that the Rateau patent could not be considered as a master patent, and that the constructions of accumulator in the two specifications are substantially different. Further, he pointed out that the automatic valve is an essential feature of Mr. Morison's patent, and that no such device is suggested in the Rateau patent.

The Rateau Co. appealed against the decision of the Chief Examiner in so far as he did not require the insertion of a specific reference to the Rateau patent. The hearing of the appeal took place before Sir Rufus Isaacs, the Solicitor-General, on May 23rd, 1910. Mr. Morison was represented by Mr. Astbury, K.C. and Mr. Frost, and Mr. Colefax appeared for the opponents. In giving judgment, on June 29th, the Solicitor-General affirmed the Chief Examiner's decision, holding that Mr. Morison's method of automatically regulating the admission of steam to the accumulator was novel, and that no reference to the Rateau patent need be made.

NEW BOARD OF TRADE REQUIREMENTS FOR TRAMWAYS

THE revised Board of Trade memorandum regarding details of construction and equipment of Tramways and Light Railways laid on public roads, which is printed in the July circular of the Tramways and Light Railways Association, contains one or two small alterations from the memorandum previously in force. In the section on posts and brackets, it is now specified that poles supporting gas lamp brackets should be efficiently bonded to the rails. The section on cars contains the following new clause: "On lines having severe gradients and sharp curves, the use of double-deck cars may be objected to." The clause on sanding apparatus has also been extended in scope, and requires sanding appliances for each rail at both ends of the car in all cases, instead of only where considered necessary on account of the gradient. Some modifications have also been made in the requirements for detecting live trolley standards. The red lamp is to be "bridged with a suitable fuse," and it is required that the signal device should be tested at least once a week. Another addition is that a catch-rope should be attached to prevent detachable trolley-heads from falling.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published July 7th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

13,842/09. **Magazine Arc Lamps.** W. R. RIDINGS. In these lamps both the carbons are fed forward simultaneously by a device attached to a carrier, which is alternately raised and lowered by a single endless sprocket chain, so that it is caused to engage successively with each pair of carbons in the magazine. Three claims, eight figures.

15,961/09. **Heating Apparatus.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., Schenectady*). Electric heating and cooking appliances in which the heating element consists of flat-tapered coils, with or without central supports, of bare wire. The specification describes the application of this construction to a toaster. Four claims, two figures.

14,010/09. **Searchlight Projectors.** SIEMENS BROTHERS & Co., F. HIRD, and G. S. GRIMSTON. These projectors have a pair of lamp barrels mounted side by side and arranged so that they can be operated independently or simultaneously. The barrels are locked together for simultaneous tipping, but provision is made for increasing the distance between the vertical axes of the barrels without interfering with the balance of the apparatus. Four claims, three figures.

17,564/09. **Rotary Converters.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., Schenectady*). In these rotary converters the circumstances are such that the armature reaction due to the motor current predominates over that due to the continuous current taken from the commutator, so that the resultant is in such a direction that it can be utilised in an unwound commutating pole to improve commutation. Four claims, four figures.

17,711/09. **Counterweight Pendants.** S. K. THOMPSON. The flexible leads leave the ceiling-rose separately, and pass under and over separate pulleys alongside each other. A special lamp-holder is also employed with separate points of entry for the conductors, so that they are kept apart throughout. Two claims, nine figures.

22,458/09. **Metal Filament Lamps.** O. KRAUSE (Electrical Engineer to the Deutsche Gasglühlicht A.-G.). The star-shaped groups of wires forming the top and bottom supports of the various sections of the filament are mounted upon a sleeve or a pair of rings supported elastically by springs from the central spindle. Six claims, four figures.

26,444/09. **Trolley Ears.** S. W. MITCHELL and H. McP. DUDGEON. These ears have extensions at either end made of softer metal than the main central portion of the ear, and tapered away almost to a point at the end, so that a certain degree of flexibility is secured with the object of lessening the liability of the wire to tear away.

26,570/09. **Tumbler Switches with Automatic Release.** C. W. DENNY. The contact arm of the switch is held in the "on" position by a catch, but the handle or knob, when released by the hand, is returned by a spring to the off position, leaving the arm free to fly off if disengaged from the catch. The release of the catch is effected in the ordinary way by a push-button at the side of the switch base, but in case of overload it can also be released by a plunger coming up through the base of the switch and actuated by the armature of a round, flat pot-magnet compactly arranged in a sub-base upon which the switch is mounted. Six claims, ten figures.

28,452/09. **Wireless Telegraphy.** E. VON LEPEL. An arrangement for producing rapid electrical oscillations in which two oscillatory circuits closely coupled are connected in parallel with a discharge gap, the capacity of one condenser being a simple multiple of that of the other, and the two circuits being coupled up so that their phases are opposed. Seven claims, four figures.

29,481/09. **Wireless Equipment for Aeroplanes.** R. A. FESSENDEN. The "antenna" consists of two capacity areas formed of metallic foil attached to the supporting or elevating planes themselves and offering no extra resistance to flight. Five claims, two figures.

350/10. **Metal Filament Lamps.** O. KRAUSE. An alternative method of arranging the springs supporting the sleeve in lamps of the class covered by Specification No. 22,458/09 abstracted above with the object of ensuring equal amplitudes of vibration of the top and bottom supports of the filament. Two claims, one figure.

Opposition to Grant of Patents

24,590/08. **Electric Smelting.** W. PORCHERS. This patent, describing a process of treating iron ores in the electric furnace, has been granted in spite of opposition. The process was described in ELECTRICAL ENGINEERING, February 10th, 1910, p. 100.

8,875/09. **Storage Battery Plates.** G. OKILL. Opposition has been entered to the grant of this patent. The specification was abstracted in ELECTRICAL ENGINEERING, May 19th, 1910, p. 330, and describes a process of manufacturing plates of the rolled grid type.

12,966/09. **Furnace Reaction.** E. C. MARKS (*T. L. Wilson*). In consequence of opposition, this patent, described in ELECTRICAL ENGINEERING, May 26th, 1910, p. 346, has been surrendered.

14,318/09. **Cranes.** STOTHERT & PITT, and W. PITT. Opposition has been entered to the grant of this patent, which covers various mechanical details of electric cranes and transporters.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: JOHNSON & PHILLIPS, LTD., and BROCKIÉ [Magazine lamps] 15,287/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: HIGHFIELD [Installation of electrical conductors] 21,021/09; SIEMENS & HALSKE A.-G. [Rectifier] 5,917/10.

Dynamos, Motors, and Transformers: WALKER [Dynamos] 11,956/09; MAGGIORA and SINCLAIR [Motors] 17,863/09; FARREL [Power transmission] 722/10.

Electric Ignition: VAN RADEN, 29,026/09.

Heating and Cooking: CHILDS and HILL [Electric ovens] 14,548/09; ROYCE [Electric heaters] 21,564/09.

Switchgear, Fuses and Fittings: LAMKIN and NUNWICK [Lamp-holders] 14,763/09; VERITY'S, LTD. and PIPKIN [Quick break switch] 15,441/09; WEST [Quick break switch] 16,649/09; LE STEPHANO [Regulator for lamps] 19,465/09.

Telephony and Telegraphy: SHORE [Street fire alarm] 13,973/09; LAKE ("*Polyfrequenz*" *Elektricitats-Gesellschaft*) [Producing oscillations] 16,558/09; MUIRHEAD and MUIRHEAD & Co., LTD. [Telegraphy] 23,429/09; MANDERS [Production of sustained oscillations] 24,134/09.

Traction: WATKINS [Conductor-rail insulator] 21,526/09.

Miscellaneous: HOLDEN [Electric clocks] 14,873/09; BULTEAN [Combined waiter's call and dinner-table centre-piece] 14,896/09; CHETWYND, KELVIN & JAMES WHITE and CLARK [Portable magnetic compass] 16,607/09; BROWN [Burglar alarm] 26,405/08; BRICE [Dental applicator for electric massage vibrator] 27,705/09; SIEMENS & HALSKE A.-G. [Subaqueous sound producers] 4,967/10; HIBBERD [Prepayment meter] 30,093/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, Motors, &c.: SIEMENS-SCHUCKERTWERKE-GESELLSCHAFT [Motor speed control] 14,345/10; A. G. BROWN, BOVERI & CIE [A.-C. commutator machines] 1,768/10 and 14,391/10.

Telegraphy: WIDEGREN and WIDEGRIN, 13,991/10.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

16,057 of July 20th, 1896. **Electrolytic Apparatus.** C. KELLNER. Electrodes for high current densities are formed of a sheet of insulating material, with smaller sheets of woven platinum wire on each side. The two wire sheets are connected together through the centre of the insulating sheet.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, &c.: J. G. LORRAIN [Insulators] 7,238/04.

Electric Ignition: A. ECKSTEIN and H. J. COATES, 6,878/04.

Electrometallurgy, &c.: L. MOND [Electro-deposition of zinc] 5,764/01.

Heating and Cooking: H. J. DOWSING [Electric heat baths] 7,071/02.

Incandescent Lamps: W. L. VOELKER [Titanium carbide filaments] 6,149/99.

Instruments, &c.: W. COWDEROY [Maximum demand indicators] 6,242/01; A. G. BLOXAM [Meters] 6,951/03.

Switchgear, &c.: E. A. CAROLAN (*General Electric Co., Schenectady*) [Circuit breakers] 6,470/03; I. H. PARSONS [Multiple switches] 6,540/03; BRITISH THOMSON-HOUSTON Co. and E. B. WEDMORE [Motor starters] 6,635/03; ZWEIGBERCK [Controller] 6,719/03; J. H. DALE [Cluster fittings] 6,873/04; ELECTRIC & ORDNANCE ACCESSORIES Co., R. E. HALL, and J. R. GARDNER [Controller contacts] 5,782/05; E. GARSIDE [Rheostats] 6,383/05.

Telephony, &c.: SIEMENS BROTHERS & Co., LTD. [Telephone exchange system] 6,741/03.

Traction: R. A. HADFIELD [Tramway rails] 5,805/01; G. WESTINGHOUSE [Couplings for electric railway cars] 9,560/01; A. W. SULLIVAN and W. RENSHAW [Signalling air trains] 5,863/05; P. J. PRINGLE [Live-trolley indicators] 6,077/05.

Miscellaneous: J. C. VICKERY [Illuminated timepieces] 6,053/05; R. GRISSON [Aluminium cell rectifiers] 6,307/05.

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LOCAL NOTES

BOURNEMOUTH: *The Tramway System.*—The Council recently decided to ask Mr. A. L. C. Fell, the Chief Officer of the L.C.C. Tramways system, to report upon the conduit system. Mr. Fell has now written that he is unable to make such a report, but that he is willing to give any information relative to the conduit system in London which the Bournemouth Council might desire. Mr. Fell's action is due to a decision of the London County Council, owing to the increasing number of requests for assistance from their various chief officers, but it is thought that Mr. Fell may be willing to give some valuable information unofficially, and he is to be asked to do this.

BRADFORD: *The "Norwich" System of Charging.*—The Electricity Committee have adopted, as an alternative charge for electricity supply, a fixed charge of 15 per cent. per annum upon the rateable value of the premises supplied, plus ½d. per unit for all energy consumed. This will include meter rents.

CHINA: *Nanking: Electric Supply.*—A British consular report states that an electric light company, with native capital, was formed in Nanking early in 1909; machinery has been secured from the United Kingdom, and is now being erected under the supervision of a British engineer. It is hoped to commence operations during the current year.

DARTMOUTH: *Street Lighting.*—The Urban Electric Supply Co. have suggested to the Council that they should increase the candle-power of the public lamps, and extend the period of the present contract. The company have been asked to instal some of the improved lights proposed, and after an inspection by the Council the matter will be further considered.

DROITWICH: *Electric Lighting.*—The Council have decided to oppose an application by a private company for an electric lighting provisional order for the town. The Council own the gas works, and two speakers frankly expressed their opposition to electric lighting on the ground that it would be detrimental to the gas undertaking.

FORMOSA: *Electric Light.*—A Consular report says that electric light was first seen in South Formosa in December, 1909, when a small power station was opened at Chikushimon, which supplies light to several neighbouring towns.

GLASGOW: *Tramways Accounts.*—The net balance on the tramways for the past year, after providing £110,688 for depreciation and £82,918 for renewals, is £53,028, against £66,275 in the previous year. In consequence of the decision of a Parliamentary Committee recently that no portion of the tramways profit can legally be applied to relief of rates, the whole of the available balance this year is transferred to the Common Good. The number of passengers carried was 222,730,571, against 221,744,569 in the previous year, and the receipts per car-mile have decreased from 10·26d. to 10·22d.

HOVE: *Electric Lighting Accounts.*—The accounts of the Electric Lighting Department to March 31st last show a debit balance of £404.

ILKESTON: *Proposed Tramway Purchase.*—The Council have been approached by financiers on the question of purchasing the municipal tramway system.

INDIA: *Electric Supply.*—According to the *Times of India*, a scheme of electric supply for Simla has been decided upon, and it is anticipated that the undertaking will be in working order by the end of next year. Distribution will be carried out by means of overhead wires at 120 volts three-phase.

ITALY: *Electric Traction.*—A British consular report states that the Italian State Railways Department have decided to extend the electrification of the Savona-San Giuseppe Railway line to Ceva, making a total length of 28 miles. The Consiglio Provinciale of Genoa has granted a 30 years' concession for the construction and working of an electric tramway from Savona to Vado. A company is about to be formed with an initial capital of about £32,000, and it is hoped that by the end of 1911 the line will be completed and ready for use.

LISKEARD: *Electric Lighting.*—The District Council have agreed to Messrs. Christie Bros. & Co. applying for an Electric Lighting Provisional Order for the rural district of Liskeard.

LIVERPOOL: *"Express" Tramcars.*—A suggestion having been made to the Tramways Committee that "Express" cars should be run on the tramways, the matter was referred to a Sub-Committee which has unanimously decided that such a scheme would be impracticable.

MAIDSTONE: *Electricity Accounts.*—The loss upon the electricity undertaking for the past year is £101, against a net profit of £1,073 in the previous year. Whilst the revenue from private consumers has increased slightly, that from public lamps and tramways has decreased.

MALDENS AND COOMBE: *Electric Supply.*—Messrs. Handcock & Dykes have been asked to prepare a report as to the advisability of applying for electric lighting powers.

MALVERN: *Maximum Demand System Abandoned.*—On the recommendation of the Electrical Engineer, it has been decided to cancel the maximum demand system, which, since the introduction of the higher candle-power metal filament lamps, has resulted in a greater percentage of the units being charged upon the higher rate. The Engineer's recommendation was for a flat rate of 6d. per unit less 5 per cent. for cash in 28 days, and increased discounts for larger consumers. The Council, however, have decided to limit the discount to 5 per cent., and not to increase it for larger consumers. This will practically mean 5 per cent. reduction to all consumers.

MANCHESTER: *Tramway Accounts.*—The tramway accounts for the past year show a net profit of £133,321. Reserve, renewals, and depreciation account is credited with £70,020, and the District Rate with £75,000. The total number of passengers carried was 159,049,096, against 155,011,884 in the previous year. The revenue per car-mile increased from 10·728d. to 10·869d.

The Mutual Telephone Co.—It may possibly be remembered that about twelve years ago negotiations were being carried on between the Manchester Corporation and the new Mutual Telephone Syndicate, by which the latter were to construct and maintain a telephone system in Manchester. The syndicate spent a considerable sum of money on the promise of support by the Corporation, but subsequently it was decided to institute a municipal service. This latter decision was never put into force, and since then constant application has been made by those who represented the Syndicate for the refunding of the expenses incurred. Some 30 firms, who were members of the Syndicate, have now presented a further memorial to the Corporation, which is supported by about 200 merchants and manufacturers of Manchester. It is alleged that the expenditure, the return of which is now claimed, was incurred upon the strength of Corporation resolutions, and that, as the negotiations fell through, the Corporation itself is liable.

MANCHURIA: *Electric Supply.*—A British Consular report from Dairen states that the present output from the electricity works there is 1,500 kw. So rapidly is the demand continuing that a further 2,000 kw. of machinery is in course of erection. The plant at Mukden is also to be further extended. At Dairen there is now a tramway system having a length of 14 miles, and an extension of 3½ miles is contemplated.

SALFORD: *Tramway Accounts.*—There was a gross profit of £90,958 on the past year's working of the tramways undertaking. After meeting payments to local authorities for running powers, interest, and sinking fund charges and repairs, the sum of £17,000 is applied to relief of rates, and £2,172 added to depreciation fund. The number of passengers carried was 45,940,775, a slight decrease compared with the previous year, although the gross receipts are slightly higher. With a view to obtaining a greater life with the rails, a trial has been made of the Sandberg type.

SHEFFIELD: *Tramway Accounts.*—After meeting capital charges, there is a net profit of £39,252 upon the tramway accounts for last year. Renewals Fund is credited with £21,600, "special purposes" with £2,000, and the General District Rate with £12,192. The net profit shows an increase of £3,546 over the previous year. The number of passengers carried was 78,620,798, compared with 76,356,031 in the previous year.

Electricity Accounts.—The accounts of the Electricity Department for the past year show a deficit of £2,035. The revenue from lighting decreased from £53,117 to £46,264, and this is attributed mainly to the great increase in the use of metal filament lamps. On the other hand, the revenue from power increased from £18,891 to £23,484. Mr. S. E. Fedden, the City Electrical Engineer, takes a hopeful view of the future. Whilst anticipating that the decrease in the sales for light will probably continue for some time, he is drawn to the conclusion that the Department is beginning to benefit by the advent of the new lamp in view of the fact that the new connections for the past year were 299 against 217 in the previous year. The sales for power show an increase of 1,500,000 units, and several electric smelting furnaces are expected to be connected up during the present year. The total costs per unit are now down to 0·57d., and, seeing that this position has been attained without the benefit of a large tramway and street lighting load, it is all the more meritorious.

SOUTHEND: *Light Railways.*—An agreement has been come to between the Light Railways Committee and the Colchester Light Railways Co. for the latter to have running powers over the Corporation's light railway between Prittlewell and Victoria corner, whilst the Corporation have similar powers over the Company's line between Prittlewell and Rochford.

SOUTHPORT: *Electricity Accounts.*—In spite of a decrease of £3,100 in revenue last year, the accounts of the electricity Department show a net profit of £1,475

STEVENAGE: *Electric Lighting.*—The Board of Trade have inquired as to what steps are being taken to put the Council's Electric Lighting Order into force. The Electric Supply Corporation have the matter in hand, and a meeting between them and Messrs. Crompton & Co. will be held in a few days. In these circumstances the Board of Trade is to be asked for an extension of time.

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TORQUAY: *The Dolter System.*—The Council in Committee have decided not to give their consent to the Torquay Tramways Co. to substitute the overhead system for the Dolter surface contact system. In the event of negotiations falling through, the question of the system to be used will be referred to arbitration.

WEST HARTLEPOOL: *Purchase of Tramways.*—It is regarded as certain that the question of purchasing the Hartlepools tramways by the West Hartlepool Corporation will have to go to arbitration.

WINCHESTER: *Purchase of Supply Co.*—Arbitration proceedings in relation to the purchase of the Winchester Electric Lighting & Power Co. by the Corporation will take place in the early autumn. It is said to be the intention of the Corporation when they have acquired the undertaking to extend the limits of supply to some of the surrounding villages.

WOLVERHAMPTON: *Electricity Accounts.*—There was a gross profit of £20,060 on the past year's working of the electricity undertaking, compared with £16,892 in the previous year. After meeting interest and sinking fund charges, there is a net profit of £5,298, against £3,401. In his report Mr. C. E. C. Shawfield points out that the decrease in consumption for lighting purposes, which was very marked during the first nine months of the year, was not only arrested during the last three months, but the returns for that quarter show a marked increase over the corresponding period of the previous year. The average price for fuel was about 9d. per ton less than during the previous twelve months. The additional motor load connected during the year amounts to 900 h.p. The number of units sold was 8,289,720, against 6,555,125, and the maximum demand was 4,180 kw., against 3,660 kw.

WORCESTER: *Electric Fittings.*—The Electricity Committee recommend that the Electricity Department be allowed to act as agents for manufacturers for the sale of heating and cooking apparatus, and motors on a commission basis, but the Council is not to be liable for the price of the goods sold. Some opposition has been offered to this by the local wiring contractors, and a deputation is to wait upon the Electricity Committee before the matter is brought before the Council.

YORK: *Tramway Receipts.*—Since the opening of the electric tramways on January 20th this year, the receipts per car mile have amounted to 10·16d. On one or two special days the receipts have amounted to as much as 18·44d. per car mile. The Tramways Committee have instructed the City Surveyor and Tramways Manager to report upon any necessary extensions of the tramways.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ALDERSHOT.—Application is to be made for a loan of £2,300 for electrical purposes.

BARNET.—Tenders are invited for dynamos, motors, battery, and wiring work for the Guardians. Particulars from the Clerk, 12 High Street, Barnet, and tenders by July 26th.

HOVE.—Mains are to be extended at an estimated cost of £245.

IRELAND.—Messrs. Wilkins & Burdon, Electrical Engineers, of Dublin, have placed details of an electric lighting scheme before the Ballymoney Council.

LEITH.—The Dock Commissioners have in hand the construction of an electric power station at an estimated cost of £20,000.

LITTLEBOROUGH.—The District Council some months ago concluded negotiations with the Rochdale Corporation for a supply of electricity in bulk, the Council doing its own distribution. The cost of the scheme is put at £3,500, and a Local Government Board inquiry has been held concerning this. Mr. W. C. C. Hawtayne is Consulting Engineer to the Council.

LONDON: *Poplar.*—The Finance Committee of the L.C.C. have sanctioned a loan of £8,910 for the electricity undertaking.

PENMAENMAWR.—A loan of £550 has been sanctioned for lighting the promenade by electricity.

SEVENOAKS.—Messrs. Mordey & Dawbarn have presented a report to the Council with regard to an electric lighting scheme. The undertaking is expected to be self-supporting in the third year, and the estimates show a progressive profit up to £1,300 in the tenth year.

WALSALL.—Extensions to the Electricity Works are recommended at an estimated cost of £23,225.

YORK.—An inquiry was held last week concerning a loan of £2,475 for services, motors, and meters. Mr. R. H. Hooper, the Local Government Board Inspector, suggested that it would be well for the Corporation to avoid borrowing money for meters, and to provide the amount out of revenue. The recommendation of the Inspector on this point is to be laid before the Electric Lighting Committee.

Miscellaneous

AUSTRALIA.—The Deputy Postmaster-General at Melbourne invites tenders by August 30th for electrical sundries, insulators, wire, &c. Copies of the specifications may be seen at the Board of Trade, 73 Basinghall Street, London.

WALTHAMSTOW.—The Council require six double-deck roof covered tramcars with magneto brake equipments. Particulars from the General Manager, and tenders by July 22nd.

WIGAN.—The Guardians of the Wigan Union require electric bells and telephones at the Billinge Workhouse Infirmary. Particulars from the Master.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

S.W.—Cinematograph theatre, rear of 439 Battersea Park Road, S.W., for H. T. Underwood.

E.—Factory, Plaistow Wharf, Victoria Docks, for A. Lyle & Sons, Ltd.

Cinematograph theatre, St. Stephen's Road, Poplar, E., for Andrews & Peascod.

N.W.—Addition, hospital of St. John and St. Elizabeth, Lennard Place, St. Marylebone. E. Goldie, architect, 31 Upper Phillimore Place, W.

PROVINCES.

BASILDON.—Model farm (to be lighted by electricity), improvements to mansion, &c., for Captain Morrison, M.P.

BRISTOL.—Electric theatre. Architect, W. H. Watkins, 15 Clare Street, Bristol.

BURNLEY.—Reconstruction of Empire Music Hall.

BURSLEM.—Municipal buildings (£24,918). Surveyor, A. Burton, Stoke-on-Trent U.D.C.

CHELMSFORD.—The Education Committee invite alternative tenders for the lighting of the Trinity Road School by electricity and gas. Particulars from the Architect, Mr. W. H. Pertwee, The Institute, London Road, Chelmsford, and tenders by August 31st.

CROYDON.—Enlargement of Borough Hospital. Builder, T. W. Moss, Rayleigh Mission Hall, 24 Mitcham Road.

DEVONPORT.—School (£12,070). Thornley, Rook & Barrow, architects, 19 Anbyn Road, Devonport.

GLOUCESTER.—School, Deacon Street (£4,855). Byard & Sons, builders, Stroud Road, Gloucester.

KING'S HEATH.—Baths (£12,000), Institute Road. A. W. Cross, surveyor, King's Norton Urban District Council.

LINCOLN.—High School for Girls (£5,000). Builders, Wright & Son, Lincoln.

MARGATE.—Concert pavilion at Fort Undercliffe Promenade. E. A. Borg, surveyor, Margate Town Council.

NORTHAMPTON.—Theatre, for Milton, Bode & Crompton. Congregational Church (£4,281). Trustees, Abington Avenue Congregational Church.

NORWICH.—Offices, for Coleman & Co., Ltd., Westwick Street (£4,339). Architects, Morgan & Buckingham, Upper King Street, Norwich.

PLYMOUTH.—Conversion of Prince's Hall, Princess Square, into cinematograph theatre, for R. Watts.

ROCHDALE.—Extensions Technical School (£3,114). E. J. Holden, Secretary, Education Committee, Rochdale Town Council.

SHEFFIELD.—Market Place. City Architect, Sheffield City Council.

Baptist Chapel and School, Firbeck and Tadcaster Roads, for W. H. Barnes.

Theatre, Fitzalam Square, for the Cinematograph Theatres, Ltd.

Public Hall and Club, Solly Street, for P. J. Benson.

WAKEFIELD.—School, Lawefield Lane (750 pl.). Percy Glover, Secretary, Education Committee, Wakefield Town Council.

WALTON-ON-NAZE.—School (£3,974). Bell & Sons, builders, Saffron Walden.

WISHAW (Lanarkshire).—Hospital (£12,000), for the Town Council.

YORK.—Theatre, Fossgate. Architect, W. T. Whincop, York. Builders, R. Dent & Sons, York.

Admiralty Electrical Scholarship.—We understand that the Admiralty scholarship for a specially able and deserving electrical fitter apprentice in the Royal Dockyard has this year been awarded to Mr. W. H. Chatten, of Sheerness Dockyard. The scholarship is tenable for one or two years, at the discretion of the Admiralty, at the Royal Naval College, Greenwich, the holder being entitled to £40 per annum and the minimum pay of a hired electrical fitter.

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TENDERS RECEIVED AND ACCEPTED

BOLTON.—The Council have accepted the tender of the Brockie-Pell Arc Lamp Co. for the supply of single-phase transformers during the next twelve months in sizes up to 15 k.v.a.

The Corporation has placed an order with Ed. Bennis & Co., Ltd., for two sprinkler stokers and self-cleaning compressed air furnaces for a new Lancashire boiler which is being erected at the Electricity Works.

LONDON: *London County Council.*—The Fire Brigade Committee report upon the use of electrically driven vehicles. Although such vehicles have for some time past been in successful operation in the principal cities of Europe, they have not yet been adopted in London. The first cost is somewhat higher than that of petrol vehicles, but the wear and tear is less, and it is expected that if new batteries are provided from time to time, the chassis and motors should last much longer than those of petrol-driven vehicles. The Committee, therefore, suggest that a tender by the "Cedes" Electric Traction, Ltd., for three electrically driven motor escape vans, including two spare wheels, should be accepted at £2,957 10s. The Austrian Daimler Motor Co., of Vienna, is to be allowed to supply the chassis fitted with wheel motors, and the Tudor Accumulator Co. will supply the batteries.

London County Council.—The following tenders have been received for the wiring of the Woolwich, Kingsland, and Lewisham fire stations. The lowest tender has been accepted in each case:—(1) *Woolwich fire station*: G. Weston & Sons, Ltd., £185; E. Newbald & Co., £186; Pinching & Walton, £192; John Barker & Co., Ltd., £203 13s.; Tredegar & Co., £270. (2) *Kingsland fire station*: W. J. Fryer & Co., £164 18s.; F. Troy & Co., £178; Alex. Hawkins & Sons, £195; John Bryden & Sons, £200; G. E. Taylor & Co., £221. (3) *Lewisham fire station*: Tilley Brothers, £160 19s.; W. Leonard & Co., £165; Pinching & Walton, £204; Whitehead Brothers, £228; G. E. Taylor & Co., £234.

MANCHESTER.—The tender of the Lorain Steel Co. has been accepted for the supply of special track-work at £6,000.

TURKEY.—The Turkish Ministry of Works have received eight tenders for the supply of electricity in the European portion of Constantinople. The firms tendering include: British Westinghouse Co.; the Union Ottoman, formed by the German Bank (Deutsche Bank) and the Berlin Tramway Co.; La Compagnie Française d'Eclairage Electrique; La Syndicate Suisse d'Electricité; Schneider & Co. (Creuzot); Ganz & Co. (Budapest), &c.

The Mirrlees Watson Co., Ltd., have recently received the following orders for steam condensing plant: From the British Thomson-Houston Co., low-level jet condensing plants, 20,000 and 15,000 lb. steam duty, for the Wath Main Colliery and Great North of Ireland Paper Mills Co. respectively; also elevated jet condensing plants, with respective steam duties of 28,500 lb. and 22,000 lb. for the Scottish Central Electric Power Co., and Lancashire & Yorkshire Railway Co., Newton Heath.—From Messrs. Willans & Robinson for Londonderry Corporation, elevated jet condensing plant, 15,300 lb. steam duty.—From Messrs. Greenwood & Batley, Ltd., for Glengarnock Iron & Steel Co., Ardeer Works, elevated jet condensing plant, 14,000 lb. steam duty.—From Messrs. Henry Tate & Sons, London, horizontal dry air pump, twin cylinder 32 in. diameter by 30 in. stroke.—From the Westburn Sugar Refinery, Ltd., Greenock, three-throw electric-driven air-pump, 26 in. diameter by 15 in. stroke; also steam-driven air-pumps for the Great Southern of Spain Railway Co., Ltd., Aquilas, per Messrs. Livesey, Son & Henderson, and for the Anglo-Chilian Nitrate & Railway Co., Ltd., London.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 5s. to £56 15s. per ton (last week, £57 5s. to £57 15s.).

AGENTS WANTED.—Agents are wanted for American electrical apparatus. (See an advertisement on another page.)

LIQUIDATIONS, BANKRUPTCIES, WINDINGS UP, &c.—In the Manchester County Court, on Monday, an application for the compulsory winding up of the North-Western Electricity & Power Gas Co. was heard. The company was formed in 1903, and received Parliamentary powers for the erection of a number of generating stations in Cheshire and surrounding districts. The nominal capital is £1,500,000. When the petition was called, it was announced that an agreement had been come to between the parties, it being thought that there was yet a chance of the company getting to work.

SIMPLEX BRANCH OFFICE.—Messrs. Simplex Conduits, Ltd., have opened a branch office under the charge of Mr. W. Kay, late assistant at the Manchester branch, at 12 Gascoigne Street, Boar Lane, Leeds. The new arrangement has been made with a view to accelerating delivery to the company's Yorkshire customers.

FOR SALE.—Freehold property in Wiltshire, suitable for electrical manufacturing company. (See an advertisement on another page.)

BRITISH VACUUM CLEANER PATENTS.—The British Vacuum Cleaner Co. have been successful in upholding the validity of their Booth patent, No. 17,433 of 1901, against the London and South Western Railway Co., who have been using a plant supplied by the Consolidated Pneumatic Tool Co. The case was recently heard before Mr. Justice Neville, in the Chancery Division.

"NESDRUM" WATER-TUBE BOILERS AND THE ADMIRALTY.—Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough, have recently received an intimation from the Secretary of the Admiralty informing them that their name has been placed on the Admiralty list of approved water-tube boiler-makers. Before coming to this decision, Messrs. Richardsons, Westgarth & Co.'s "Nesdrum" vertical-tube boilers were most carefully examined by Admiralty inspectors.

SIEMENS' ANNUAL SPORTS.—The fifth annual sports of the Siemens Institute, Stafford, take place on Saturday, August 20th. In addition to a full list of members' events, there are also included in the programme a number of open items. All athletes, especially those from other firms, would be very welcome, and can obtain further information from the General Secretary, Mr. F. E. Read, Siemens Institute, Stafford.

SMITH, MAJOR & STEVENS, LTD.—This firm of lift engineers (formerly known as Messrs. Archibald Smith & Stevens) inform us that they are building new works at Northampton, as for some time they have found their Battersea premises inadequate for their growing needs. It is hoped that the new works will be ready for occupation in the autumn. A portion of the staff and a considerable number of workmen will be retained in London.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—United River Plate Telephone Co., final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for the year. Dublin United Tramways Co., half-yearly dividend to June 30th at the rate of 6 per cent. per annum. Rio Janeiro Tramway, Light & Power Co., quarterly dividend of 1¼ per cent.

Fife Tramway, Light & Power Co., interim dividend on the preference shares at the rate of 6 per cent. per annum for the June half-year. Para Tramways Co., dividend of 8 per cent. per annum for the half-year to May 31st.

Telegraph Construction & Maintenance Co., 12s. per share for the past half-year. City of London Electric Lighting Co., interim dividend of 6s. per share less tax.

City and South London Railway Co., 1¼ per cent. on the consolidated stock for June half-year.

APPOINTMENTS AND PERSONAL NOTES

Mr. H. J. Hawkins, who for three years has been Deputy Borough Electrical Engineer at Salford, has been appointed Borough Electrical Engineer there in succession to Mr. V. A. H. M'Cowan, at a salary of £500 per annum, rising by annual increments of £50 to £700. There was some opposition to the appointment of Mr. Hawkins, it being argued that there were two other candidates for the appointment who were better fitted for the post. Another amendment to the effect that Mr. Hawkins be appointed pro tem. at a salary of £400 per annum was withdrawn.

Mr. W. Frisby has been appointed Borough Electrical Engineer at Colchester at a salary of £250 per annum, rising to £300. Mr. Frisby has been in charge of the works since the resignation of Mr. Sillar a few months ago.

Mr. J. W. Saaler, of Bruce Peebles & Co., Ltd., was married on the 12th inst., at St. Margaret's Church, Westminster, to Miss Frances R. Knott, of Southsea, a reception being afterwards held at the Westminster Palace Hotel. Mr. and Mrs. Saaler sail on Saturday by the R.M.S. *Saxon* for South Africa, where Mr. Saaler is taking up an important position for his firm in Johannesburg. Mr. Saaler has been in charge of Messrs. Bruce Peebles' Manchester office for some time past, and the vacancy caused by his leaving is now filled by Mr. H. B. Tilley, who has been with the company for a number of years.

Foreman-Jointer wanted, Great Western Railway Co. (See an advertisement on another page.)

The salary of Mr. R. E. Meade, Chief Electrician to the Stafford Corporation, has been increased from £175 to £200 per annum.

Extension of Electric Traction on the London, Brighton, and South Coast Railway.—The London, Brighton, and South Coast Railway Co. have ordered from the Allgemeine Elektricitäts-Ges. of Berlin, twenty-eight further single-phase motor-carriage equipments, each consisting of four 150 h.-p. commutator motors with control gear. These equipments are for the trains for the south suburban lines. As in the case of the South London line, the line pressure is from 6,300 to 6,800 volts, and the frequency 25 cycles.

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NEW COMPANIES

INTERNATIONAL "Z" ELECTRIC LAMP ASSOCIATION.—Orient House, New Broad Street, London. Capital £40,000 in £5 shares (40,000 preference). Manufacturers of incandescent lamps and other electrical apparatus, fittings, and plant. To adopt agreements with (1) Compagnie Internationale des Lamps Electriques Zircone Wolfram Société Anonyme; (2) the "Z" Electric Lamp Manufacturing Co., Ltd.; and (3) Kilburn, Brown & Co. The subscribers include Mr. W. L. Pakenham, of the "Z" Electric Lamp Manufacturing Co., who is also one of the first directors.

HELSBY WIRELESS TELEGRAPH CO., 25 Victoria Street, London, S.W. Capital £50,000. Manufacturers of telegraphic, telephone, and electrical instruments, &c.; to acquire certain patents and inventions relating to wireless telegraphy and telephony, and to adopt an agreement with the Telegraph & Telephone Instruments, Ltd. First directors are Lieut.-Col. J. Bernard, 46 Ashley Gardens, London, and Capt. C. M. Gonne, 9 Fernsham Mansions, Chelsea, S.W.

WITTON, JAMES, 71 Queen Victoria Street, London. Capital £6,000 (2,000 preference shares). Manufacturers of and dealers in electrical driving equipments for printing, textile, and paper-making machinery, &c., and to adopt agreements with the General Electric Co., Ltd., and H. V. James. The first subscribers are H. Hirst, A. H. Railing, and A. I. S. Baron, all of the General Electric Co., Ltd. The first directors are H. V. James, A. H. Railing, and A. I. S. Baron.

COMPANIES' MEETINGS AND REPORTS

ELECTRIC & GENERAL INVESTMENT CO.—At the annual meeting on Thursday Mr. J. B. Braithwaite, the Chairman, said that the balance-sheet exhibited a distinct improvement since last year. They had been able steadily to build up the contingent fund to counterbalance the depreciation on the British Electric Traction stocks which they held. In addition, there were several indications in various directions of better times to come.

ELECTRIC CONSTRUCTION CO.—The accounts for the year to May 31st show a sum of £10,811 available for distribution, including £3,687 brought forward, and after meeting debenture interest and crediting £5,000 to depreciation account. The directors recommend the dividend on the 7 per cent. cumulative preference shares, carrying forward a balance of £6,416. Regret is expressed that the results do not entirely fulfil the hopes expressed in the last report, but few orders for large installations have been placed, and the works have not been fully employed throughout the year. Meanwhile, the closest attention is being paid to expenses, and further reductions have recently been effected.

ELECTRIC TRACTION CO. OF HONG KONG.—At the annual general meeting last week the capital of this company was reduced to £81,250 by reducing the value of the £1 shares to 5s. each. This course was urged upon the shareholders as the only one by which the company could pay dividends upon their capital within a reasonable time. It was also decided to change the name of the company to the Hong Kong Tramway Co., Ltd. A further resolution was passed increasing the directors' borrowing powers by £10,000.

EDMUNDSONS' ELECTRICITY CORPORATION.—The report for the year to March 31st shows a net profit of £10,000 after meeting interest charges. To this must be added £14,800 brought forward. It is proposed to carry the total of £25,600 forward. A scheme of capital reorganisation is in hand with a view to extinguishing the arrears of dividend on the preference shares, which date back to October, 1906.

PERTH ELECTRIC TRAMWAYS.—At the annual meeting last week, reference was made to certain offers from the Town Council to purchase the undertaking. The Board have received an offer which they do not consider satisfactory, and they have refused it. There was no reason, said Mr. A. H. Stoneham, the Chairman of the Company, why they should sell unless they got a good price. The view of the Board was that if the undertaking were purchased, it should be bought by the State, and not by the Town Council. Owing to the increase in traffic, more plant and more cars were necessary, but the order for these has been delayed in view of the proposed purchase. Nevertheless, a new generating set has been ordered, and will be at work in about six months' time.

NORTH STAFFORDSHIRE TRAMWAYS CO.—At the annual meeting last week Mr. W. G. Bond stated that the company's liability to the Potteries Electric Traction Co. has been reduced to £32,329. The accounts for the past year allow of a 6 per cent. dividend on the preference shares, and 5 per cent. on the ordinary shares. A balance of £1,255 is carried forward.

MADRAS ELECTRIC SUPPLY CORPORATION.—The report for 1909 states that the construction contract is now completed, although the plant has not yet been officially taken over. Supply to the tramways was commenced in January. The company have been granted licenses to supply electricity to the Madras Port Trust and to Port St. George. In order to meet the cost of extending the mains, an issue of £100,000 6 per cent. first mortgage debentures will shortly be made.

GENERAL ELECTRIC CO.—The net trading profits for the year to March 31st were £95,461. Depreciation and debenture interest reduces this to £68,404, and, after meeting the 5 per cent. preference shares, there is a balance of £55,904. A dividend of 5 per cent. is declared on the ordinary shares and £22,000 is placed to reserve. A balance of £8,918 is carried forward. The factories at Witton, Salford, Birmingham, and London have been well employed during the year. The switchgear, arc lamp, and small motor departments have been removed from Salford to Wittor. The Peel Works at Salford are now entirely devoted to the manufacture of telephone and telegraph apparatus, a subsidiary company having been formed for this purpose.

KALGOORLIE ELECTRIC TRAMWAYS.—The revenue for last year shows a decrease of £2,100, but, owing to economy in expenses, the net profits have increased by £1,120. Mr. Norman presided at the annual meeting last week, and attributed the declining receipts to the fact that the people of Kalgoorlie are becoming more economical, and, instead of spending their money on race meetings, are using it for purchasing plots of land and building houses.

CHILI ELECTRIC TRAMWAY & LIGHT CO.—At the annual meeting last week it was stated that the tramways last year had carried 7,000,000 more passengers than in the previous year, and that the receipts had increased by about £54,000. The receipts from the light and power department also showed an increase of £34,000. After paying 5 per cent. on the preference stock, the sum of £32,000 has been placed to reserve.

Trade Openings in South Africa.—An information bureau in connection with the Commercial Intelligence Branch of the Board of Trade, is being established at Cape Town, by H.M. Trade Commissioner for South Africa. The object of the bureau is that anyone in South Africa applying, either personally or by letter, may receive the fullest information concerning goods manufactured in Great Britain and Ireland, and the Board of Trade, therefore, suggest that British manufacturers would find it useful to forward the following data, viz.: Name and address of firm; class of goods manufactured; code address and codes used; terms of payment and discounts; and name and address of South African agents, if any, together with catalogues complete (in duplicate); price lists, photographs, &c. Samples are not desired. Communications on the subject should be addressed direct to His Majesty's Trade Commissioner, P.O. Box 1,346, Cape Town.

Telegraph Traffic.—On the 4th inst. the line between Bagdad and Fao was interrupted for a short while.—On the same day the cable between Gibraltar and Tangier was restored to working order; while the cable between Zanzibar and Mombassa broke down.—On this date also the cable between Fort de France, Martinique, and Paramaribo, Dutch Guiana, was repaired by the cable steamer belonging to the Compagnie Française des Cables Télégraphiques; while the Direct Spanish Telegraph Company had trouble with the Falmouth-Bilbao cable, on which a great deal of money has already been spent.—Further, on this same day, communication between Rome and Constantinople was restored.—After an interval of three days the Zanzibar-Mombassa cable was again in working order; and on the 10th the route *via* Hanekin was at rest on Persian territory.—July 8th saw the reopening of the radio-telegraphic station at Heligoland, which was recently closed.—According to the *Tageblatt*, the new cable agreement between France and Germany provides for the laying of a cable between Brest and Emden.

The Institution of Mechanical Engineers' Summer Meeting.—The summer meeting of the Institution of Mechanical Engineers will be held jointly with the American Society of Mechanical Engineers in Birmingham from July 25th–28th, and in London on July 29th and 30th. The papers to be read in Birmingham are mainly on railway practice and working. There is, however, a paper on "High Speed Tools and Machines to Fit them," by H. I. Brackenbury. In London on July 29th the meeting will be held at Storey's Gate, St. James's Park, and the following papers have been submitted: "Electrification of Suburban Railways," by F. W. Carter; "Cost of Electrically-Propelled Suburban Trains," by H. M. Hobart; "Economies of Railway Electrification," by W. B. Potter; "Electrification of Trunk Lines," by L. R. Pomeroy; and "Electrification of Railways," by G. Westinghouse.

OSRAM·LAMPS

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ELECTRICAL ENGINEERING

No. 186 [Vol. VI., No. 29] THURSDAY, JULY 21, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

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Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*
Small Advertisements and Official Announcements, *Wednesday first post.*
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Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

The Leeds Corporation Bill, which authorises the adoption of the trackless trolley system, has now passed both Houses of Parliament.—Rhondda Tramways Bill was passed by a House of Lords Committee last week. (Page 472.)

The chief features of the Balsillie system of wireless telegraphy and telephony are the rotating discharger, the magnetic receiver, and a transmitting key obviating the necessity for using a change-over switch for receiving and sending. The rotating discharger gives a pure musical note, and is claimed to work successfully with high powers, while the magnetic receiver is said to be particularly reliable and constant. (Page 473.)

A Bill for rendering wireless telegraph installations compulsory on ships carrying more than 50 persons was read a first time in the House of Commons on Wednesday last. (Page 474.)

Some notes are given on the electric equipment of the new Dover–Ostend turbine steamers. (Page 474.)

At a meeting last week, the formation of an Association of Consulting Engineers was decided upon. (Page 475.)

The experimental work that has been done on the application of electricity to improving the conditions of agriculture is reviewed in a short article. (Page 475.)

A long letter from the Chairman of the Smoke Abatement League refers to our remarks on the deputation which recently waited on Mr. John Burns. (Page 476.)

Mr. W. P. Durtnall has been unsuccessful in his opposition to the grant of a patent to Messrs. C. A. Parsons, G. G. Stoney, and A. H. Law for a system of electrical marine propulsion. Mr. Durtnall claimed to have a master patent for a polyphase electrical speed reduction system for this purpose, but the Comptroller does not consider this to be the case. (Page 476.)

The following books are reviewed in this issue:—"Electricity," by H. M. Hobart; "Direct- and Alternating-current Testing," by F. Bedell and C. A. Pierce; "Principes de la Télégraphie sans Fil," by C. Tissot; "Wireless Telephones," by J. Erskine Murray; "The Indicator Handbook," by C. N. Pickworth; Vol. VI. of the Deinhardt Schlomann Series of Technical Dictionaries; "Exposition Franco-Britannique de Londres"; "Soldering, Brazing, and Jointing of Metals," by T. Bolas; "Auto-Transformer Design," by A. H. Avery. (Page 479.)

In an original communication to the Journal of the Institution of Electrical Engineers, Mr. W. Pollard Digby puts forward a method of testing feed-water, &c., by measuring its electrical resistance. (Page 467.)

A new design of motor-generator for supplying searchlights, cinematograph projectors, and other large arc lamps has been placed on the market. The current is taken from brushes displaced 90° from the ordinary brushes, which are short-circuited. The machine is

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connected so that the arc current is the sum of the generator and motor currents, and the reactions between armature and field are so adjusted that a practically constant current is delivered under all conditions of the arc. (Page 479.)

THE action by the Attorney-General against the West Ham Corporation in respect of the financial management of their electricity undertaking, concluded on Tuesday, when judgment was reserved. At the close of his speech for the London County & Westminster Bank, Mr. Buckmaster, K.C., without admitting liability, agreed, on the understanding that proceedings against the Bank were withdrawn, to repay £7,000 received as interest on the alleged illegal loans. In view of this arrangement, Sir Alfred Cripps, on behalf of the Attorney-General, asked for certain declarations and an injunction against the Corporation. (Page 481.)

AMONG the specifications published by the Patent Office on Thursday last was one by Miles Walker for a method of obtaining pressure variation on the D.C. side of rotary converters by rocking the brushes.—A design of electric oven with a glass window in the inner door for enabling the contents to be inspected is patented by J. G. Childs and T. S. Hill.—A method of control for guns and turrets in which the motors are arranged in series and supplied by a constant-current generator, is covered by H. C. Leake.—Opposition has been entered to the grant of a patent to the Felten & Guilleaume Lahmeyer Werke A.-G. for a method of lengthening the life of metal filament lamps.—J. and E. Conradi have surrendered their patent for a wall-plug in consequence of opposition.—A patent by Siemens Bros. & Co. for a method of control for motor-actuated railway points expires on Sunday after a full life of 14 years. (Page 482.)

SOME particulars are given of the multiple-unit single-phase trains now in use on the New York, New Haven & Hartford Railway. (Page 482.)

MR. A. H. DYKES has called the attention of the Beckenham Council to the very poor return from their "free wiring" system.—The Incorporated Municipal Electrical Association have communicated with the various municipalities regarding electric wiring powers, and at Dundee the promotion of a Bill has been approved.—A scheme of electric tramways has been placed before the Edinburgh Council.—Mr. James Swinburne is to advise the Leicester Corporation with regard to their electricity undertakings.—Marylebone electricity accounts show a net profit of £8,482 for last year, against a loss of £930 in the previous year. Mr. Seabrook's report deals with the question of wiring.—At Poplar there was a net profit of £4,426 upon the electricity undertaking last year, and at Stepney £1,515.—The Sheffield electricity accounts for last year show a loss of over £2,000. (Page 483.)

MAINS extensions are contemplated at Dover, Walsall, Wimbledon, and Battersea, and by the Belfast Harbour Board. Loans are to be taken up at Beckenham (£6,000); Dublin Board of Guardians (£3,000); and Eccles (£3,324). Extensions of plant are proposed at Wolverhampton and Hackney. (Page 484.)

AT the Victoria Falls Power Company's meeting last week, it was stated that the use of electric power on the Rand mines had resulted in savings in works cost ranging from 6d. to 1s. per ton crushed.—At the first annual meeting of the National Telewriter Co., the opening of a West End exchange in London was mentioned, and it was also stated that difficulties in obtaining deliveries of the instruments have been overcome.—The Central London Railway Co. propose to raise £500,000 new capital.—The accounts of Messrs. Crompton & Co., Ltd., for the year to March 31st, show a loss of £23,369 after meeting depreciation, debenture interest, and repairs. (Page 487.)

PARLIAMENTARY INTELLIGENCE

THE RHONDDA TRAMWAYS IMPROVEMENTS BILL.—This Bill, which seeks powers to construct further tramways and to make street improvements in connection with them, was under consideration by a House of Lords Committee last week, and was eventually ordered to be reported for a third reading. There were only a few opponents, including the Taff Vale Railway Co., some collieries in Rhondda, and the Swansea Bay Railway Co. Mr. Robert Hammond appeared as engineer to the scheme, which presents no engineering difficulties, the extensions being mainly with a view to linking up some outlying districts, and reducing certain overcrowding which now takes place owing to the lack of building operations due to absence of communication.

TRACKLESS TROLLEY SYSTEM.—The Leeds Corporation Bill was before the Unopposed Committee of the House of Commons on Thursday, and was ordered to be returned for third reading. The main proposal of the Bill is to adopt the trackless trolley system of electric traction. In view of the experimental nature of this proposition, it has been decided, as in the case of the Bradford Bill, only to authorise one line, and, to obviate the necessity of coming to Parliament again, the Board of Trade are given powers to sanction further lines should the working of the experimental line meet with their approval. A period of 15 years for repayment of loans is allowed for both vehicles and equipments. The Bill has already passed the House of Lords.

METROPOLITAN DISTRICT RAILWAY BILL.—This Bill was passed by a House of Commons Committee last week. The main proposals are to double the portion of the company's line between the Studland Road Junction and Turnham Green, and the raising of £187,500 additional guaranteed stock. The Bill has already passed the House of Lords.

PROGRESS OF ELECTRICAL BILLS.—The Baker Street & Waterloo Railway Bill was read a third time and passed in the House of Commons on Friday.

The Wimbledon and Sutton Railway Bill was read a third time, and the London United Tramways Bill a second time, in the House of Commons on Wednesday last week.

Telegraph Traffic.—The Direct Spanish Telegraph Co. has repaired the Falmouth-Bilbao cable, reported broken in our last issue. The repair was effected on the 11th inst. On the day following, communication between Rome and Constantinople was down for a short while, and the via Hanekine route was restored. The Bagdad-Bassorah line failed on the 13th inst., but was put into working order again on the 14th.—The Siamese administration announce that the Sultanates of Kelantan, Kedah, and Perlis are now, for telegraphic purposes, incorporated in the Federated Malay States.

Continental Telephony.—In an official communication from the Post Office concerning the submarine cable, fitted with loading coils, recently laid across the English Channel (see ELECTRICAL ENGINEERING, March 17th, 1910, p. 179), it is stated that the new cable will be brought into regular use as soon as the corresponding French land lines are completed, but the tests so far made have given very satisfactory results. It is also stated that the French Government propose to lay a similar cable across the Channel. In the meantime it is proposed to use the new English cable for experiments in conversation between London and Amsterdam, and possibly Berlin and other cities in Germany.

Middleton Tramways Dispute.—At the Manchester Assizes last week, before Mr. Justice Hamilton, Messrs. G. Freeman & Sons, contractors at Hollinwood, Manchester, sued the Middleton Electric Traction Co., Ltd., for £1,699 for extra work done in carrying out a contract for the tramway company, which amounted to £38,781. It was claimed that the company's Resident Engineer gave orders for extra work to be done amounting to £6,843, all of which had been paid with the exception of the £1,699 claimed. After hearing evidence, judgment was entered for the plaintiffs. The main point for the defence was that Mr. Stephen Sellon is Chief Engineer to the company, and that the orders for extra work should have been given by him. On the other hand, a Resident Engineer was appointed, to whom, it was alleged, the plaintiffs were referred as the Engineer under the contract.

X-Ray Dermatitis.—Yet another worker with X-ray apparatus has fallen a victim to X-ray dermatitis, in the person of Mr. F. S. Pepperdene, of Wimpole Street, London, who has done much work in this direction for the City Orthopædic Hospital, London, and the Eversfield Hospital, St. Leonards-on-Sea. An endeavour is being made to raise the sum of £2,000, as in the case of the late Mr. H. W. Cox. The Rev. E. H. Leale, Vicar of St. Stephen's Church, Bexhill-on-Sea, is treasurer of the fund.

In answer to a question in the House of Commons on Monday, Mr. Asquith said that the question of granting the widow of the late Mr. H. W. Cox a pension from the Civil List would be considered if the usual particulars were furnished him.

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THE BALSILLIE SYSTEM OF WIRELESS TELEGRAPHY AND TELEPHONY

WE were afforded recently an opportunity of inspecting the London wireless station of the British Radio Telegraph & Telephone Co., which is situated in London Wall Buildings, Finsbury Circus. The system developed by this company is based on the patents of Mr. J. G. Balsillie, and includes many novel features. The station itself is situated in the basement of the building, and is connected to an aerial supported about 135 ft. above the ground by three towers on the top of the building, the two outer of which are about 140 ft. apart. An equipment, taking a maximum of 2 kw. and with a range of about 250 miles over land, or 500 miles over sea, is installed; but, in accordance with the Post Office rules, the power employed is normally only ¼ kw.

The connections of both the transmitting and receiving circuits are shown in Fig. 1. A step-up transformer, *T*, supplies the

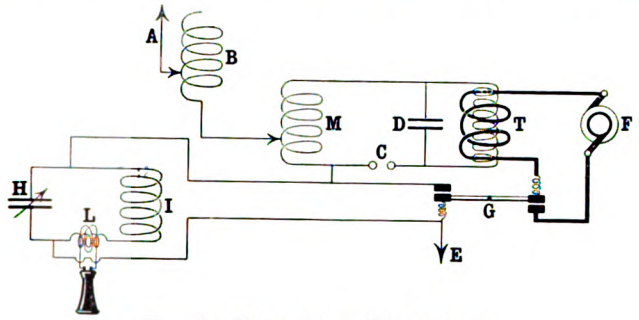


FIG. 1.—DIAGRAM OF CONNECTIONS.

oscillating circuit with alternating current at 15,000 volts, and at a frequency of from 60 to 120 cycles per second. The oscillating circuit comprises a condenser, *D*, an inductance, *M*, and

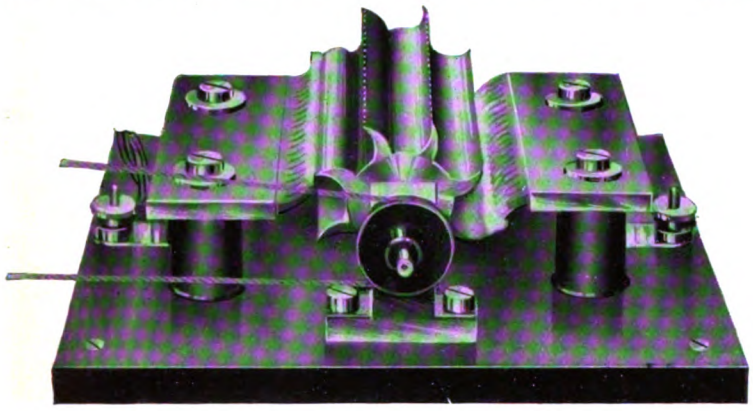


FIG. 2.—ROTARY DISCHARGER.

a special form of rotary discharger, *C*. Twelve Mosciki glass jars, with a total capacity of 0·01 mfd., are used for the condenser, and the inductance is the usual solenoid of bare copper tubing. The rotary discharger, illustrated in Fig. 2, consists of an aluminium cylinder, 5 in. long, with eight curved teeth, rotating between two fixed brass electrodes at a speed of 30 or more revs. per sec. The discharge from the condenser is thus interrupted some 240 or more times per second. By adjusting the constants of the circuit, the frequency of the oscillations is regulated so as to give a normal wave-length of 600 metres. The frequency of the discharges can be varied from 200 to 1,500 per second, and a clear musical note is obtained in the receiving telephone. It will be noted that this, the "group" frequency, is independent of the frequency of the alternating current supplied to the circuit. The effect of the curved teeth of the discharger is to produce a strong air blast across the two gaps. This cools the sparking tips, thus reducing the damping and preventing the formation of an arc. A spark length of $\frac{1}{32}$ in. is employed. The transmitting key (*G* in Fig. 1) is designed so as to obviate the necessity for using a change-over switch for receiving and transmitting. When the key is depressed to energise the transformer, the receiving circuit is short-circuited and the aerial connected direct to earth, but when the key is raised, the aerial is earthed through the receiving apparatus. It is thus possible for the operator to be interrupted while he is transmitting.

The receiving circuit, as shown in Fig. 1, consists of variable condensers, *H*, and inductances, *I*, a magnetic detector, *L*, and a device, not shown, for varying the coupling between the primary and secondary circuits. For preventing the detector from being affected by oscillations other than those which it is desired to receive, an auxiliary highly-damped oscillating circuit is provided. This is tuned to the disturbing oscillations and absorbs them. Fig. 1 shows one arrangement of the receiving apparatus, but by simple switching a number of different arrangements can be made according to the wave-length it is desired to receive. The detector, illustrated in Fig. 3, comprises a rotating armature of six cores of soft iron wire, each core being wound separately with a winding of insulated copper wire. These primary windings are connected up to the bars of a commutator on the armature shaft. A secondary coil wound over the whole armature is connected to two slip-rings, from which the induced currents are conveyed to the receiving telephone by means of suitable spring brushes. By means of similar brushes bearing on the commutator, the received oscillations are passed through two of the primary windings in series. The armature of the detector is rotated by clockwork at a very slow speed between two permanent horse-shoe magnets with their opposite poles opposed, and the magnetic flux through each of the iron cores is therefore reversed at every half revolution. The connections are so arranged that the oscillations are passed through the primary windings just at the period when the iron cores are in a neutral position between the two magnetising fluxes, and therefore in an unstable magnetic condition. The slightest current in the windings produces sudden wiping out of any residual magnetism in the cores, and this induces currents in the secondary circuit containing the telephone. It is claimed that this detector, though not quite so sensitive as the crystal and other delicate detectors now in use, is equally as sensitive as the electrolytic detector and more constant and reliable in use than any other.

For wireless telephony, a special form of rotary disc discharger has been developed. This consists of an aluminium disc about 10 in. diameter, with a large number of curved teeth on its periphery similar to those of the discharger described above. This is rotated at a speed of 12,000 r.p.m., and a group frequency giving a note of so high a pitch that it is inaudible is obtained. The speech vibrations are superposed on the waves generated by this discharger by means of a suitable microphone, and the variations in the received oscillations reproduce the speech in the receiving telephone. Mr. Balsillie informs us

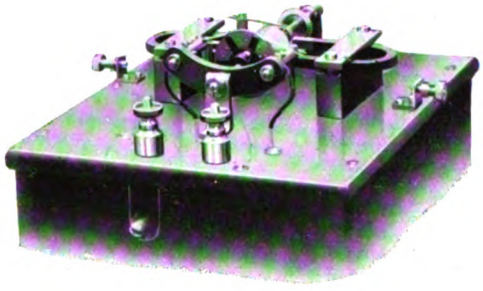


FIG. 3.—MAGNETIC DETECTOR.

that he has succeeded in transmitting music over a distance of 30 miles with this apparatus.

Prosecution under the Factory Act.—An important case came before the Houghton-le-Spring magistrates on Thursday of last week in connection with the fatality, already referred to in ELECTRICAL ENGINEERING, at the Philadelphia power station of the Newcastle Electric Supply Co. On April 15th, W. Liddle, a joiner in the employ of Messs. G. Wardroper & Sons, contractors, of Penshaw, was engaged in fitting a wooden framework round some connections which were alive at the time. He accidentally touched one with a sharp tool, and was killed instantly. The action was brought against the Supply Co. by the Director of Public Prosecutions, who summoned them for neglect to comply with the Factory and Workshops Act in that they allowed an incompetent man to undertake the work. In defence it was urged that Liddle was a competent joiner, 31 years old, who had already worked three weeks in the station. He had been fully warned of the danger of touching the connections, which were all painted yellow, with sharp tools, but he must have done so, as they were well insulated. The bench found that the man was not competent for the work he had to do, and therefore fined the company £10.

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WIRELESS TELEGRAPHY AT SEA

A BILL providing for making compulsory installation of wireless telegraph equipments on vessels carrying a total number of passengers of over 50 was introduced into the House of Commons on Wednesday of last week by Sir Edward Sassoon. It is proposed to make it unlawful, under a penalty of £1,000, for a ship with more than that number of persons on board to leave port without an equipment capable of transmitting or receiving messages over a minimum range of 100 miles. Coasting steamers plying between British and Irish ports not more than 100 miles apart would be exempt. The company installing the apparatus would be required to contract to exchange messages with shore or ship stations using other systems of wireless telegraphy.

The introducer of the Bill called attention to the services which wireless communication had rendered in the preservation of life and property at sea, including the recent case of the steamship *Trieste*, and compared its compulsory adoption to the obligations in the matter of brakes and other matters imposed in the interest of public safety upon railways. The average cost of such an equipment would not exceed £200, and some compensation would doubtless be obtained in the reduction of insurance premiums. The expense of a separate operator might in small ships be avoided by giving some training to the engineer or junior engineer. In New Zealand there was power in the authorities to enforce such an obligation upon vessels: that was also the case in France, and a like proposal was before the Italian Parliament.

Mr. Gibson Bowles, in opposing the introduction of the Bill, pointed out that a great majority of large ships were already provided with wireless apparatus, but to tramp steamers the expenditure of £200 would be a serious item. Again, two operators would be required for continuous service, as it was out of the question to take the engine-room staff from their work for the purpose. He contended that shipping was already too much hampered by Board of Trade regulations, and further pointed out that it was no use installing wireless telegraphy on board ships unless they had a sufficient number of stations on land to take the messages.

The insufficiency of shore stations is certainly a fact, but contains no argument against the Bill. Increasing the demand for them cannot but tend to spur the Government Department involved to increased action in the matter. Whether ultimately the business of the marine wireless communication would remain in the hands of the Post Office we do not know, but we are sure that as easy and satisfactory a method as any of providing the many additional shore stations which would be necessary round our coast would be the installation in most, if not all, of our existing coast-guard stations of wireless telegraph apparatus for universal marine communication, thus rendering the fine body of men who tenant them of increased usefulness, instead of finding excuses for their disbandment. The initial outlay for the equipment is certainly a consideration for small ship owners, but it must be borne in mind that the increased demand for such apparatus will tend to lower its cost.

However, like many others of real utility to the nation which do not form pawns on the party chess-board, this Bill has not been afforded the facilities for it to possibly become law this session, nor has it ever been referred to a select committee. When the Bill is reintroduced we hope that the value of wireless communication, not only for calling attention to distress, but also as a means of localising position in fog, will be recognised, for the success of directive systems in this field is very marked, and we believe that already a simple "wireless compass" is on the market, which can be of great utility in the determination of a ship's position.

The Electrical Committee.—At a meeting of the Committee for the Protection of Electrical Interests held on July 6th, it was decided that the President, the Vice-President, the Hon. Treasurer, and the Hon. Secretary should form a Committee of Management entrusted with power to call meetings when necessary, and generally to prepare the business for the Committee.

ELECTRICAL EQUIPMENT OF THE NEW DOVER-OSTEND BOATS

AN account of the equipment of the two new turbine steamships *Jan Breydel* and *Pieter de Conninck*, which have recently been put into service on the Dover-Ostend route by the Belgian Government appears in *Engineering*. The two boats are of interest as being a great advance in size, comfort, and speed on the paddle-boats, which, with the earlier turbine boat *Princess Elisabeth*, they supersede, and the *Pieter de Conninck*, which started service at the end of June, has attained on her trials speeds up to 24·8 knots. The electrical generating plant consists of two 80-kw. Siemens Schuckert machines and one 20-kw. A.E.G. machine, all driven by steam turbines. The last-mentioned is for lighting when in harbour, but can be run in parallel with the others if required.

The lighting installation comprises over 300 incandescent lamps and two large searchlights. All the wiring in the stokeholds, engine spaces, and wherever it is liable to injury, is in Bergmann steel tubes, and a form of brass conduit tube is used in the saloons and cabins. Two electric motors of 34 h.p. each drive the Howden forced draught fans, and considerable use is made of electric power for ventilation about the ship, including the electric fans, supplying heated air on the "thermotank" system to the first-class saloons. An electric revolving-crane in the rear of the promenade deck serves the luggage hold; it can lift one ton, and is driven by an enclosed 8-h.p. motor for hoisting, and by a similar 2½-h.p. motor for slewing. Both operations are governed by one lever operating a controller of the tramway type. Further applications of electricity include the tell-tale signalling device in connection with the hydraulically worked water-tight doors, the side and masthead lights, and various instruments, such as tacheometers, torsiometers, &c. As has been the case for some time with all the Ostend boats, a Marconi wireless telegraph equipment is carried; electric signalling in various parts of the ship and a Lelas loud speaking telephone connects the wheelhouse with the engineer's platform. The electric equipment was supplied by the builders of the boats, the Société Anonyme John Cockerill of Seraing.

Obituary.—Members of the Electro-Harmonic Society will hear with regret of the death of Mr. A. E. Izard, who has for many years acted in the dual capacity of accompanist and musical director of the Electro-Harmonic Society's concerts. Mr. Izard had been suffering since last summer from a nervous breakdown, and had been staying at Kingsgate, near Broadstairs, for several months. In the early spring of this year, unfortunately, he had another seizure, which may be attributed to his resuming his musical duties before complete recovery and against the wish of his medical advisers. Mr. Izard became a student in the Royal Academy of Music in 1878, was appointed a sub-professor in 1883, and a full professor in 1885, and he held the latter position until his death.

Forced Ventilation for Railway Motors.—According to the *Street Railway Journal*, an interesting development of the past year is the method used for securing increased motor capacity on some of the cars of the Pennsylvania Railway Company for use in the new tunnels through Manhattan Island. Each car is equipped with two interpole motors, normally rated at 215 h.p., but which, by means of forced ventilation, are enabled to do work which would otherwise require motors rated at about 250 h.p. each. The blower outfit consists of a 1½-h.p., 2,250-r.p.m. motor, to the shaft of which is attached, at each end, a blower fan, 9 in. in diameter and 3 in. wide. Each of these fans is capable of forcing between 400 cu. ft. and 500 cu. ft. of air per min. through the motor to which it is connected. The truck on which these motors are mounted is so arranged that the blower outfit can be mounted below the bolster; 180 cars are being equipped in this way.

St. Petersburg International Electric Railway Exhibition.—The opening of the exhibition of the applications of electricity to railways which was organised to be held in St. Petersburg at the end of this year has been postponed until April 15th, 1911. The exhibits will be divided into three sections: (1) Uses of electricity on steam railways; (2) electric traction on main lines, local lines, and tramways; (3) development of water-power for electric traction purposes. Applications for space will be received up to February 15th, 1911, by the President of the Organising Committee, Mr. N. A. Sitenko, 24 Sadovia, St. Petersburg, who will also supply any information desired. The exhibition will remain open for three months, and, in view of the fact that the railway authorities of Russia are considering the conversion of several main lines to electric traction, and have already held conferences on the subject, exhibitors have good chances of doing business.

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ASSOCIATION OF CONSULTING ENGINEERS

ON Wednesday of last week, a meeting, presided over by Sir William Preece, K.C.B., F.R.S., was held at Caxton Hall to consider the desirability of forming an Association of Consulting Engineers. A number of consulting engineers were present, and letters of regret from several engineers, in sympathy with the scheme, were read.

Mr. MIDGLEY TAYLOR, who presided at the opening of the meeting pending the arrival of Sir William Preece, said that the object of calling the meeting was to form an Association of Consulting Engineers. A Provisional Committee had already held a number of meetings, and the present meeting had been called to confirm, or otherwise, the action taken by the Committee. The Institution of Civil Engineers had helped the consulting engineer by forming rules for professional conduct, but the Committee considered that the Council of the Institution could not, in the very nature of things, give all the protection that was desirable for the consulting engineer. He felt that the public wanted protecting. At the present time, if municipal authorities erected works, even of large magnitude, they were not compelled to employ a qualified man to advise them, and there was nothing to prevent an absolutely unqualified man going to the particular authority, touting for the work and being employed.

Mr. JAMES SWINBURNE proposed that the Association be formed at once. There had been an idea that there was some antagonism between the proposed Association of Consulting Engineers and the Institution of Civil Engineers and other institutions. The only thing that a body like the Civil Engineers could do was to frame rules of etiquette which were very good things in themselves, but which really limited the powers of the genuine consulting engineer rather than helped him. It was, therefore, necessary that consulting engineers should work in sympathy with the Institution of Civil Engineers and other institutions, and that they should, in addition, form an association themselves, not for the purpose of technical papers but purely to guard the interests of consulting engineers as such, and of the public in so far as the latter were bound up with the interests of the consulting engineer.

The motion having been seconded by Mr. E. L. Mansergh, a general discussion took place. Mr. E. H. Stevenson wished that such an Association had been started twenty or thirty years ago, and although it might not now affect the older members like himself, it would be of very great assistance to the younger consulting engineers. Mr. Robert Hammond dwelt upon the importance of such an Association from the public point of view. Although a private company was quite at liberty to have work carried out in any way that might seem desirable, in the case of municipal work it became highly desirable that public money should be spent only under the guidance of properly qualified engineers. Mr. A. H. Preece thought that a committee might be sufficient without any formal Association. On the other hand Mr. Swinburne, Mr. Midgley Taylor, Mr. Lowcock, Mr. Hammond, and others, were in favour of an Association with a Council. Mr. W. M. Mordey saw no objection to the formation of an Association from the point of view of adding to the already long list of societies, because its functions would be very different from those of the ordinary society. There was also some discussion as to whether the term "consulting engineer" was altogether the best to be adopted in the name of the Association. Mr. Druitt Halpin thought it was undesirable, but other speakers thought it was difficult to substitute any other term. Mr. A. P. I. Cotterell asked whether the Institution of Civil Engineers were in favour of the scheme, as otherwise the Association might come in conflict with the Institution sooner or later, which would be highly undesirable. In reply to this question Mr. A. H. Dykes said that he had received a letter of a most sympathetic nature from the Secretary of the Institution of Civil Engineers. The formation of the Association was also supported briefly by Mr. Campbell Swinton, Mr. B. M. Jenkin, and Mr. H. W. Handcock.

Sir WILLIAM PREECE, who had arrived during the discussion and had taken the chair, said he was entirely in sympathy with the movement. He assured them of the sympathy of the Institution of Civil Engineers, and he was sure that the Committee of the Association would be received heartily by the Council in the discussion of any points that might arise. He then put the resolution, that the Association be formed, to the meeting, and declared it to be carried unanimously.

The following Committee was then elected, with power to add to their number: As representing *Civil Engineering:* Messrs. Latham, S. R. Lowcock, E. L. Mansergh, H. Rofe, and Midgley Taylor. *Electrical and Mechanical Engineering:* Messrs. Robert Hammond, B. M. Jenkin, W. M. Mordey, W. H. Patchell, Sir Wm. Preece, J. F. C. Snell, J. Swinburne. *Gas Engineering:* Messrs. C. Hunt, E. H. Stevenson, and Henry Woodall.

Mr. B. M. JENKIN explained the lines on which a code of rules had been drawn up by the Provisional Committee, with the object of defining what a consulting engineer was.

Amongst those who accepted the invitation to the meeting or who wrote that, whilst unable to be present, they were in sympathy with the movement, were: Messrs. J. S. Alford (Messrs. Chatterton & Alford), Walter Beer, W. I. E. Binnie (Messrs. Sir Alexander Binnie, Son & Deacon), Charles Bright, F. Broadbent (Messrs. Wilkinson & Broadbent), H. R. J. Burstall, H. R. Carr, A. P. I. Cotterell, A. T. Coode (Messrs. Coode, Son & Matthews), W. R. Cooper, Martin Deacon, A. L. Dearlove (Messrs. Clark, Forde & Taylor), R. A. Dawbarn, W. T. Douglass, A. H. Dykes, S. Moore-Ede, Tom Ekin, Percy Griffith, Robert Hammond, Robert Hammond, jun., H. W. Handcock, K. P. Hawksley (Messrs. T. & C. Hawksley), G. W. S. Hawes, H. M. Hobart, H. H. Humphreys, C. Hunt, F. H. Jones, B. M. Jenkin and J. M. Kennedy (Messrs. Kennedy & Jenkin), Baldwin Latham, E. M. Lacey, S. R. Lowcock, E. L. Mansergh and W. L. Mansergh, John May, J. C. Mellis, C. H. Merz (Messrs. Merz & McLellan), E. W. Monkhouse, William M. Mordey, W. H. Patchell, A. F. Phillips, Sir William Preece, A. H. Preece, Llewellyn Preece, Henry Rofe, Henry Rofe, jun., A. M. Sillar, A. T. Snell, J. F. C. Snell, E. J. Silcock, C. P. Sparks, E. H. Stevenson, James Swinburne, A. A. C. Swinton, Midgley Taylor (Messrs. Taylor, Son & Santo Crimp), W. C. Unwin, Robert Weekes, Henry Woodall (Messrs. Corbet Woodall & Son), A. Valon, G. A. Yourdi.

The honorary secretary of the Association is Mr. A. H. Dykes, of 1 Victoria Street, Westminster, S.W.

ELECTRICITY IN AGRICULTURE

WHILE a considerable advance has been made in recent years, particularly in Germany, in the application of electrical power for driving agricultural machinery, there have been very few workers in the direction of pursuing the investigations of the late Prof. Lemström on the actual stimulation of plant growth by means of electricity. The only large scale trials have been carried out by Mr. J. E. Newman, who, with the assistance of Sir Oliver Lodge and his son, Mr. Lionel Lodge, and the co-operation of Mr. Raymond Bomford, of Salford Priors, near Evesham, have obtained some most interesting results with various crops on Mr. Bomford's l .d. Particulars of these experiments have been published from time to time, and we have now before us the last available information in the form of an article in the *Journal of the Board of Agriculture* by Mr. J. H. Priestley, of Bristol University, who has been enabled to keep in close touch with the experiments throughout.

Evidently the chief value of the electrical treatment lies in its acceleration of the growth of the crops, although in some cases a considerable increase in the yield was noted. For instance, experiments with tomatoes, wheat, and strawberries at Evesham are recorded for 1908. In the case of the tomatoes three areas were under cultivation, two "electrified" areas with 483 and 929 plants respectively, and one "control" area with 148 plants. The two electrified areas each yielded on an average one ripe tomato for every three plants before September 24th, while the control area produced only one for every ten plants. The total yield for the season in lbs. per plant was 2·9 and 3·5 for the two electrified areas, and 2·4 for the control area. The latter was under identical conditions to the first electrified area, but the second electrified area had a better aspect, and was occasionally irrigated by the overflow from a pond. With wheat, 7·68 "electrified" acres were under cultivation, and 10·2 acres of "control" area; they produced 32·5 and 26·15 bushels per acre respectively—an increase of 24·3 per cent. for the electrified area. On the other hand, the total yield of strawberries was 9 per cent. less per acre from the electrified than from the control area, but two early pickings (June 20th and 22nd) gave 1,318 lbs. from an electrified area of 56 per cent. the size of a control area, which gave 1,876 lbs., so that there was a gain of over 25 per cent. in the early crop. The acceleration of growth thus indicated is, of course, of extremely great value to the market gardener, and off-sets any slight decrease in the total production; but Mr. Priestley points out that the decrease in the total output was probably due to an exceptional dryness of the season, which apparently resulted in the electrical treatment not working to such advantage; in the previous year the first complete picking from the two areas was 56 lbs. from the electrified and 33 lbs. only from the non-electrified, in spite of the latter being nearly double the size, and the final result was an increase of 25 per cent. per acre.

The method of "electrifying" the area is as follows:—An induction coil is employed, taking from 2 to 5 amperes at 110 volts D.-C. on the primary side, and transforming up to 100,000 volts, and a mercury vapour valve is employed as rectifier. The positive pole is connected to thick telegraph wires carried on insulators raised some 16 ft. above the ground by means of larch poles. The wire is arranged in rows 102 yards apart, and the poles in a row are 71 yards apart. The rows of wires are cross-connected by thinner galvanised iron wire 12 yards apart, and these act as discharge wires. Twenty acres are under treatment in this way, and only about 20 poles are needed to carry the wires. The tomatoes were grown in the open, and were treated, as regards the position of the wires, in precisely the same manner as the other crops.

Under glass, a single wire runs the whole length of the greenhouse, and to prevent danger of shocks the arrangements are contrived so that the wire is let down to the ground and discharged as the door is opened. In spite of the fact that a

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large proportion of the discharge must be diverted by the hot-water pipes and (in the case of cucumbers) by the wires placed near the roof to support them, yet the results obtained show considerable gain due to the electrical treatment. Experiments at Bitton, near Bristol, in five cucumber houses, three of which were "electrified," showed in 1908 an average of 2,443 cucumbers per non-electrified house to 2,731 per house in the electrified houses, and the average numbers picked per house in the two sets of houses before April 29th were 278 and 449 respectively. The cucumber houses were all of the same size and aspect, and formed one continuous block.

There is still considerable doubt as to the reason for the beneficial action of the charged wires upon plant growth, and some further physiological experiments are needed to elucidate it. Mr. Priestley, in his article, reviews the question generally, but is unfortunately unable to reach any definite conclusion.

CORRESPONDENCE

To the Editor of ELECTRICAL ENGINEERING.

DEAR SIR,—May I offer a few remarks upon your somewhat unsympathetic leader of July 7th on the Memorial organised by the Smoke Abatement League which we had the honour to present to Mr. John Burns on June 29th. As your readers are men of technical knowledge and serious interest in the subject, I make no apology for troubling you with a somewhat statistical letter. I wish to lay before you such figures as are at my disposal upon the question of the proportion of domestic and factory smoke, which together constitute the great evil under which we labour. We shall all realise that the question is an extremely difficult one. It has been approached, however, in two ways.

In Manchester a number of analyses of air have been made by Professor Knecht, of the School of Technology, and by Mr. R. H. Clayton, B.Sc., President this year of the local branch of the Society of Chemical Industry. They have treated boiler soot, domestic soot, and the average air of Manchester at the centre of the city, as revealed by the deposits left on the cotton wool which purifies the air which enters the Midland Hotel.

It is, of course, known that domestic smoke is very much more deleterious than factory smoke, inasmuch as it contains a larger quantity of unburnt hydrocarbons, in the form of troublesome tarry oils and acids. It also contains much more ammonia. All this, as your readers will know, results from the imperfect combustion of the domestic grate.

We will take hydrocarbons first. These chemists found that for every 100 parts of pure carbon present, domestic smoke contained of hydrocarbons 58 parts, boiler smoke contained 3 parts, and the average Manchester air contained 27·3 parts on week days. I obtain these figures by averaging the results of a number of their experiments. A short algebraical equation gives the proportion.

Let x per cent. of the smoke in Manchester air be domestic; then $100-x$ will be factory smoke, and the equation arises:

$$58x+3\ (100-x)=(27{\cdot}3)\ 100.$$
$$58x=2430.$$
$$x=44 \text{ (about)}.$$

Treating in the same manner the figures for tarry oils only, we obtain 59 per cent. for the domestic portion, and taking ammonia only, we obtain 40·5 per cent. domestic, all on week-days. These figures, which do not claim to prove anything with perfect accuracy, leave one with the conviction that something less than half of the smoke in Manchester is due to domestic grates. Figures for Sundays were also obtained, from which it will appear that on that day, when the factories are closed, 74 per cent. of the smoke is domestic. This is what one would expect, and suits the other figures very well.

Adopting another method of investigation, the chemists of the City Corporation of Glasgow have this last winter been measuring the rate of velocity at which smoke issues from factory and from domestic chimneys, and have measured the relative size of them; and their conclusion, which has been published in expert articles in the *Glasgow Herald*, is that one factory chimney is the equivalent of 39 domestic chimneys. If we apply this to the figure which Mr. Burns obtained from official sources for his speech to us, we find that there are 1,000,000 houses in London and 35,000 factories. By far the majority of these houses are small ones, with only one fire constantly burning; if we allow, however, three smoking chimneys for every two houses, we obtain 1,500,000 domestic chimneys; and, if we multiply the 35,000 factories by 39, we obtain 1,365,000 as the equivalent figure, thus making the factory smoke and the domestic smoke in London approximately equal, with a slight advantage in favour of the factories. As factories in London do not predominate to the extent that they do in the Manchester district, these figures on the whole confirm one another. So I believe a fairly safe conclusion is that, over the large towns of England, factory smoke and domestic smoke are each about equally responsible for the evil. If we could get rid of either half England would be a different country. We could do with a little smoke without harm; it is the grand total which troubles us.

Now science has provided, as you point out, and is continuing to provide more and more successfully, means of dealing with manufacturing smoke; it is therefore legitimate to press for the use of those means on those who, in addition to their own domestic fireside, make a living by polluting the air. I hope very much that Coalite, or other smokeless fuel, will before long give us a satisfactory remedy for domestic smoke also, and I cordially support the extension of gas and electricity for domestic uses, though in approaching Mr. Burns it was proper and necessary to dwell on the legislative side only.

You appear to be sensitive upon the well-earned attacks which have been made upon the electrical power works at Chelsea and elsewhere. We should certainly be able to support your industry with greater confidence if electrical works would learn to consume their smoke as other works can.

I remain, yours truly,

JOHN W. GRAHAM

(*Chairman of the Smoke Abatement League.*)

Dalton Hall, Victoria Park, Manchester.
July 13th, 1910.

[We think that if Mr. Graham had applied his exact methods of analysis to the products of the chimneys at Lots Road, he would have found that the amount of unconsumed carbon discharged was at the time when complaints were made very much less than in the case of the average factory. It is also only fair to say that most of the trouble was due to causes which have now been modified.—Ed. E. E.]

ELECTRICAL MARINE PROPULSION

THE Comptroller-General of Patents has just issued his decision with regard to the opposition made by Mr. W. P. Durtnall to the grant of a patent to Messrs. C. A. Parsons, G. G. Stoney, and A. H. Law for an electrical system of marine propulsion. The specification in question is No. 6,177 of 1909, and an abstract appeared in ELECTRICAL ENGINEERING of April 14th, 1910, shortly after its acceptance. Mr. Durtnall opposed the patent on the ground that the invention was claimed in his patent No. 17,248 of 1905. The system consists in avoiding the use of high pressures by inter-winding the generators and motors of the equipment so that portions of the motor windings are connected with corresponding portions of the generator windings. Thus, only small differences of potential have to be dealt with in these short windings, and the insulation is easy to maintain in spite of the presence of salt and moisture in the air. For a 2,000-volt winding, for example, the pressure is generated and used in, say, twenty steps of 100 volts each. Various means of effecting this and of obtaining the required speed ratios are described in the specification.

At the hearing before the Comptroller, Mr. Durtnall conducted his case personally, while Mr. Adams appeared for the applicants. Mr. Durtnall limited his objections to certain claims of the specification covering the use of the above system of winding with high-speed engine shafts and low-speed propeller shafts, and asked for a specific reference to his patent, which he considered to be a master patent for the combination of a polyphase generator with a motor having a greater number of poles, so as to obtain an electrical speed reduction from the generator shaft to the propeller shaft. The Comptroller holds, however, that this arrangement was not new at the time of the opponent's patent, and cites patent No. 21,030/00, granted to the British Thomson-Houston Co., in which a different number of poles were used on generator and motor. He concludes that the system described in Mr. Parsons' patent is not claimed in Mr. Durtnall's previous patent, and that no reference to the latter patent nor any disclaimer need be inserted. An amendment of little importance has been made at the suggestion of the applicants, however.

Lectures on Law Relating to Engineering.—The Council of the Junior Institution of Engineers, in conjunction with the Council of the Society of Engineers, have arranged for a course of six fortnightly lectures on "The Law Relating to Engineering," to be delivered by Mr. L. W. J. Costello, the first to be given on the 10th October next.

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REVIEWS OF BOOKS

Electricity. By H. M. Hobart. 207 pp. 8¼ ins. by 5¼ ins. 115 illustrations. (London: Constable & Co.) 6s.

MR. HOBART has from time to time provided several excellent works of a more or less specialised nature for the use of engineers, who have already a knowledge of the general principles upon which electrical phenomena are based, and it is with some interest that we take up a book in which his clear, logical methods and his originality are applied in providing a first introduction, or, to use his own expression, a foretaste, of the subject. His work shows that he has realised more completely than any other modern writer that the best introduction to a subject is not necessarily one which follows the course of the historical development of the science. Not only that, but he has to a more than usual extent the courage of his own convictions. The title "Electricity" is somewhat vague, and it must be understood, before we criticise any lack of completeness, that it is to "heavy" electrical engineering that the book is an introduction, not the study of the electrical aspect of physical science to what the Germans call the *Schwachstromtechnik* of the "milliampere man."

True to these principles, Mr. Hobart casts frog's legs and pith balls, beloved by the older writers, to the winds, and on page 2, instead of finding a woodcut of a gold leaf electroscope, we meet with the conventional sign resembling the commutator and brushes of a generator. The idea of conduction of currents is at once introduced, and not many pages on the reader is able to fix his ideas on something concrete in the relative conductivity and price of copper and aluminium. General considerations of energy follow, and Mr. Hobart puts in a strong plea for the use in connection with energy in all its forms of one unit, the kilowatt-hour, or, as he prefers to call it, the kelvin. A thousandth of a kelvin he wishes to call a siemens. The idea is excellent in principle, and if Mr. Hobart were the only technical writer, would work splendidly, but we are not sure that the introduction of new names of units does not sometimes tend to aggravate the confusion which it is intended to cure. At any rate, we are afraid that it will be long before we shall hear of mechanical engineers speaking of kinetic energy in "kelvins per ton." Following his sequence, the author shows how his kelvins are made of watts and hours, and the watts of volts and amperes. Having further elaborated, with illustrations always of the most practical character, the conception of the current carrying conductor, the author considers the magnetic state of affairs round it, and thus leads on to an equally logical development of the idea of the magnetic field. Moving an independent conductor in it, he generates first continuous and then alternating currents, and in connection with the latter, we are pleased to note the adoption of the term "crest value" for the maximum instantaneous current or voltage. The two succeeding chapters are headed "Inductance" and "The Magnetic Circuit," and are admirable in their clearness and straightforward treatment. The final chapter on insulating materials is of different character to the rest of the book, and is in itself a masterly little treatise on the subject, setting forth principles revealed by recent researches in a way which will be useful to many of riper experience than those to whom the book is primarily addressed.

Direct and Alternating Current Testing. By F. Bedell and C. A. Pierce. 265 pp. 9½ ins. by 6¼ ins. 115 illustrations. (London: A. Constable & Co.) 8s.

THE authors have made no attempt in this work to provide either a compendium of testing methods for the use of commercial test-room assistants or a full laboratory course for students. Although it is primarily to the latter class that the book is addressed, their object has been more to direct the reader's attention to the principles that underlie the various tests described, and to the significance of the results than to give such detailed instructions as to reduce the amount of mental effort required to little more than filling in a table and working a slide rule, as is the tendency in some laboratory manuals. The tests treated of are such as can be carried out in any ordinary college laboratory, and have been chosen with a view to illustrating principles well to the student rather than as being suited to commercial routine work. In fact, the aim has been more to enable the student to understand any form of test which he will afterwards come across in his work than to equip him with a detailed knowledge of the best methods to employ in every case.

Commencing with a general study of series, shunt, and compound generators and motors and their characteristic curves, a discussion is given of methods of measuring losses and efficiencies of continuous current machines. Alternators are then dealt with, and particular prominence is given to methods of predetermining the performance of a given machine without actually running it on load. The succeeding chapter on single-phase currents is not so much devoted to testing proper as to explanation with experimental illustration of the properties of alternating current circuits, and the same may be said to some extent of the sections on transformer and polyphase currents. Much of the matter here included usefully fills a gap between purely theoretical and purely engineering literature.

Les Oscillations Électriques: Principes de la Telegraphie sans Fil. By C. Tissot. 470 pp. 7¼ ins. by 4¾ ins. 152 illustrations. (Paris: Doin & Fils.) 5 francs.

THIS volume forms part of the *Encyclopédie Scientifique* series edited by Dr. Toulouse, and is the first of a pair on the principles of wireless telegraphy by Lieutenant Tissot, whose work in France on this subject is well known. It is devoted to the general subject of the properties and production of electric waves. The first few chapters lay the foundations of the theory of the subject, after an introduction treating generally of vibratory and periodic motion. A mathematical treatment of the properties of low-frequency alternating currents leads to a discussion of methods of producing high-frequency oscillations by means of condenser circuits, and arc as well as spark methods are gone into. Succeeding chapters deal principally from a mathematical point of view with high-frequency measurements, the propagation of impulses along wires, electric waves, radiation, and resonance. Much of this has a very practical bearing on wireless telegraphy, but the object of this volume has been rather to provide completeness in the theoretical treatment than to deal with practical applications. A useful bibliography, including works in English, French, and German, is given at the end.

Wireless Telephones. By J. Erskine Murray. 68 pp. 7¼ in. by 5 in. 17 illustrations. (London: Crosby, Lockwood & Son.) 1s. 6d.

THE book is evidently not intended for the engineer or the scientifically trained reader, but it will be of value to the general reader who is scientifically inclined and who desires to know what is being done in wireless telephony without wishing for more than a superficial knowledge of the phenomena involved. The opening pages include a lucid explanation of the propagation of sound waves, but wireless transmission is dealt with as though it were merely a matter of sending out current impulses in rapid succession along the surface of the earth; why, the uninitiated reader will ask, is it necessary to have a big thing sticking up in the air for sending current impulses along the surface of the earth?

The Indicator Handbook. Part II. By C. N. Pickworth. Fourth edition. 134 pp. 7¼ in. by 4¾ in. (Manchester: Emmott & Co.) 3s.

THE second part of Mr. Pickworth's "Indicator Handbook," of which the fourth edition has recently been published, deals

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with treatment of indicator diagrams and the revealing of the information they contain, while the first part deals with the construction and use of the indicator itself. The elementary thermodynamics of the subject are studied, as well as the detection of defects in value setting, &c. Considerable space is given to gas-engine diagrams, and those from compressors, pumps, &c. The new edition before us contains some additional notes on recently introduced methods of diagram measurement, and a useful table of piston constants has been added.

The Deinhardt-Schlomann Series of Technical Dictionaries in Six Languages. Vol. VI.: Railway Rolling Stock. 796 pp. 7 ins. by 4 ins.; illustrated. (London: Constable & Co.) 10s. 6d.

THE fifth volume of this series of technical dictionaries is arranged in the same way as the previous volumes on other branches of engineering, that is to say, the ideas are arranged according to subject matter with the German, English, and French expressions on one side of the page, and the Russian, Italian, and Spanish on the other, while suitable illustrations are given in the central space. The latter part of the book consists of alphabetical indices with the Russian words separately, owing to the difference in alphabet. The majority of the volume deals with steam railway stock, and the illustrations, as elsewhere, naturally represent Continental practice entirely. The English equivalents are not always quite happy—to an English reader they would no doubt be useful in explaining the meaning of foreign terms, but a reader of one of the other five nationalities represented should not rely on the expressions given as those used in England by railway men, in spite of the fact that several prominent British railway men have allowed their names to be printed in the introduction as revisers and contributors. There is also a fairly long section on electric railway stock, which to some extent make up the deficiencies of which we complained in connection with the earlier volume on general railway matters, but is still far from complete as regards real technical terms, although many obvious expressions are laboriously translated.

Exposition Franco-Britannique de Londres, 1908. Section Française, Groupe IV. (Mécanique Générale). Rapport de M. Ch. Michel. 421 pp. 10¾ ins. by 7¼ ins. 142 illustrations. (Paris: Comite Français des Expositions a L'Etranger.)

A FITTING record of the Engineering Sections of the Franco-British Exhibition of 1908 for French readers has been provided in this work, which forms the official French report of this part of the Exhibition. All the regulations and other official documents which were addressed to exhibitors are given in full, besides a good deal of general information as to the organisation and arrangement of the exhibition. To the general reader, however, the most interesting part is the detailed description of the exhibits, which, as regards the French section, is as complete as the display itself was incomplete during most of the season. This is made all the more acceptable by the numerous and excellent illustrations provided, which include details of apparatus exhibited, as well as representations of complete stands, and views of the building. Full lists of the awards are given, and the utility of the volume is enhanced by the copious index.

Auto-Transformer Design. By A. H. Avery. 60 pp. 8½ ins. by 5½ ins. 25 illustrations. (London: E. & F. N. Spon.) 3s. 6d.

THOUGH entitled "Auto-Transformer Design," this books deals only with the particular pattern of auto-transformer which was developed a few years ago for low-voltage metal filament lamps. Indeed, the author does not appear to be aware of the fact that auto-transformers have a far wider and more important application in connection with the starting and controlling of the various types of A.-C. motors, and the wording of the introductory chapter is very misleading in this respect. Much of the general information in the book with regard to metal filament lamps and the cost of lighting is quite incorrect; nor is the author's exposition of the theory of the transformer and of the formulæ involved in its design free from mistakes. The latter portion of the book contains a certain amount of practical information on the construction of small auto-transformers.

Soldering, Brazing, and Joining of Metals. By T. Bolas. 60 pp. 7¼ in. by 4¾ in. 16 illustrations. (London: Dawbarn and Ward.) 6d.

THIS is a useful little manual giving a quantity of practical information regarding soldering, brazing, &c. The first section deals with soft soldering, and includes hints on a number of different methods, suitable for various circumstances. The next section is devoted to pipe joints and similar work, and this is followed by chapters on brazing or hard soldering and "burning" together without solder, including lead burning and oxy-acetylene autogenous welding. Only brief mention is made of electric welding.

ELECTRICAL TESTING OF WATER

AN original communication to the Journal of the Institution of Electrical Engineers by Mr. W. Pollard-Digby describes an improved apparatus for making resistance tests of water. He points out the very great effect which the presence of minute quantities of impurity has on the specific resistance of water, and suggests that resistance tests would often be found more convenient than chemical analysis. For feed-water testing the conductivity is a good indication of the degree of hardness when due to calcium carbonate, and such tests can be used for checking the operation of evaporators for make-up purposes at sea, or for the supply of distilled water for hydraulic gun mountings, and further to provide a check on the operation of surface condensers in all places. Given a boiler free from priming, a single conductivity measurement of the water passing from the condenser to the hot well will indicate the tightness of the condenser tubes. The grade of the water within boilers is subject to wide variation. The author has found the specific conductivity of water in boilers to vary from 11·1 reciprocal megohms to more than 90,000 reciprocal megohms. It therefore becomes necessary for each test for boiler priming to plot a special curve giving the conductivity of various portions of the water actually in the boiler mixed with standard distilled water. Where hard waters containing an excessive quantity of calcium and magnesium carbonates are softened by the Clark process, the conductivity tube and conductance meter can be used as a substitute for the standard soap test in defining how far the process of softening has been carried. Details of a large number of tests are given, and in a final *résumé* the author claims that the determination of the electrical conductivity of liquids offers to the engineer:—The knowledge as to when the analyst should be called in to report upon the nature and probable effect of a change in the constitution of a boiler feed water indicated by the conductivity tube and conductance meter; the knowledge as to whether condensers are leaking, and the amount of the leakage, so that the date for overhaul (immediate or remote) can be promptly settled; an exact determination of the amount of priming arising in any type of boiler under any defined conditions of load, water-level, or nature of water in the boiler; the control of oil eliminating plants, preventing the inadvertent addition of injurious constituents to the boiler feed; the control of water-softening plants.

Development of Telephone Systems.—The *Deutsche Verkehrs-Zeitung* gives the following comparative figures illustrating the development of the telephone service in the five leading countries:—Number of stations connected on January 1st, 1909: America, 2,200,000; Germany, 212,200; England, 115,000; France, 63,200; Sweden, 63,500. The corresponding figures in January, 1909, were: America, 6,620,000; Germany, 860,000; England, 590,000; France, 197,000; Sweden, 167,000. The number of calls in the year 1908 were over 11 billion in America, 1·5 billion in Germany, and 1·8 billion in England. The number of stations per 100 of the population were: America, 8·2; Germany, 1·4; England, 1·3; France, 0·5; Sweden, 3·1.

British Association.—The eightieth annual meeting of the British Association for the Advancement of Science will, as already announced in our columns, be held at Sheffield from August 31st to September 7th, under the Presidency of Prof. T. G. Bonney, F.R.S. Among the sectional Presidents are: Section A (Mathematical and Physical Science), Dr. E. W. Hobson, F.R.S., and Section G (Engineering), Prof. W. E. Dalby. The reception room at the Cutlers' Hall will be opened on Monday, August 29th, at 2 p.m. The inaugural meeting will be held on Wednesday evening, August 31st, and the concluding meeting will be held on Wednesday afternoon, September 7th. In the Engineering Section, Prof. W. E. Dalby, the President, will deliver an address, and the following Papers will be read: "The Testing of Lathe Tool Steels" and "A New Method of Testing the Cutting Quality of Files," by Prof. W. Ripper; "Experiments on Aeroplanes," by Mr. W. A. Scoble; "Accelerometers," by Mr. H. E. Wimperis; "The Optical Determination of Stress," by Prof. E. G. Coker; "The Laws of Electro-Mechanics," by Prof. S. P. Thompson, F.R.S.; "The Electrification of the Brighton Railway," by Mr. Philip Dawson; "Heat Insulation," by Mr. F. Bacon. A Report of the Gaseous Explosions Committee will be read, and joint discussions will be held with Section B on "The Chemistry of Combustion," and with Section A on "Aerial Flight." Tickets for the meeting may be obtained until August 24th at the Office of the Association, Burlington House, Piccadilly, London.

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MOTOR-GENERATOR FOR PROJECTORS

AN interesting motor-generator set for supplying searchlights and other large arc lamps has been introduced by Messrs. Mather & Platt, Ltd. (Park Works, Manchester), and is illustrated in Fig. 1. There is nothing unusual about the motor, but the generator is of a special design to prevent the load current exceeding a certain predetermined limit. The connections are shown in Fig. 2. It will be seen that the motor M is in series with the arc, and that the generator G is connected across the arc, so that the total arc current is the sum of the motor and generator currents. The generator is shown diagrammatically in Fig. 3. The field system is similar to that of an ordinary two-pole generator, but the section of the

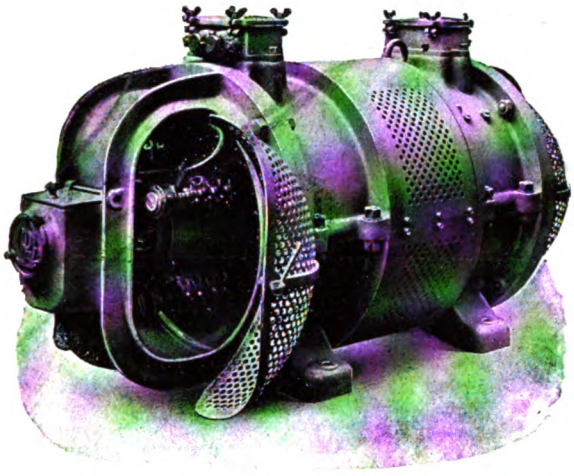


FIG. 1.—MATHER & PLATT SEARCHLIGHT MOTOR-GENERATOR.

yoke and pole cores is much reduced, while that of the pole shoes is increased. An increased air-gap is provided at D and D_1. The armature has an ordinary two-pole drum winding, but what would be the main brushes in an ordinary machine are short-circuited. These are the brushes B, B_1, which are in connection with the conductors in the neutral zones at C and C_1. Auxiliary brushes are placed on the commutator at A and A_1, and these collect current from the conductors in the gaps at D and D_1, and are connected across the arc.

When the projector is working normally, the pressure across the carbons is about 60 volts. The voltage across the motor is then 220 − 60 = 160 volts. The generator field coils, E, E_1, are connected across the 220-volt mains, and tend to set up a flux

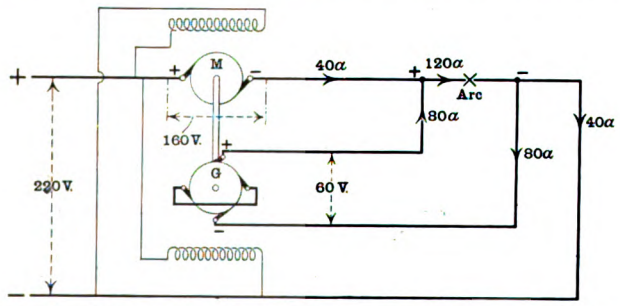


FIG. 2.—DIAGRAM OF CONNECTIONS FOR SEARCHLIGHT MOTOR-GENERATOR.

in the ordinary way. The effect of this is to cause a current to circulate in the armature between the brushes B, B_1, which produces a cross flux at right angles to the primary flux. This cross flux, which in this machine is the main working flux, induces a voltage in the armature which is a maximum between the points D and D_1, and the current due to it is collected by the brushes at A and A_1. The load current, therefore produces a magneto motive-force exactly opposing the magneto-motive force of the field windings. These two opposing magneto-motive forces are proportioned in such a manner that the resultant flux produces a current between the brushes B, B_1 sufficient to set up the main working flux.

In the case of a 120-amp. motor generator, the field winding E, E_1 has a magnetising force of 2,500 ampere-turns. The armature has a winding such that, with 80 amperes flowing through it, it produces a demagnetising effect equivalent to 1,800 ampere turns. The balance of 700 ampere turns is employed in producing a current of 40 amperes between the brushes, B, B_1. This sets up a flux which induces a pressure of 60 volts at the brushes A, A_1, and sends 80 amperes through the arc lamp carbons. For a generator output of 80 amperes, 60 volts, the motor requires an input of 40 amperes, therefore the total current in the arc lamp circuit is 80+40=120 amperes.

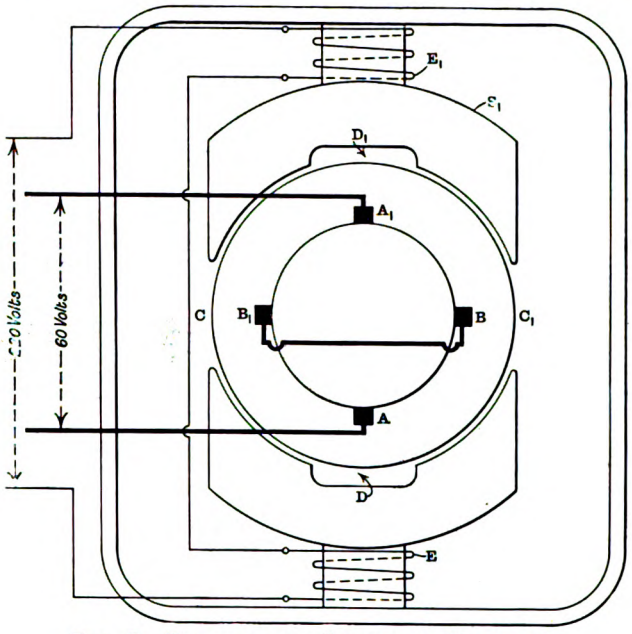


FIG. 3.—DIAGRAMMATIC SKETCH OF GENERATOR.

When the carbons are brought into contact, the resistance across the main brushes drops to zero (in actual practice to about 0·05 ohms, corresponding to 6 volts and 120 amperes). The 60 volts which were generated tend to produce a large current, but do not, for the following reason. Suppose the current increases to 111 amperes. Now, whereas the field ampere-turns remain constant, the armature reaction increases from 1,800 to 2,500 ampere-turns. The magneto-motive forces,

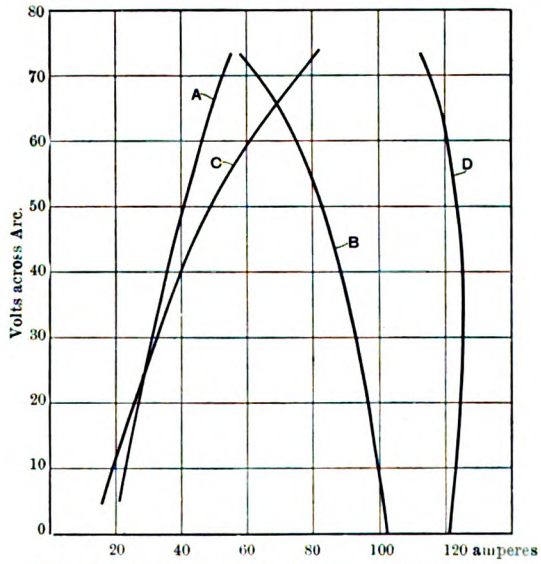


FIG. 4.—CURVES OF VOLTAGE AND CURRENT.

A. Motor (Supply) Circuit.
B. Generator Circuit.
C. Short-circuited Armature Circuit.
D. Projector Circuit (A+B).

therefore, exactly neutralise one another, leaving no flux for producing current to generate the cross-working flux. It will be seen, therefore, that the armature current cannot increase to 111 amperes, but must always be between the limits of 80 and 111 amperes, so long as the machine is under normal con-

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ditions of working. Actually, with the carbons short-circuited, the current in the generator rises to 100 amperes, but at the same time the motor current falls to about 30. Therefore, the current in the arc-lamp circuit remains constant at 120 amperes. The current between the brushes B, B_1 will have fallen to about 15 amperes. The current variations under conditions of varying length of arc are clearly shown in the curves of Fig. 4.

When the arc circuit is broken, the field is then unopposed by any demagnetising effect in the armature, and tends to set up a large flux. This would produce a very large current through the brushes B, B_1, were it not limited by the saturation of the pole cores and yoke. It is not necessary that the carbons should be apart when the projector circuit is closed with a view to striking the arc. This precaution has hitherto been necessary owing to the fact that a big rush of current took place when the carbons were brought into contact, and the time during which these remained in contact, had, therefore, to be as small as possible. This end was effected by the striking mechanism of the lamp dawing the carbons apart the moment current passed through them. With this motor-generator such precautions are entirely unnecessary, and, in fact, the opposite method of working is preferable, namely, to keep the carbons closed while the generator is being run up to speed. If it is already running, and the main switch controlling the arc open, it is preferable to bring the carbons into contact before closing the main switch. The arc may then be struck by slowly moving the carbons apart. This method of working enables the carbons to reach their normal working temperature much more quickly than if they were allowed to strike by automatic striking gear. Automatic striking gear is thus unnecessary unless it is desired to switch on the projector from a distance, and the striking of the arc without the use of the automatic gear prevents the flickering which takes place when the cold carbons are brought together in the first instance.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

MOTOR STARTERS, RESISTANCES, &c.—A folder from the British Thomson-Houston Co., Rugby, calls attention to the firm's latest pattern of motor starter, with carefully graded resistances, made up of units, wound with non-rusting wire on fireproof tube encased in cement. Particulars are also given of complete tramcar resistances built up of grids of special design.

ELECTRICITY SUPPLY.—The Marylebone Electricity Department have sent us a copy of a leaflet which they are circulating among consumers calling attention to a statement of Prof. J. A. Fleming in the course of a recent lecture to the effect that with gas at 2s. 10d. per 1,000 cu. ft., and electricity at 1d. per unit, the costs of cooking by gas and by electricity come out about the same. Another circular invites consumers not to hesitate in calling in the aid of the department in cases of irregularity of working of fans, heating appliances, &c.

MOTOR STARTERS AND REGULATORS.—A very complete list of motor starting and controlling apparatus has just been issued by Messrs. Verity's, Ltd. (Hardman Street, Deansgate, Manchester). The patterns dealt with include a new double-arm starter constructed so that the contact arm falls away from the operating arm in the event of overload during starting. Attention may also be drawn to the complete range of shunt regulators for front or back of the switchboard. These have resistances of the enamel type, which can easily be renewed. Three-phase starters are also listed.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRIC TYRE PUMPS AND GAS ENGINES.—A leaflet from the Eclipse Electric Co. (77 St. John's Road, Bootle, Liverpool) describes the "Whipple" electric tyre pump, which consists of a small motor geared to a reciprocating air compressor. Another leaflet from the same firm gives prices of some small gas and oil-engine generating sets.

ARC LAMPS.—We have received from Mr. G. Braulik (8 Lambeth Hill, Queen Victoria Street, London) a leaflet giving prices of the two new flame arc lamps for A.C. and D.C. circuits respectively, which were described in ELECTRICAL ENGINEERING, July 14th, p. 462. Another leaflet gives particulars of the semi-enclosed 30-hour lamp, burning pure carbons. This works with 80 volts across the arc, and thus can be run singly on 100-110-volt circuits.

INSULATORS.—Another illustrated leaflet from Mr. G. Braulik gives prices and particulars of a number of patterns of white porcelain insulators and china wiring accessories.

FITTINGS.—A further leaflet from this firm describes a variety of cast-iron watertight electric-light fittings, including cluster fittings for street lighting, ship's fittings, hand lamps, and some special designs for high candle-power lamps for yards, railway sidings, &c.

PORTABLE AIR COMPRESSORS.—A leaflet from the A. E. G. Electric Co., Ltd., contains an illustration of a compact two-cylinder motor-driven air-cooled compressor, specially adapted for the blowing out of dynamos, motors, and various machinery installed in situations where loose matter may be drawn into the machine, such as in rope factories, flour mills, spinning mills and weaving sheds, cement factories, &c.

ELECTRO-MEDICAL APPARATUS.—Three new illustrated pamphlets have been issued by Messrs. Siemens Bros. & Co. (Caxton House, Westminster, London, S.W.). The first is a booklet produced for the forthcoming British Medical Association Annual Exhibition in London, and contains brief interesting descriptions of X-ray and other electro-medical apparatus, including recording clinical thermometers, light baths, high-frequency apparatus, and ozone generating plant. The second pamphlet is a supplement dealing with X-ray tubes of various patterns, including heavy current tubes for instantaneous radiography, with extra-thick anticathodes and water-cooling and special tubes for radiotherapy or the treatment of skin diseases with X-rays. Regenerators, regulators, and valve tubes are also listed. The third pamphlet gives for the first time a description and prices of the various radium salts, and of the tubes and other devices employed in its uses for medical purposes. The radium is that supplied by the Banque du Radium, Paris, for which Messrs. Siemens Bros. & Co. are the sole agents in this country. The last section of the pamphlet describes the radio-active earths and is based on the latest researches.

ARC LAMPS.—The Union Electric Co., Ltd. (Park Street, Southwark, London, S.E.) have issued a new list relating to the well-known "Excello" flame arc lamps, including special patterns fitted with self-contained automatic cut-outs and compensating resistances, so that if one lamp in a circuit fails the others will continue burning. Some new reflectors and covers are illustrated. Another leaflet gives particulars and prices of the "Kino" cinematograph lamp for currents up to 30 amps. This is a hand-regulated lamp with constant position of the arc, and particularly simple regulation from the back of the lamp.

THREE-PHASE MOTOR STARTERS.—A list dealing with the various patterns of the "Fortiter" three-phase motor starters has been issued by the Union Electric Co., Ltd. (Park Street, Southwark, London, S.E.). Among the new designs illustrated is a compact star-mesh switch for starting motors with short-circuited rotors. These are supplied in two sizes for motors up to 10 and 20 h.p. respectively. Resistance starters for slip-ring motors, with and without oil cooling, and others with water-cooled, oil-immersed resistances are listed, as well as small open-type starters and liquid starters. Auto-compensator starters for motors with short-circuited rotors are also listed.

SMOKE ABATEMENT.—Several leaflets are to hand from Smoke Consumption, Ltd. (120 Fenchurch Street, London, E.C.), who own the Cowper-Coles' patents for smokeless combustion. One leaflet describes the "Caloriser," which consists of a lining of special tiles in the boiler flue immediately behind the fire bridge. These tiles do not abstract the draught, but become incandescent and prevent the plates from reducing the temperature of the gases until complete combustion of all the carbons and hydro-carbons. Another device to reduce the production of smoke is the "Auto-Air Regulator," which automatically admits the varying quantity of air required during the periods between stoking.

BALL BEARINGS.—A catalogue from the Skefko Ball Bearing Co., Ltd. (Carlton House, Lower Regent Street, London, S.W.), gives particulars and standard sizes of the "Skefko" self-aligning ball bearings, the invention of a Swedish engineer, Mr. Sven Wingquist. The construction and application of these bearings are clearly described and illustrated by a number of drawings and photographs. They are claimed to allow of deflection of the shaft without injury and to withstand axial as well as radial loads.

CONTINUOUS-CURRENT MOTORS.—A pamphlet from Messrs. T. W. Broadbent, Ltd. (Victoria Electrical Works, Huddersfield), describes this firm's latest series of encased motors of the protected and ventilated type, in sizes from 2 to 160 b.h.p.

Industries and Commerce of Leeds.—The first issue of a new annual publication, to be known as the "Commercial Year-Book of the Leeds Chamber of Commerce," has been published by Bemrose & Sons, Ltd. It consists of a brief review of the industries and commerce of the city of Leeds, information as to the regulations of Foreign and Colonial Governments in relation to British merchants doing business in their territories, and other information of a commercial nature. Brief particulars are given in subsections of nearly one hundred branches of engineering. In a section on electric power it is stated that the aggregate capacity of the motors connected to the city mains amounts to over 12,000 h.p., while the units sold for power and heating alone during the year ending March 31st, 1909, were over six million, exclusive of the energy for the tramways. Brief reference is also made to the supply of electricity outside the city boundaries by the Yorkshire Electric Power Co., who include a number of municipalities, large works, collieries, textile mills, and a calcium carbide factory, among their consumers. The greater part of the publication consists of a comprehensive trade index of the firms in Leeds and the surrounding district.

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SERIOUS CHARGES CONCERNING THE WEST HAM ELECTRICITY UNDERTAKING

THE action by the Attorney-General, at the relation of certain large ratepayers in West Ham, principally the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., of Silvertown, against the West Ham Corporation, was concluded before Mr. Justice Neville in the Chancery Division on Tuesday. The general charge against the Corporation is that monies have been borrowed in the form of overdrafts from the London County & Westminster Bank in respect of the electricity undertaking for which the sanction of the Local Government Board had not been obtained, and that consequently the interest paid to the Bank, amounting to £14,000, is illegal, and must be repaid. A further charge is made that deficits upon the electricity undertaking have been carried forward from year to year, instead of being met out of the current rate, as provided for by the Acts of Parliament relating to Municipal Government, and also that proper provision has not been made for sinking fund in repayment of previous loans. The action started on Tuesday last week, and has been continued daily since. In our last issue we dealt with Sir Alfred Cripps' opening speech on behalf of the Attorney-General.

On Wednesday, July 13th, Sir Alfred Cripps continued his opening statement and read certain correspondence, which he said demonstrated that the Bank, who are cited as defendants to the action, were fully aware that the Local Government Board had not sanctioned the loans in respect of which they were allowing overdrafts.

On the question of the Consolidated Loans Fund, referred to earlier in the opening statement, Mr. Justice Neville said the real question was whether the loan was authorised. The Corporation had power to borrow from their Consolidated Loans Fund for temporary purposes, and the policy of allowing the quarterly payments to this fund to be set off against the overdraft by the Bank would be legitimate.

Sir Alfred Cripps pointed out that there was an uninvested amount standing to the credit of the Consolidated Loans Fund which ought to have been invested in outside trustee stock. It was in this connection that Mr. Patterson, the West Ham Treasurer, was also cited as defendant, because he was trustee for the ratepayers' money in respect of the repayments, and therefore could not plead the orders of the Corporation in regard to the manner of dealing with the sinking fund. The Attorney-General might have to consider later on whether he should endeavour to make individual persons liable in respect of the interest paid on these illegal loans.

Mr. L. Keen, a chartered accountant, was then called, and spoke to having investigated the books of the Corporation up to the year ending March 31st, 1908, at which period the electricity capital account was overdrawn to the extent of £53,488, and the revenue account to the extent of £43,863. As the plaintiffs' pleadings referred only to the three years to March 31st, 1908, he had been refused access to any of the books since then. He said that the sum of £79,667 standing in the books as "cash in bankers' hands" was really a portion of the Consolidated Loans Fund, which was being set off against the overdrafts.

On Friday, Mr. Danckwerts opened the case for the Corporation, and maintained that the policy pursued was a perfectly legal one. There was no permanent borrowing from the Bank, but merely an arrangement for the Bank to provide the Corporation with funds temporarily. The position in which the Corporation had been placed financially was largely due to the action of the Local Government Board in delaying sanction to loans which had been applied for, and the West Ham Corporation were not alone in spending money by means of overdrafts before actual sanctions were received. This was constantly being done by other Corporations throughout the country. There was no suggestion that the accounts of the Corporation were not in perfect order.

Mr. Patterson, the Borough Treasurer at West Ham, was then called, and said that the Corporation had been compelled to borrow money by means of overdrafts to meet their ordinary debts. At the present time, however, the Corporation's account with the Bank showed a credit of £58,803. The Local Government Board was largely the cause of the present position. In January, 1906, a loan of £218,000 was applied for in respect of the new station at Canning Town, but this was not granted until April, 1908. The loan asked for in 1906 included certain expenditure in respect of the transfer from the old Abbey Mills power station, amounting to £11,058, but the Local Government Board refused to grant this, holding that the amount was really in respect of superseded works which ought to have been met out of the revenue from the Abbey Mills station. This amount had eventually to be made up out of the district rate.

Throughout the case an enormous number of figures have been given on both sides, having nothing to do with the electricity accounts, in direct conflict with each other, and more than once the Judge himself has complained of his inability to follow them. Consequently Mr. Patterson was asked to keep to general principles, as all the details will have to be gone into by an inquiry should the case go against the Corporation. During the case for the defence considerable use was made of the figures relating to the position of the West Ham finances since March 31st, 1908, access to which has been denied to the plaintiffs. Consequently further confusion was caused, and ultimately Mr. Justice Neville said that he would adjourn the case if necessary for the plaintiffs to have access to these later figures.

On Monday Mr. Buckmaster addressed the Court on behalf of the London County & Westminster Bank. His argument was that the Bank only had one account with the Corporation, and lent money on the representation that the Corporation had borrowing powers to the amount required, irrespective of the use to which the Corporation applied the money afterwards. There was no denial that the Corporation had actually, at the time the overdrafts were made good, unexhausted borrowing powers to the extent of £200,000. The suggestion that the Bank were aware of the particular uses to which the Corporation intended to put the money was an impossible one, because the additional entries in the pass-book, which certainly did indicate the directions in which the money had been applied, were made by the Corporation officials themselves after the money was in their hands. The correspondence between the Bank and the Corporation demonstrated that the loans were for temporary puposes pending the floating of a permanent loan when the condition of the money market improved. It was quite true that these temporary loans extended over a long period, but nevertheless they were six-monthly loans renewed from time to time. Further, at the date the action was brought, there was no overdraft from the Bank, but the Corporation's account with the Bank was actually in credit to the extent of £4,800.

In his reply on behalf of the Attorney-General, Sir Alfred Cripps repeated most of the arguments which he made in his opening speech, and asserted that the letters between the Corporation and the Bank clearly indicated that it was the intention of the Corporation to use the monies for their various undertakings, in respect of which they had no borrowing powers. It was a wholly unjustified thing to deal with current expenses by overdrafts, except under very exceptional circumstances, which could not be held to apply in this case, as the use of borrowed money at West Ham had been part of a regular system. In his opinion the Bank really wanted this business, and he quoted the case of another Corporation, who refused to place their account with a Bank who were not ready to grant overdrafts. So long as Banks were allowed to do this without being liable, so long would these irregular methods go on, and it was necessary to stop them. Apparently the only defence the Bank had was that they were granting temporary loans, and not permanent loans. But it was quite clear that the loan was not within the limits of the Corporation borrowing powers in relation to the undertakings for which the money was used, neither was it required for matters requiring immediate settlement.

At this point in Mr. Cripps' speech a short adjournment took place in order to see whether it was not possible for an agreement to be come to with the Bank. The following arrangement was eventually come to on the understanding that proceedings against the Bank were stayed. The Bank is to repay to the Corporation the sum of £7,000 in respect of sums received by them for interest on overdrafts, and also to pay certain costs.

Mr. Morten, K.C., on behalf of the Corporation, asked for an adjournment in order to reconsider their position in consequence of this agreement. He did not know whether the Corporation were in a position to accept repayment of the money, because the arrangement was based upon an assumed illegality.

Mr. Justice Neville thought this point was met by altering the agreement to repay, in such a way that the Bank would be willing to repay the £7,000 on demand.

Sir Alfred Cripps said he did not now think that an inquiry would be necessary, but he asked for declarations from the Court that the payments made in the nature of interest on illegal overdrafts were wrong, and a further declaration stating that the manner in which the Corporation had dealt with their Consolidated Loans Fund was illegal. He further asked for an injunction to restrain the Corporation from paying back the unpaid amounts of the overdrafts, but this point was quickly met by the announcement on behalf of the Corporation, as has already been stated previously, that at the present time no monies are owing to the Bank by the Corporation.

Judgment was reserved.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published July 14th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

11,956/09. **Rotary Converters.** MILES WALKER (British Westinghouse Co.). In order to admit of rocking the brushes over a wide arc without sparking, so as to vary the pressure on the D.C. side, the main poles are divided into two portions by cutting away the pole-face for a short portion of the arc. At this part, where the gap is large, a uniform weak field is obtained, proportional to the load, owing to the effect of the series winding, and this ensures good commutation. The brushes are rocked so that the E.M.F. generated by this flux assists or opposes the main E.M.F. Four claims, six figures.

14,548/09. **Electric Oven.** J. G. CHILDS and T. S. HILL. The oven proper consists of a box of sheet metal with a door provided with a glass window so that the contents of the oven can be inspected without opening it. The box is supported on slabs of heat-insulating material, placed edgewise in an outer casing of wood. This outer casing has a door of special construction to ensure an air-tight joint. Six claims, two figures.

21,021/09. **Wiring System.** J. S. HIGHFIELD (Metropolitan Electric Supply Co.). In wiring systems where the conductors are carried one in each edge of a flat flexible strip of insulating material, difficulty has been experienced in making an angle in the plane of the strip. According to this invention, the strip is bent in its own plane so that the outside wire is curved through the required angle. The inner wire is bent similarly, but projects up from the plane of the strip, and to protect it a hemisphere of metal with slots to fit the strip is screwed over the bend. Two claims, three figures.

21,526/09. **Third-rail Insulator.** A. WATKINS. The circular porcelain body has a central vertical passage for receiving a portion of a wooden liner, which rests on the top of the insulator and forms a cushion for the rail. The rail is fixed to the insulator by clamps bolted to it and formed with hooks engaging with the rail on each side. A metal ring surrounding the conical base of the insulator is gripped to the sleeper by hooked clamps bolted to it. Three claims, four figures.

24,134/09. **Oscillation Generator.** H. MANDERS. This is an oscillation generator for producing sustained oscillations for wireless telegraphy and other purposes. The plane of the discharge is vertical, and the upper electrode is suspended by springs. Its movement is electromagnetically controlled so that automatic regulation of the critical length of the arc is obtained with simultaneous preservation of the parallelism of the discharging surfaces. Eight claims, two figures.

28,732/09. **Brake Blocks.** J. A. PANTON (Liverpool Overhead Railway). This patent covers a construction of brake block of the type in which the wearing shoe is provided with a reinforcing back of tough metal and a key lug for attaching the shoe in its place in the brake head. The lug is anchored upon the back across its full length, and is made thicker than is usual. Cast metal is run round the back and around the base of the lug. The cast block may be worn right down to the backing without the lug coming off. Seven claims, eight figures.

30,093/09. **Prepayment Meter.** C. H. HIBBERD. This comprises any suitable train of gearing driving a disc and controlled by a coin-freed mechanism. An arm rotated about the same axis as the disc by the motor meter moves axially under the influence of a spring and engages the disc. Assuming the meter to be running and no further coin inserted, the arm finally engages the disc and first moves the switch so as to throw in a resistance and dim the lights. After a predetermined time, the switch is caused to cut off the current completely. Five claims, six figures.

12,709/10. **Gun and Turret Control.** H. C. LEAKE. In a system of control for motors employed for rotating turrets and training and elevating guns, some or all of the motors for one or more turrets are connected in series, and are supplied from one constant-current generator. The motors are series-wound or separately excited, and each is controlled by means of a movable brush rocker, by which the torque can be varied from zero to a maximum in either direction. The motors not required at any time are short-circuited. Control can be effected by means of resistances in the fields when the motors are separately excited. Two claims, one figure.

Opposition to Grant of Patents

10,791/09. **Battery Electrolyte.** G. SCHAULI. Opposition has been entered to the grant of this patent. The specification was abstracted in ELECTRICAL ENGINEERING, June 2nd, 1910, p. 364.

17,960/09. **Metal Filament Lamps.** FELTEN & GUILLEAUME LAHMEYER-WERKE A.-G. The grant of this patent is opposed. The specification (abstracted in ELECTRICAL ENGINEERING, May 26th, 1910, p. 346) describes the prevention of disintegration of the filaments by the introduction of phorphorus nitride into the bulb.

18,228/09. **Wall-plug.** J. F. and E. S. CONRADI (British Central Electrical Co.). In consequence of opposition, this patent has been surrendered. The specification was abstracted in ELECTRICAL ENGINEERING, April 28th, 1910, p. 290.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: LESSING [Carbons] 15,647/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: FIELD and FERRANTI, LTD. [Generation and distribution systems] 12,685/09.

Dynamos, Motors, and Transformers: POHL and PHŒNIX DYNAMO MANUFACTURING CO. [Commutator machines] 15,319/09; LEITNER [Train-lighting system] 15,325/09; CROMPTON & CO., MACFARLANE and BURGE [Motor-generators and motor control] 15,494/09; DELON [Production of H.-T. direct current] 847/10; SIEMENS SCHUCKERTWERKE GES. [Polyphase commutator machines] 1,611/10.

Electric Ignition: ROBINSON and KYNOCH, LTD. [Electric blasting fuses] 28,532/09.

Electrometallurgy and Electrochemistry: GRUNWALD [Induction furnace] 14,937/09; LACROIX [Electrolysis] 845/10.

Switchgear, Fuses, and Fittings: BERRY [A.-C. distribution apparatus] 7,121/09; HOWGRAVE-GRAHAM [Switches] 14,833/09; HANSFORD and WRIGHT [Automatic switches] 15,086/09; CLARKE [Lamp-shades] 20,342/09; KINGSBURY (*Weston Electric Co., U.S.A.*) [Automatic sequence switch] 20,840/09; WATERHOUSE [Wiring fittings] 24,770/09; D'OLIER [Lamp-shades] 4,425/10; DOCKING [Pendant fitting] 5,735/10.

Telephony and Telegraphy: POTTS [Telegraphy] 15,167/09 and 8,610/10.

Traction: ADAMS [Trucks] 18,654/09; MUNRO and RAILLESS ELECTRIC TRACTION CO. [Collectors] 22,087/09; FREDERICKS, RUSSEL, WEDDING and CONNELLY [Trolley] 23,504/09; SIEMENS & HALSKE A.-G. [Signalling] 10,087/10.

Miscellaneous: HAILWOOD [Miners' safety lamps] 14,914/09; ELECTROMOTOR EQUIPMENT CO., and MEACOCK [Combined friction clutch and brake] 16,113/09; ROYCE, LTD., and HULLEY [Capstans, cranes, &c.] 22,454/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: W. C. HERAEUS GES. [Mercury-vapour lamps] 1,782/10; PODSZUS [Vapour apparatus] 14,857/10.

Dynamos, &c.: A.-G. BROWN, BOVERI ET CIE. [Driving of machines] 13,502/10; ALLGEMEINE ELEKTRICITÄTS GES. [Machines] 14,024/10 and 14,862-3/10.

Miscellaneous: SIEMENS & HALSKE A.-G. [X-ray apparatus] 13,765/10; MARMION [Alarm-contacts under carpets] 14,742/10; ENGEL [Contact device] 15,150/10.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

16,445 of July 24th, 1896. **Railway Points.** SIEMENS BROS. & CO., LTD. (*Siemens & Halske A.-G.*). This patent covers a method of control for motor-actuated railway points. Two electromagnets are employed, and the control of the actuating motor is separate from the control of the point rails and their connections. The use of a reversing mechanism for the motor, not connected with the points, is also covered.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: E. A. CAROLAN (*General Electric Co., U.S.A.*) [Clutch mechanism] 7,459/03, and [Mechanism for magnetite lamp] 7,662/04.

Distribution Systems, &c.: C. JUNG, A. BRECHER and A. KITTEL [Insulating material] 5,755/00.

Dynamos, &c.: J. JOHNSON (*Elektricitäts A.-G.*) [Flywheel storage system for electric winding] 7,716/03.

Incandescent Lamps: L. SUNDERLAND and G. PILLINGER [Lamp cap] 6,456/05.

Instruments, &c.: H. P. DAVIS and F. CONRAD [Moving coil instrument] 21,810/99.

Storage Batteries: T. PESCATORE and TUDOR ACCUMULATOR CO. [Manufacture of plates] 6,723/01.

Switchgear, &c.: L. BRADLEY and S. ALLEN [Variable resistance] 7,561/03; LAND and SEEKABELWERKE A.-G. [Protective devices] 3,510/05.

Traction: J. ALDWORTH [Bracket for trolley head] 7,625/03; H. PEIPER [Petrol-electric systems] 7,526-7/04.

Miscellaneous: J. W. STOVER [Date and time stamp] 5,731/00; LAMSON PNEUMATIC TUBE CO. and R. JENNEY [Electrically operated despatch apparatus] 6,150/00; I. B. BIRNBAUM and F. BELL [Street fire-alarm] 6,866/05.

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MULTIPLE UNIT SINGLE PHASE TRAINS ON THE NEW YORK, NEW HAVEN AND HARTFORD RAILWAY

THE *Electric Railway Journal* (New York) contains some particulars of the new single-phase multiple-unit cars which have recently been put into service on the New York, New Haven & Hartford Railway. All these cars are constructed without wood; the floors are of cement, and the metal walls are finished to imitate mahogany. Each motor-car weighs about 77 tons, and is designed to haul two trailers each weighing about 44 tons.

The cars are constructed to work either on the 11,000-volt single-phase circuit or on 600 volts direct current, and the electrical equipment of each consists of four Westinghouse 150-h.p. single-phase series motors, which are geared to spring-supported "quills," arranged in a similar way to those of the well-known New York, New Haven & Hartford gearless locomotives. This arrangement was illustrated in ELECTRICAL ENGINEERING, Vol. V., page 10 (January 7th, 1909). The quill encloses the axle, instead of forming the armature shaft (as is the case with the locomotives), and is carried from each wheel by means of four pins in spring pockets in the wheel, surrounded by eccentrically wound helical springs.

Each motor, which has six poles, has a nominal rating of 150 h.p. on the one-hour rating, with forced ventilation, and may be operated continuously at approximately 75 per cent. of its one-hour current rating. The field winding is of the compensated-series type, and the armature is provided with preventive leads. Use is made of partially closed slots in the armature core and an especially rigid commutator construction. The leads have been brought out on the axle side instead of the bolster side of the frame, so that they may be secured without interference from truck parts or brake rigging. The weight of the motor, complete with gears, gear case, axle bearings, and quill, is approximately 7,450 lb., and of the motor only, approximately 5,600 lb. The quill complete weighs about 1,400 lb. The motors are connected four in series, or two in series and two in parallel when working on the direct-current section. On alternating current they are permanently connected two in series and two in parallel. A complete motorman's equipment is placed in both ends of every car, trailers as well as motor-cars, so that the train can be operated with "trailer" cars in front if so desired. A step-down air-blast transformer is placed under the floor at the middle of each motor-car. The air for cooling the transformers and motors and for operating the brakes, whistles, pantograph, and third-rail shoes is supplied by a motor-driven compressor, which is capable of delivering 35 cubic ft. of free air per minute. The overhead current collector is of the pneumatically operated pantograph type, similar in construction to those used on the New Haven locomotives. The upward pressure ranges from 15 to 20 lb., and with the steel contact wire, which is now used on this line, this high pressure does not produce the excessive wear that occurred when a copper contact wire was used. When running, the forward pantograph is usually down, and the rear one up. In this way, in case of any accident to the collector which might drag it off the car, the forward one is still intact, whereas were the forward collector to be torn off it would probably take the rear one with it. In passing from the alternating-current section to the direct-current third-rail system, or *vice versa*, the necessary change of connections is accomplished by an automatic air-operated change-over switch.

During a test run a motor-car with two trailer cars, having a total weight of 371,400 lb., accelerating up to 25 m.p.h., had an average acceleration of 0·5 mile per hour per second.

LOCAL NOTES

BECKENHAM: *"Free Wiring."*—At the last meeting of the Council, Mr. A. H. Dykes called attention to the "free wiring" undertaking of the Council. He said that he was not concerned at the moment as to whether free wiring was paying or not, but wished to call attention to the figures in connection with it. There were 27 consumers, and the average cost per lamp was 23s. 4d., whilst the average receipt for sale of current had gone down to 3s. 9d., whereas some time ago it was 7s. 9½d. per lamp. A good many of the consumers were not paying anything like their proper proportion, and he urged that no "free wiring" should be undertaken unless the consumer paid not only the cost of the wiring, but also a proper proportion of the standing charges. One particular consumer with 10 lamps cost the Council 30s. per light, and the return they got was 15s. 10d. per light. Two other consumers each with 20 lamps produced a return of 4s. 10d. per lamp and 2s. 1d. per lamp respectively. He urged the adoption of some system by which a definite return for each lamp wired was obtained.

BIRMINGHAM: *Halesowen Light Railway.*—The Light Railway Commissioners have decided to grant a new order authorising the Birmingham Corporation to construct the portion of the Halesowen light railways which has, by reason of certain extensions of boundaries, come within the Birmingham Corporation jurisdiction.

CARLISLE: *Electricity Profits.*—After a lengthy discussion the Corporation have decided to allocate £1,000 of the electricity profits to relief of rates; £1,000 to reserve fund; and to carry forward the balance of over £1,000.

CORK: *Overhead Wires.*—At the last quarterly meeting of the Rural District Council, a resolution calling upon the Cork Electric Lighting Co. to remove the overhead wires which they have erected for supplying electricity in the rural district was passed. It was pointed out that the erection of overhead wires is illegal, as under the Company's Provisional Order they are bound to lay underground mains. This resolution, however, does not seem to be decisive, as the matter has been referred to the County Council.

DUNDEE: *Wiring Contractors and the Council.*—The Incorporated Municipal Electrical Association have communicated with the Council, in common with all other municipalities, relative to the proposal made at the Glasgow Convention of the Association in June, that a Bill should be promoted in Parliament giving wiring powers to all municipalities. The Electricity Committee have agreed to support the proposal, and in this connection a discussion took place, in which some objections were taken to the proposition. Mr. H. Richardson, the City Electrical Engineer, expressed his strong opinion that such powers ought to be in the hands of all municipalities, if only for the moral effect. Personally, he was quite in favour of the contractors doing the work, and did not wish to set up a department for this purpose, but hitherto contractors had adopted the policy of picking and choosing, and if municipal electricity departments left the canvassing to the contractors they would not move ahead at all. A little while ago at Dundee the Electricity Department slackened off in its canvassing, and their business went down immediately. He had found that over 90 per cent. of the extra business obtained in Dundee, even although the contractors supplied it, was canvassed for by the Department's men, and the specifications were actually prepared by the Department.

EDINBURGH: *Proposed Electric Tramways.*—A proposal has been placed before the Town Council by a London company for the construction of a network of electric tramways in Edinburgh.

JAPAN: *Electric Tramways.*—The British Acting Consul at Tamsui reports that applications have been addressed to the Formosan Government by three rival groups of company promoters for a concession for the construction of electric tramways in Taihoku, where there is a population of 84,000. The names of the applicants are on file at 73 Basinghall Street, London.

KIRKCALDY: *Electric Lighting and Tramways Accounts.*—There was a net profit of £700 on the Electricity Department last year, and £44 on the tramways.

LEICESTER: *Management of Electricity Undertaking.*—The Electric Lighting Committee have retained Mr. James Swinburne to advise them in connection with the proposal to amalgamate under one control the electric lighting station and the tramways power station.

[illegible]: *London County Council: Invention by an Official.*—Mr. A. Champion, an assistant in the Electrical and Highways Branch of the Chief Engineer's Department, has been granted permission to patent an invention in connection with the construction of electric junction boxes for the prevention of gas and water accumulation therein, on the condition that the Council be allowed to use the patent without payment.

New Tramway Proposals.—The Highways Committee recommend application being made to Parliament next session for new tramways in various parts of London, aggregating twenty-two miles of single track, at an estimated cost of £462,470. With the exception of one line, from Marble Arch to Cricklewood, which will be a combination of overhead and conduit, the remaining eight lines are on the conduit system. The figure given of estimated cost is exclusive of cars, car sheds, sub-stations, &c.

Bermondsey: Electricity Accounts.—Reporting upon the small net profit of £43 on the electricity undertaking last year, the Finance Committee state that the result is partly due to the very low price at which energy is now being sold, and they

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think the Council should be very careful as to how the undertaking is managed in the future.

Hackney: Heating and Cooking.—To stimulate the demand for heating and cooking, the charge for energy for all domestic purposes, except lighting, is to be fixed at 1d. per unit. A modified "telephone" system of charging is also to be introduced.

Hampstead: Street Lighting.—The Lighting Committee have been authorised to convert a further 802 gas lamps to incandescent electric lamps.

Marylebone: Wiring Work. The electricity accounts for the past year show a net profit of £8,482, against a loss in the previous year of £930. The number of units sold was 10,776,459, an increase of 1,775,598. This is partly due to the public lighting extension scheme, but chiefly to some very important additions to the consumers' roll, assisted by the more active policy which has been initiated in obtaining new business. The average revenue per unit was 3·8d., compared with 4·13d. in the previous year, and the cost per unit sold amounted to ·961d., compared with 1·19d. in the previous year. The revenue from the Sales Department was £6,666, whilst the expenditure was £7,851. These figures, however, do not represent a complete year. It is pointed out that the Department has the benefit of fifteen outdoor representatives for the same net expenditure as the original staff of five. The report points out that it is no part of the policy of the Sales Department to take from private contractors work which would have been carried out by them. On the contrary, many instances have occurred where, while the preliminary work and expense of advising, estimating, and planning for new installations or extensions has been done freely by their staff, the order has been given to a private contractor. In other cases they have been withdrawn as soon as it has been found that a contractor was already dealing effectively with the work in hand. The sum of £6,168 of the balance has been used in connection with the public street lighting scheme.

Poplar: Electricity Accounts.—The accounts of the Electricity Department for the past year show a net profit of £4,426, compared with £3,381 in the previous year. The report of the Borough Electrical Engineer points out that negotiations are being carried on for a supply in bulk from the Stepney Council, which will save capital expenditure in anticipation of increasing demands.

Stepney: Electricity Accounts.—The accounts of the Electricity Department for the year to March 31st show a gross profit of £20,816, and after meeting capital charges there is a net profit of £1,515. The net revenue was £52,266, compared with £46,934 in the previous year. The average income per unit is the lowest in London, namely, 1·458d. Mr. W. C. P. Tapper, the Borough Electrical Engineer, calculates that had they received per unit an amount equal to the average price received by all other Metropolitan Supply Authorities and Companies—according to the latest available figures, 2·49d.—the net profit at Stepney would have been £35,954.

MACCLESFIELD: *Electricity Supply.*—The Council have received two letters giving notice of proposed applications to the Board of Trade for Electric Lighting Provisional Orders for the district.

PENZANCE: *Electric Supply.*—The Penzance District & Electric Supply Co. have informed the Council that a bulk supply of electricity will be available from the Cornwall Electric Power Co. before the end of the year. In this connection the Power Company have applied to the Board of Trade for consent to erect certain overhead electric mains from their power station which they are erecting at Hayle.

PRESTON: *Tramways to Chorley.*—The Anglo-Continental Industries, Ltd., have put forward a proposal for constructing a tramway between Chorley, Horwich, and Preston. The lines proposed aggregate twenty-three miles of track, and will touch a population of 100,000. The estimated cost will be about £300,000. Some years ago a Company received Parliamentary powers to construct lines between these towns, but the powers lapsed.

RUSSIA: *Tramways.*—The Belgian Company which controls the electric lighting and tramways in Sebastopol has recently obtained a concession for the construction of an electric tramway at Symphcropol, the chief town of the Crimea.

SHEFFIELD: *Electricity Accounts.*—At the last meeting of the Council, the electric lighting accounts were discussed, several members taking objection to the charges made for electrical energy. Alderman Bennett, who introduced the accounts, said that but for the set back caused by the use of metal filament lamps, there would have been a profit of £4,880, instead of a deficiency of over £2,000. Other speakers pointed to the fact that the condition of the undertaking had been severely handicapped by the high price of £168,754 which had been paid for the original Company in Sheffield. The Chairman of the Committee promised an opportunity for a full discussion with reference to the charges at an early date.

SOUTH SHIELDS: *Electricity Accounts.*—After meeting capital charges, the electricity accounts for the past year show a deficit of £209, compared with a surplus of £1,209 in the previous year.

TASMANIA: *Launceston Tramways.*—The Council have taken up a loan with the Commercial Bank of Tasmania for £50,000 at 4 per cent., repayable in thirty years.

TAUNTON: *Electricity Accounts.*—The accounts of the Electricity Department for the past year show a gross profit of £3,941, and a deficit, after meeting capital charges, of over £400.

WALSALL: *Supply in Bulk.*—The Electricity Committee have considered the offer of a power company to supply the Corporation with electricity in bulk, but recommend that it should not be entertained.

WEST HARTLEPOOL: *Purchase of Tramways.*—The Hartlepool Tramways Co. are asking £22,000 for their undertaking, but as this is far beyond the figure which the Corporation are willing to offer, arbitration proceedings must be taken.

WHITLEY: *Tramways.*—The Whitley and Monkseaton Council have appointed a Committee to meet representatives of the Blyth Council with a view to the construction of electric tramways between the two towns.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

BECKENHAM.—Loans of £5,000 for mains and services, and £1,000 for meters, are to be applied for.

BELFAST.—The Harbour Commissioners require 3¼ miles of 7/18 H.T. cable for 3,000 volts C.C., and ½ mile of 7/18 rubber-insulated cable. Particulars from the Harbour Engineer, and tenders by July 27th.

DOVER.—The Electricity Committee have decided to lay a cable for furnishing power to the Harbour Board and the Admiralty Pier at an estimated cost of £525.

DUBLIN.—The South Dublin Board of Guardians having been granted permission to borrow £3,000 in respect of the electric lighting of the Workhouse buildings, applied to the Board of Public Works for a loan. Owing to the high rates in the Dublin area, the Board have refused to make a loan, and consequently the Guardians propose to advertise for offers.

DUNDALK.—Mr. A. P. Trotter, the Electrical Adviser to the Board of Trade, held an enquiry last week to consider the objections to the Dundalk Electric Lighting Provisional order. The chief objections to the scheme were in respect of overhead wires.

ECCLES.—The Local Government Board have sanctioned a loan of £3,234 for electrical purposes.

INDIA.—The Lahore Municipality are contemplating an electrical installation, and the Government are to be asked for a donation in connection with it.

LONDON: *Battersea.*—Cable extensions are to be carried out at an estimated cost of £1,061.

The Finance Committee of the L.C.C. recommend sanction to a loan of £9,905 for electrical extensions.

Hackney.—Switchboard extensions, at an estimated cost of £900, are to be carried out.

SOUTH AFRICA.—Large extensions of the generating plant are necessary at the Johannesburg Municipal Electricity Works.

WALSALL.—Extensions at the generating station are to be carried out at an estimated cost of £23,225. Of this £16,425 are for extensions to generating plant, and the remainder for mains.

WHITEHAVEN.—An enquiry was held last week concerning a loan of £5,293 for electrical extensions. Of this £2,993 are for plant extensions, and £2,300 for mains. During the enquiry Mr. H. R. Hooper, the Local Government Board Inspector, remarked that the estimates seemed to be more than double what they ought to be, and he made certain suggestions in this connection. He also urged upon the Council the necessity for "pushing" the undertaking.

WIMBLEDON.—The Council have received the sanction of the Local Government Board to borrow the following amounts: £3,400 for mains, £1,600 for house services, and £1,600 for meters.

WOLVERHAMPTON.—The following additions are to be made at the power house. Water softening plant (£400); renewal of economisers (£600); pump house and storage tank (£450).

Miscellaneous

BELFAST.—A scheme of tramway extensions, at an estimated cost of £132,350, has been adopted by the Corporation.

INDIA.—The Secretary of State for India requires electrically-driven water-supply pumps. Particulars from the Director-General of Stores, India Office, Whitehall, London, S.W., and tenders by August 3rd.

LONDON: *London County Council.*—The Council require 4,800 steel tyres for driving wheels, and 1,600 steel tyres for pony wheels for electric tramcars. Particulars from the Chief Engineer, and tenders by July 26th.

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Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

S.E.—Cinematograph hall, St. James Road, Bermondsey. H. E. Barley, 38 Lime Street, E.C.

E.—Mill, warehouse, &c., Cairn Mills, Silvertown. Architect, Bruce Dawson, 6 Old Queen Street, S.W.

E.C.—Proposed extensive alterations to Guildhall, E.C. F. Sumner, Engineer and Surveyor, Guildhall, E.C.

N.—Cookery depôt (£2,921), Tottenham. Surveyor, Education Committee, Tottenham.

W.C.—Theatre, Shaftesbury Avenue, W.C. Architect, B. Crewe, 75 Shaftesbury Avenue, W.C.

PROVINCES.

AIRDRIE.—Town hall (£10,000). Burgh Surveyor.

AYR.—Club premises, shops, and workrooms, Sandgate and Boswell Park (£4,000). G. S. Abbott, Braemar, Ayr.

BANGOR.—St. Paul's Schools. T. Gill, Surveyor, Bangor.

BIRMINGHAM.—Consumptive hospital. Sir Hallewell Rogers, Chairman, Board of Delegates, Birmingham Hospital Saturday Fund.

BURTON-ON-TRENT.—Theatre. Thos. Jenkins, Architect, Burton.

DARTFORD.—Workrooms, Darenth Asylum (£5,198). Architect, T. W. Aldwinckle, 20 Denman Street, W.

DERBY.—County buildings (£22,000). County Surveyor.

DUMFRIES.—It has been decided to light the Academy by electricity. The Dumfries School Board have the matter in hand.

EDLINGTON.—School (£12,000). W. V. Dixon, Secretary, Education Committee, West Riding C.C., Wakefield.

GLASGOW.—Electric theatre, Bridgeton Cross (£4,000). Architect, G. A. Boswell, 53 Bothwell Street, Glasgow.

Co-operative buildings (£15,000). Architects, Bruce & Hay, 261 West George Street, Glasgow.

KEIGHLEY.—Villa (£1,100). Architect, D. W. Weatherhead, Law Street, Keighley.

KING'S LYNN.—Conservative club. Architect, H. Tilson, Paradise Parade.

LEITH.—Extensions, Messrs. Cochrane's factory (£2,250). Architect, R. S. Henderson, 20 Leith Walk.

MEADOW BANK.—School (£2,400). Architect, c/o Winsford & Middlewich Education Sub-Committee.

MERTHYR.—Extensions, hospital (£3,000). D. & J. Jenkins, builders, Penydorren.

Conversion of Cyfarthfa Castle into school (£16,200). Jones Bros., builders, Treharris.

NEWPORT (MON.).—School (£10,000). C. Ward, Town Hall, Newport.

ROCHDALE.—Alterations and extensions, Town Hall (£2.075). S. S. Platt, Borough Surveyor.

SOUTH SHIELDS.—Co-operative store (£1,430). J. E. Stout, architect, Commercial Chambers, South Shields.

TUNBRIDGE WELLS.—Fire station, Calverley Parade Mews. W. H. Maxwell, Borough Surveyor.

WEDNESBURY.—Theatre. Architects, Bishop & Grundy, Wednesbury.

TENDERS RECEIVED AND ACCEPTED

CARLISLE.—The tender of Messrs. Pratchett Bros., of Carlisle, at £652, has been accepted for pipe-work at the generating station.

CROYDON.—The Corporation have accepted the tender of Messrs. Johnson & Phillips, Ltd., at £349, for the electric lighting of the extensions to the Borough Hospital. There were 26 tenders varying from that accepted to £784 12s. 3d.

LONDON: *London County Council.*—Tenders have been received for 250 electric cars of the bogey truck double-deck type, fitted with roof covers and draught screens. For the car bodies, the tender of the Brush Electrical Engineering Co., Ltd., amounting to £94,375, is recommended for acceptance; for the trucks, that of Messrs. Heenan & Froude, Ltd., at £28,750; and for the electrical equipments, that of the British Westinghouse Co. at £83,812 10s. Messrs. Dick, Kerr & Co., Ltd., and the British Thomson-Houston Co., Ltd., also tendered for electrical equipments, their prices being £85,000 and £86,187 10s. respectively. Messrs. Dick, Kerr & Co. proposed to supply interpole motors. The Committee point out that the controller fingers in this tender were not quite to specification, and the schedules of rates of pay and hours of labour were not filled in. The tender of the Westinghouse Co. is also recommended for acceptance for 250 sets of magnetic brake equipments at £14,250. Under these contracts the cost of each car will amount to £683 15s., against £884 15s. under the contracts in 1909.

The following tenders have been received for the supply of low-tension cables, cable boxes, &c., in connection with the wiring for power purposes of the second section of the Central Car Repair Depôt:—Western Electric Co., Ltd. (recommended), £948 14s.; Johnson & Phillips, Ltd., £979 12s.; W. T. Glover & Co., Ltd., £1,004; Siemens Bros. & Co., Ltd., £1,011 12s.; W. T. Henley's Telegraph Works Co., Ltd., £1,016; British Insulated & Helsby Cables, Ltd., £1,053; Callender's Cable & Construction Co., Ltd., £1,053.

Hackney.—The present contract with the British Insulated & Helsby Cables, Ltd., for cables, is to be extended to include new mains at an estimated cost of £18,384.

Hammersmith.—The Electricity Committee have accepted the tender of Ferranti, Ltd., at £3, for all sizes of prepayment meters for 110 and 220 volt. For the supply of one 200-kw. transformer, the tender of the British Electric Transformer Co. has been accepted at £159.

LOWESTOFT.—The Council have accepted the tender of the Standard Cable Co. at £326 for a supply of cable. Two years guarantee is given.

NEWPORT (MON.).—The tender of the General Electric Co. at £3,063 has been accepted for extensions to the switchgear. The tender of Messrs. Balcke & Co. at £681 has been accepted for a cooling tower, that of Messrs. Babcock & Wilcox for fixing superheaters to six boilers at £915, and the Albion Clay Co. for four-way ducts for electric cables at 3s. 11½d. per yard, less 2½ per cent.

STRETFORD.—The District Council have accepted the following tenders for the electricity undertaking:—British Westinghouse Co., Ltd.; three-wire booster, £832, and safety attachment, £51; Worthington Pump Co., Ltd.: condensing plant, £1,180; James Hodgkinson (Salford), Ltd.: one pair patent coking stokers, £132 10s.; E. Green & Sons, Ltd.: additional economiser tubes, £110.

TASMANIA.—The Launceston Council have accepted the following tenders:—Car-sheds and offices, Messrs. J. & T. Gunn, Ltd., £2,989; trucks, Brush Electrical Engineering Co., Ltd., £1,122; motor equipments, Australian General Electric Co., Ltd., £3,206. The Council have also accepted the tender of Messrs. Hinman & Wright, at £937, for alterations to the sub-station in Cameron Street.

WEST HAM.—The Council have accepted the following tenders for the electric lighting of certain schools: Clarkson Street, Newbald & Co. (Stannos system), £153 10s.; Denmark Street, Weston & Sons, Ltd. (Simplex system), £136 11s.; Hallsville, ditto, £115 13s.

The following tenders have been accepted by the Government Departments named:—Admiralty: Batteries, boxes, &c., Atlas Carbon Co., Ltd., India Rubber, &c., Co., Ltd., Siemens Bros. & Co., Ltd.; indicators, Elliott Bros.; switches, Thames Ironworks Co., Ltd. War Office: Electric cable and wire, &c., Callender's Cable & Construction Co., Ltd., Hooper's Telegraph and India Rubber Works, Ltd., W. Rickard, Ltd.; testing dynamos, Laurence, Scott & Co., Ltd. India Office: Cables, India Rubber, &c., Co.; insulators, Bullers, Ltd. General Post Office: Telegraph apparatus, Brown & Murray, Ltd.; telephonic apparatus, Peel-Conner Telephone Works, Ltd., Western Electric Co., Ltd., British L. M. Ericsson Manufacturing Co., Ltd.; zinc battery plates, Siemens Bros. & Co., Ltd.; paper core cable, British Insulated and Helsby Cables, Ltd., Henley's Telegraph Works, Co., Ltd., Johnson & Phillips, Ltd., Western Electric Co., Ltd.; electrically driven air-compressing plant at G.P.O. (West), London, E.C., Alley & MacLellan, Ltd.; electric lighting of extension of Bristol head post office, Alexander Hawkins & Sons; installation of local telephone exchange equipment at telephone exchange, Monserrat Road, Putney, S.W., Western Electric Co., Ltd., L. Shaw. Commissioners of Public Works, Ireland: Electrical equipment of the New Royal College of Science, Dublin, V. G. Middleton.

The D. P. Battery Company, Ltd., call attention to the present low prices of batteries, due to the depreciated market values of lead. Amongst many other orders this firm are now installing a second large battery at Letchworth for the First Garden City, Ltd., and have recently supplied three light and power batteries to the Midland Railway Co., the Melbourne Electric Light & Power Co., and the Blackpool Co-operative Society. They are also shipping five batteries for India, China, New Zealand, and the Argentine, and have even been able to ship to the United States, in spite of the tariff.

Railway Signals and Tramways.—The Highways Committee of the L.C.C. report that complaints have been received from the engineer to the London, Brighton & South Coast Railway of interference with that company's signalling apparatus at Tulse Hill station, and other stations in the neighbourhood by the working of the Council's tramways between Loughborough Junction and Norwood. These lines are worked on the overhead trolley system. The railway company's engineer intimated that he proposed to duplicate the signal wires affected at the cost of the County Council. As a result of a conference between the parties, however, Professor Gisbert Kapp has been appointed arbitrator to settle the point in dispute.

OSRAM·LAMPS

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 5s. to £56 15s. per ton (last week, £56 5s. to £56 15s.).

AGENCY.—Messrs. W. F. Dennis and Co. (49 Queen Victoria Street) have been appointed sole agents in the United Kingdom for the Karlsbaden Kaolin Industrie Gesellschaft, Merkelsgrün, Austria, makers of porcelain insulators, &c.

TURBO PUMPS.—Messrs. Willans & Robinson, Ltd., ask that all inquiries for their "Victoria" turbine pumps should be addressed to Victoria Works. We understand that some 20 of these new pumps have already been delivered, varying from 150 up to 9,400 gallons per minute capacity, for heads from 35 to 535 ft.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—A receiver has been appointed to the Witney Electric Supply Co., Ltd., on the motion of a debenture-holder. A receiver was applied for owing to the interest on debentures not having been paid.

A meeting of the Britannia Electric Lamp Works (1905), Ltd., will be held on August 9th, at 11 a.m., at Broad Street House, New Broad Street, London, E.C., to hear the liquidator's account of the winding-up.

F. Sheppard, electrician, 4 Haslett Road, Kensington, London, has been adjudicated bankrupt. The public examination will be held on August 16th at Bankruptcy Buildings, London, at 11 a.m.

A meeting of the Alliance Electrical Co., Ltd., will be held at 23 Grafton Street, London, W., to-morrow (Friday), at 11 a.m., for the purpose of arranging a reconstruction. This is merely a voluntary liquidation for rearrangement of capital, and all the creditors will be paid in the ordinary course.

TRADE WITH GREECE.—The 20 per cent. import duty on electrical machinery has been dropped, and imports of this nature are now free of duty.

AWARD AT THE JAPAN-BRITISH EXHIBITION.—In addition to the awards in the Electrical Engineering Section mentioned in our issue of last week, we learn that Messrs. Hans Renold, Ltd., have been awarded a gold medal for their exhibit of steel driving chains.

HOLIDAYS.—Messrs. Mawdsley's Ltd., Dursley, Gloucestershire, ask us to state that their works will be closed from Friday, 29th inst., till Monday, August 8th.

OSRAM LAMPS.—In view of the fact that in a number of cases the brass caps of high candle-power lamps used for street lighting have corroded away before the filaments have failed, the General Electric Co. have decided in future to supply the high candle-power Osram lamps with plated copper caps instead of brass.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. H. Rider, Chief Electrical Engineer to the L.C.C., has resigned, having accepted an important appointment in South Africa. Mr. Rider's resignation will take effect from August 31st, 1910. We understand that Mr. Rider's new appointment is that of Chief Electrical Engineer to an important group of mines on the Rand.

Mr. Walter H. Derriman has entered into partnership with Messrs. Dicker & Pollak, Chartered Patent Agents, of 37 Furnival Street, Holborn, E.C., and, in consequence, the name of the firm has been changed to Dicker, Pollak & Derriman. Mr. Derriman is personally taking charge of the electrical business of the firm.

Mr. G. F. Craven, Assistant Engineer of the Reading Corporation Tramways, has had his salary increased from £160 per annum to £180 per annum, to rise by two further annual increments of £10 each to £200 per annum.

The Birmingham Electricity Committee have unanimously decided to recommend the City Council to appoint Mr. Howard Foulds to the position of Secretary of the Electric Supply Department. For the past sixteen years Mr. Foulds has held the position of Secretary to the Electrical Standardising, Testing, and Training Institution, Faraday House, London. Three hundred and twenty-two applications were received for the post, and the following were selected for the short list: Mr. Howard Foulds, secretary of the Faraday Electrical Institute, London; Mr. W. E. Foden, assistant secretary of the Electricity Department, Manchester; Mr. W. T. Green, chief clerk of the Leeds Electric Supply Department; and Mr. E. J. Jennings, secretary to the St. Marylebone Electrical Supply Department. The salary attached to the new post is £600 per annum.

The Marylebone Electricity Committee report that they consider it is all important to secure continuity of management in the Electricity Department during the next four years, and they therefore propose that the Council should enter into agreements with certain officers in the Department. The details of the agreements proposed are as follows:—(1) Mr. A. H. Seabrook, general manager; present salary, £800; proposed salary from July 1st, 1910, £850, rising by £50 per annum to £1,000, plus 2 per cent. on profits up to £10,000 and 3 per cent. on the profits beyond. (2) Mr. Jennings (secretary and accountant); present salary, £400; proposed salary from July 1st, 1910, £425, rising by £25 per annum to £500, plus 1 per cent. on profits up to £10,000 and 1½ per cent. on the profits beyond. (3) Mr. Richardson (station superintendent), Mr. Smyth (main superintendent), and Mr. Holmes (sales manager) each receive £400 per annum at present, and it is proposed to increase this in each case by four annual increments of £25 to £500, with 1 per cent. on profits up to £10,000, and 1½ per cent. on the profits beyond.

Mr. G. D. Vickers, of Birmingham, has been appointed Assistant Electrical Engineer to the Watford Council.

The Electricity Committee of Burton-on-Trent Corporation has decided to increase the salary of Mr. T. Hall, Assistant Manager of the Electricity Department, from £160 to £170 per annum.

MISCELLANEOUS CITY NOTES

CENTRAL LONDON RAILWAY CO.—It is proposed to raise £500,000 new 4½ per cent. preference stock. Additional borrowing powers to the extent of £160,000 are also contemplated.

DIVIDENDS ANNOUNCED.—Bournemouth & Poole Electricity Supply Co., interim dividend on the ordinary shares for the June half-year at the rate of 5 per cent. per annum, less tax.—Lisbon Electric Tramways, interim dividend of 3 per cent. on the ordinary shares.—British Columbia Electric Railway Co., half-yearly dividend on the 5 per cent. non-cumulative preferred ordinary stock, together with an additional dividend of 1 per cent.—Anglo-American Telegraph Co., 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock for the June quarter.—County of London Electric Supply Co., half-yearly dividend on the ordinary shares at the rate of 4 per cent. per annum less tax.—Newcastle-upon-Tyne Electric Supply Co., interim dividend of 1¼ per cent. on the ordinary shares less tax.—Metropolitan Railway Co., half-yearly dividend on the ordinary shares at the rate of 1¼ per cent. per annum.

MORTGAGES AND CHARGES.—Particulars of the following have been registered:—Johnson-Lundell Electric Traction Co. Satisfaction in full of mortgage, dated 5th April, 1906, in respect of which £4,070 14s. 6d. was outstanding on 1st July, 1908. —Sunbeam Lamp Co. Issue on 30th June of £6,250 debentures, part of a series of which particulars have already been filed.—Telegraph and Telephone Instruments. Particulars of £600 debentures, created 20th June, 1910, the amount of the present issue being £500. Property charged. The company's undertaking and property, present and future. No trustees.

COMPANIES' MEETINGS AND REPORTS

CITY & SOUTH LONDON RAILWAY CO.—The accounts for the June half-year show a net profit of £47,332, including the balance brought forward. After making provision for debenture stock interest, rent charge, and transferring £1,500 to renewals fund, a full dividend of 5 per cent. per annum is paid upon the preference shares, and 1¼ per cent. upon the ordinary stock for the half-year, carrying forward £1,654.

TRAFFORD POWER & LIGHT SUPPLY CO.—There was a loss of £417 on the past year's working after meeting debenture and loan interest.

ELECTRIC CONSTRUCTION CO.—At the annual meeting on Thursday, Mr. W. S. B. McLaren, M.P., the chairman, said that the present improvement in trade justified their expecting a large demand for electrical machinery during the coming year. He congratulated the shareholders upon the strong financial position of the company, as they had no loans of any kind, and their realisable assets were many times greater than their current liabilities. Moreover, they had been able to redeem on favourable terms £40,000 second mortgage debenture stock.

EDMUNDSONS' ELECTRICITY CORPORATION.—Satisfaction was expressed at the annual meeting on Thursday at the marked and all-round progress of the past year. The carry forward of £25,577 is to be added to the general revenue until 1912, when, according to the trust deed, dividends may be resumed. In the meantime, said Mr. P. D. Tuckett, the chairman, the Board will probably come before the shareholders with a scheme for the reduction of capital which will involve wiping out all special reserves.

NATIONAL TELEWRITER CO.—The first annual general meeting was held on Monday. Sir William Treloar, who presided, said that the results of the first year's working were disappointing, but this had been mainly due to difficulties encountered with regard to the delivery of the instruments. They had now obtained orders for over a hundred instruments, and in addition, trials were being made with the instruments by railway companies, hotels, and others. They now looked forward with confidence to extending their business in the provinces, and in this connection they had appointed agents in the principal provincial centres. They contemplated the early opening of an exchange in the West End of London, and there were indications that the result of the present year's working would be much more satisfactory.

GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE.—At the statutory meeting last week Sir J. Clifton Robinson, who presided, said that works had been erected at Pilning, on the Bristol Channel, and he believed that not

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many weeks would pass before it would be possible to give the shareholders some gratifying information.

VICTORIA FALLS & TRANSVAAL POWER CO.—The Marquis of Winchester presided at the annual general meeting on Friday. Dealing with the Transvaal Power Bill, he mentioned that the action of the Company in securing the services of Mr. Vesey Knox, K.C., who visited South Africa accompanied by Mr. A. E. Hadley, the Managing Director, and Mr. Arthur Wright, Electrical Engineer, had resulted in certain amendments to the proposed Act of Parliament, which had the effect of removing any provisions which were calculated to hamper the carrying on of their business. With regard to the supply of electric power, application has been made to the Transvaal Government for the erection of a new station at Vereeniging, and this would undoubtedly add facilities for establishing new industries. Having mentioned that the fullest advantage of the Company's plant could not yet be obtained owing to many important works having to be completed, the Marquis of Winchester mentioned, as an example of the advantage of using electric power in mines, certain figures relating to the City Deep Mines. The use of electric power here had resulted in savings in works cost ranging from 6d. to 1s. per ton crushed, the figures being 14·2d. for electricity and 24·7d. with steam. Sir Charles Metcalf said he had just visited the works of the Company in the Transvaal, and they could congratulate themselves upon them. The deliveries of the A.E.G. had been up-to-date, with the exception of the switchgear, which was delayed owing to a strike at the factory. He anticipated that by the end of next year the sales would be three times what they were to-day.

NATIONAL TELEPHONE CO.—The net profit for the June half-year, after meeting Post Office royalties amounting to £161,530, is £541,300, against £509,210 in the corresponding period of last year. The following dividends are recommended: at the rate of 6 per cent. on the first and second preference shares, 5 per cent. on the third preference shares, 6 per cent. on the preferred stock, and 6 per cent. on the deferred stock, less tax in each case. It is proposed to transfer £175,000 to reserve, and to carry forward £15,344.

MEXICO TRAMWAYS CO.—The net revenue in gold for 1909 was $922,458. After meeting four quarterly dividends at the rate of 6 per cent. per annum, $300,000 have been added to reserve, and $416,344 carried forward. The company acquired during 1909 a controlling interest in the Mexican Light & Power Co.

MEXICAN LIGHT & POWER CO.—The net revenue for 1909 was $2,426,811. From this the dividend on the 7 per cent. preference shares has been paid, and after paying 4 per cent. on the common stock, $149,386 are carried forward. When the works at the Tenango dam have been completed, the company will have a plant of 100,000 h.p. The carrying capacity of the high-voltage transmission lines has been increased to 100,000 h.p.

GENERAL ELECTRIC CO.—The annual general meeting was held on Tuesday under the Chairmanship of Mr. G. Byng. After referring to the low quotation on the Stock Exchange of their preference shares, which, he said, was the result of the action of certain outside brokers, the Chairman expressed satisfaction that at last the British Post Office had seen their way to encourage them in the manufacture of telephone apparatus. After being subjected to deep-rooted prejudice for many years, they had received an order for one of the most important telephone exchanges in the kingdom, and they had also nearly completed the installation of another Post Office exchange. Telephone apparatus was also being sold by the company in Australia and India, and, curiously enough, the prices which the British Post Office were now paying were lower by some 30 per cent. than the prices previously paid for foreign instruments. They were keeping the flag flying over their carbon works, although they were not showing a profit in face of foreign competition. They had been greatly encouraged by the policy now pursued by the Admiralty, but there was much to complain of in the action of many municipalities, who sent ratepayers' money abroad while many workers here were unemployed, and whilst it was a matter of almost national importance that the only carbon works in this country should be kept going. With regard to metal filament lamps, he regretted that their patent rights had been greatly infringed, and they had been compelled to take legal proceedings both on the master patent and upon minor patents. In conclusion, Mr. Byng pleaded for reform in our fiscal system, and urged the further extension of preferential duties with the Colonies.

NEW COMPANIES

NEW ELECTRICITY COMPANY OF MACCLESFIELD.—Capital £5,000 in £1 shares. To supply electricity in Macclesfield.

ACTON LAMP CO.—Registered by Burgess, Cosens & Co., 5 Laurence Pountney Hill, London, E.C. Capital £8,000 in 5,000 "A" and 3,000 "B" shares of £1 each. Manufacturers of and dealers in electric lamps, electrical apparatus, &c.

UITENHAGE ELECTRIC LIGHT & POWER CO.—71 Queen Victoria Street, London. Capital £15,000 in £5 shares. To take over from the General Electric Co., Ltd., a concession for the supply of electricity in Uitenhage, Cape Colony. The subscribers include Mr. Hugo Hirst, and Mr. A. I. S. Baron, of the General Electric Co., London, who are also on the Board.

ELECTRO-METALS, 22 College Hill, London, E.C. Capital £30,000 in 4,000 £5 shares and 10,000 £1 shares. Electrical engineers, metallurgists, &c. To adopt an agreement with Messrs. Jens Orten-Boving & Co.

NOKES & CANNON, Canning Street, Leicester. Capital £2,000. To acquire the business of electrical and mechanical engineers, carried on at the above address as "Clerk & Nokes."

WELDINGS, 80½ Lionel Street, Birmingham. Capital £1,500. Electrical, mechanical and civil engineers, and contractors, welders, manufacturers of electrical and other machinery and accessories, &c.

RIO DE JANEIRO SUBURBAN TRAMWAYS, 7 and 8 Poultry, London, E.C. Capital £1,000. To take over concessions for the construction of tramways and light railways in or near Rio de Janeiro.

OUDTSHOORN ELECTRIC LIGHT & POWER CO., 71 Queen Victoria Street, London. Capital, £15,000 in £5 shares. To supply electricity in Oudtshoorn, and to acquire a concession granted by the Council to General Electric Co., Ltd. Mr. H. Hirst and Mr. A. I. S. Baron, of the General Electric Co., Ltd., are on the Board.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Electric Trains," by H. M. Hobart. (London: Harper & Bros.) 6s. net; by post in U.K., 6s. 4d.; abroad, 6s. 6d.

"Nightshade," by Paul Gwynne. (London: Constable & Co.) 6s.

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WIRING CONTRACTORS. See page iv

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ELECTRICAL ENGINEERING

No. 187 [Vol. VI., No. 30] THURSDAY, JULY 28, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

Official Notices and Technical College Announcements are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

The London United Tramways Bill, relating to the tramways across Kew Bridge, which has already passed the House of Lords, was read a third time in the House of Commons on Tuesday.—The London Electric Supply Bill has passed the House of Commons, and was read a first time in the House of Lords on Monday. (Page 490.)

A letter from Mr. L. H. Walter refers to the success of the Bellini and Tosi "wireless compass" equipment for locating the position of ships in fog. Mr. W. P. Durtnall writes with reference to his opposition to a patent of Hon. C. A. Parsons. (Page 491.)

The chief electrical feature at the exhibition of the British Medical Association is an apparatus for a new high-frequency treatment. A comparatively large oscillating current is passed through the body, and the heating effect is claimed to be highly beneficial in cases of rheumatism, gout, &c. Further, a current of between two and three amperes from this apparatus may be used for destroying diseased tissue through coagulation. (Page 492.)

An article by Mr. C. C. F. Monckton describes some experiments on the radiation from a wireless telegraph aerial under different conditions. (Page 492.)

Electric power is extensively employed in the works of the Barrow Hematite Steel Co. at Barrow-in-Furness. The various shops, the machinery in the iron works and on the rail banks, the blast-furnace hoists, pumping and other plant are electrically driven, and in all some 120 motors are installed, aggregating about 2,500 h.p. Power is generated by three large gas-engine sets running off blast-furnace gas, and is distributed at 220 volts direct current on the two-wire system by means of bare overhead cables. The auxiliary plant in connection with the gas-engine sets, the main switchboard, and the overhead cable lines, have many interesting features. (Page 493.)

Messrs. Mordey & Dawbarn have presented a report to the Torquay Corporation in which they express the opinion that the Dolter surface contact system now in use in Torquay can be made to work satisfactorily by the substitution of improved studs at a total cost of £6,500. (Page 496.)

A new line of quick-break knife switches with the wearing parts of steel to ensure durability has been introduced. (Page 497.)

Among the specifications published by the Patent Office on Thursday last was one by A. F. Berry for an automatic switch for house transformers. The transformer is connected with a reactance in series, and this is short circuited automatically directly any current flows in the secondary circuit.—M. B. Field covers a method of protection for three-phase feeders: the system is earthed through a high resistance, and the switches are operated by relays supplied from current transformers which supply current when the balance of the phases is disturbed.—The application of the Crompton auto-converter to the control of motors

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is described in another specification.—Opposition has been entered to the grant of a patent relating to the balancing of the axial thrust in steam turbines. (Page 498.)

THERE has been a net loss of £2,029 on the Bristol Electricity Department, which is covered by cash brought forward from the previous year.—Meters are to be used as a current check on tramcars at Cardiff.—The Heston & Isleworth Electricity Committee are making arrangements through contractors for the engagement of canvassers.—It is expected that the Hull telephone system will not be taken over by the Post Office at the time of the transfer of the National Telephone Company's undertaking.—The double trolley line from Eltham to Woolwich has been opened for traffic.—The Southport electricity undertaking shows a net profit of £1,475. (Page 499.)

LOCAL GOVERNMENT BOARD inquiries have been held for loans at Aston (£23,500); and Torquay (£3,500). Extensions are also contemplated at Leicester (£19,190), and Walthamstow (£1,834). A loan of £35,933 is also to be applied for, for tramway extensions at Rochdale. The Frodingham Council have decided to use electricity for street lighting. (Page 499.)

THE accounts of the Metropolitan Railway Co. show an increase of receipts of £12,000 over the previous half-year, and an increase in expenses of only £776. The report of Messrs. Crompton & Co. records a loss of £20,493. The directors, however, are of the opinion that, by exercise of rigid economy, a profit can be earned. (Page 502.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY), THURSDAY, JULY 28TH.

The Institution of Mechanical Engineers and the American Society of Mechanical Engineers. Joint Summer Meeting.

Excursion to Rugby to visit Messrs. Willans & Robinson's and the British Thomson-Houston Co.'s works.

9 p.m. Conversazione at the Institution, Storey's Gate.

FRIDAY, JULY 29TH.

10 a.m. At Institution of Civil Engineers, Westminster:—"Electrification of Suburban Railways," by Mr. F. W. Carter; "Cost of Electrically-Propelled Suburban Trains," by Mr. H. M. Hobart; "Economics of Railway Electrification," by Mr. William B. Potter; "Electrification of Trunk Lines," by Mr. L. R. Pomeroy; "Electrification of Railways," by Mr. George Westinghouse.

The Sinking of the Pluviose.—The *Times* correspondent states that during the work of refitting the ill-fated French submarine Pluviose, which sank due to a collision off Calais, traces of fire were discovered in the interior, which are suggested to have been due to a short circuit in the electrical equipment.

Wireless Telegraphy.—In the House of Commons on Thursday, Colonel Seely stated that the Australian and New Zealand Governments had taken space to establish high-power wireless telegraph stations at Sydney and Doubtless Bay, but it had not yet been possible to carry out the recommendations of the Conference of Australasian Governments with regard to the Pacific Islands.

A fire broke out on Friday on board the Southern Pacific steamer *Momus*, bound from New York to New Orleans, when off the coast of Florida. Assistance was called for by wireless messages, and the 86 passengers on board were transferred to the ss. *Comus*, of the same line, without mishap.

In reply to a question in the House of Commons on Monday, Mr. H. Samuel stated that the following wireless stations could be used by ships sailing between England and India: North Foreland (Kent), Niton (Isle of Wight), Bolt Head (Devonshire), Lizard (Cornwall), Seaforth (Liverpool), Rosslare (Wexford), Crookhaven (Kerry). A station has been recently opened at Bombay, and two stations at Port Said and Port Tewfik belonging to Lloyd's are open for communication with ships on matters relating to navigation. There are also Government stations at Gibraltar, Malta, and Aden, which, though not open for general purposes, would communicate with ships in case of distress. The question of opening stations at Gibraltar, Malta, Aden, and other places for general communication with ships is under consideration. The stations working east of Aden are under the control of the Admiralty.

PARLIAMENTARY INTELLIGENCE

LONDON UNITED TRAMWAYS.—This Bill, which has already passed the House of Lords, and was sent forward for third reading by the Unopposed Committee of the House of Commons, was read a third time in the House on Tuesday. The chief proposal is to extend the powers granted in 1909, for constructing tramways across Kew Bridge. At that time the company agreed not to use the overhead system, but an arrangement has now been made with the Richmond Corporation whereby the overhead system may be used, upon certain conditions.

PROGRESS OF ELECTRICAL BILLS.—The Metropolitan District Railway Bill, which has already passed the House of Lords, was read a third time in the House of Commons on Thursday.

The London Electric Supply Bill was read a third time in the House of Commons on Thursday, and for the first time in the House of Lords on Monday.

The Rhondda Urban District Council (Tramways Extension, &c.) Bill, and various other Corporation Bills were read a third time, and passed in the House of Lords on Monday.

ELECTRIC LIGHTING PROVISIONAL ORDERS.—The Electric Lighting Provisional Order (No. 2) Bill, which confirms a Provisional Order granted to Mr. George Balfour for Ardrossan, Saltcoats, and Cambuslang, was before a Select Committee of the House of Lords last week. The only opposition was by the Caledonian, Glasgow, & South-Western & Lanarkshire & Ayrshire Railway Companies, who asked for a clause protecting them from liability in respect of damage to electric mains carried over their bridges. The Committee refuse to insert the clause asked for.

L.C.C. TRAMWAYS.—The London County Council (Tramways and Amendments) Bill has been before a House of Lords Committee during the week. The Bill has already passed the House of Commons. Of the proposals originally contained in the Bill, eight were struck out by the Standing Orders Committee, on the ground that the consents of the Road Authorities concerned have not been obtained. The proposals passed, the remainder of the Bill, although meeting with some opposition, was passed by the Committee, and provides for an extension of the tramway system in various parts of London. Among the clauses in the Bill is one for the protection of Greenwich Observatory, which gives the Admiralty absolute veto in respect of any tramways which may be deemed likely to affect injuriously any apparatus at the Royal Observatory. The Admiralty, before the House of Commons, refused to agree to a suggestion that "reasonable and proper precautions" should be taken by the Council. The Council is given powers to apportion between the Tramways and Improvements account the cost of all street improvements, and the ratification of past apportionments. A point was raised before the House of Commons Committee that tramways ought not to be sanctioned where there would be less than 9 ft. 6 in. between the kerb and the nearest rail, but it was not pressed except in a few particular cases. The Highways Committee, reporting upon others, stated that if these conditions were insisted on, it would render the cost of reconstructing existing tramways, and of constructing tramways almost prohibitive. Before the House of Lords, the Bill is opposed by the City of London Corporation, Lambeth Borough Council, the Metropolitan Water Board, and owners and occupiers of premises in Tooley Street, all of whom were heard by the House of Commons Committee. With regard to the opposition of the Lambeth Borough Council, this was to the effect that the Dulwich Road was not wide enough for a double line, and Mr. Stephen Sellon gave evidence in support of this contention. The Committee decided that the road should be widened at the joint cost of the County Council and the Borough Council. If the two parties cannot agree as to the amount to be paid by each, the Committee will fix the proportion.

Damages for Tramcar Accident.—Mr. E. Jackson, of Hackney, has been awarded £415 damages against the London County Council in respect of serious damage to health and loss of wages arising out of a collision between a tramcar in which he was travelling and another car at Clerkenwell in November last.

Telegraph Traffic and Movements of Cable Ships.—The cable between Madagascar and Reunion was restored on 18th inst.—The lines of the Indo-European Telegraph Co. were interrupted between Kertch and Soukounn and Kale on the 22nd inst., but were repaired on the same day.—The new cable between Ascension and Buenos Aires belonging to the Western Telegraph Co. is 3,186·5 nautical miles in length.—The cable ship *Mackay-Bennett*, of the Commercial Cable Co., and the *Contre Amiral Caubet*, of the French Cable Co., remained at their moorings during June, and the c.s. *Minia*, of the Anglo-American Telegraph Co., was working on one of the cables of the Western Union Telegraph Co. The *Robert C. Clowry*, of this latter company, has been engaged in repairing one of its short sections, and has returned to New York.

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CORRESPONDENCE

WIRELESS TELEGRAPHY AT SEA.

To the Editor of Electrical Engineering.

Sir,—I have read with interest your editorial in this week's issue dealing with the Compulsory Wireless Telegraphy Bill, and note that yours is the first journal to appreciate that wireless methods have advanced to such a degree that a further and very important service can now be rendered by Hertzian-wave transmission, over and above what is afforded by wireless telegraphy pure and simple—and that is, the facilitation of navigation during fog. It appears to the writer that while so much stress is laid upon the necessity of equipping ships with a wireless outfit which enables messages to be sent summoning assistance *after* a disaster has occurred, not enough emphasis has been laid upon the advantage of possessing a means of *avoiding* accident, or, at any rate, of very greatly reducing the risk of collision, &c., in time of fog. You have referred to the fact that there already exists a practical wireless compass arrangement for aiding navigation during fog; and as, so far as I am aware, there is only one such device at present, namely, that of Messrs. Bellini and Tosi, I think that a few particulars of the results obtained therewith may prove of interest to your readers, especially as nothing has as yet been published in the technical press.



S.S. La Provence, showing Bellini & Tosi "Wireless Compass" Aerial.

The Bellini-Tosi wireless compass equipment has been in use for some months on the s.s. *La Provence*, of the Compagnie Générale Transatlantique, and other liners of the same company are being equipped. I am sending you herewith a photograph of the *Provence*, from which it can be seen that the encumbrance caused by the aerial gear is nothing to speak of, while the arrangement can be fitted to any existing wireless telegraph system. For instance, the compass has been added to the ordinary Marconi installation already fitted. Her captain (Capt. Poucelet) has declared that the installation of the compass equipment increases the safety of navigation by 100 per cent., and he further considers that collisions at sea may be entirely averted by this system of wireless detection. In view of these results, it appears that those responsible for the introduction of the Bill would have shown more consideration for the safety of the passengers had they advocated the adoption of wireless telegraphy in conjunction with a device by which most mishaps could be avoided. To consider the fitting of a wireless installation for communication purposes only as being sufficient is practically equivalent, to take an analogy from another source, to providing a railway train with a telephone system by which it would be possible to signal that an accident had occurred, and yet neglecting to provide the ordinary signals for indicating the presence of an obstruction on the line.

London, S.W.
July 23rd, 1910.

I am, &c.,
L. H. Walter.

ELECTRICAL MARINE PROPULSION.

To the Editor of "Electrical Engineering."

Sir,—In your report of my opposition to the sealing of the Hon. C. A. Parsons' patent, in your issue of the 21st inst., there are certain inaccuracies which I trust you will allow me to correct.

You state—"Mr. Durtnall claimed to have a master patent for a polyphase electrical speed reduction system for this purpose, but the Comptroller does not consider this to be the case."

This particular point was one which I was not allowed to press, as I had not filed a notice thereof within the prescribed time allowed by the Rules of the Patent Office. As a consequence, the hearing, and the decision, were mainly concerned with the terms of the disclaimer, which is to be inserted in the Parsons' patent.

In your report you state that the Comptroller did not consider "any" reference or disclaimer should be inserted, and you follow this up with, "An amendment of little importance has been made at the suggestion of the applicants, however."

As a matter of fact, the applicants were obliged to alter the general disclaimer in the preamble of their specification, so as to make it clear that they were aware that it had already been proposed to use polyphase alternating current electrical machinery in connection with turbines for the purpose of marine propulsion, and as I was the first to make that proposal in my patent, No. 17248 of 1905, this amendment (made on my suggestion and not on the suggestion of the applicants) amounts to a disclaimer of my invention, the specific reference by number not being allowed because of a legal technical error, on my part, in patent opposition procedure.

This disclaimer by the applicants is, therefore, a matter of very much more than "little importance," particularly as my claim to the exclusive right of using a polyphase alternating-current speed reduction system for self-contained ship propulsion, will be revived as against another proposed infringement, within the course of a few weeks.

I am, Dear Sir,
Yours faithfully,
William P. Durtnall.

11 Bush Lane, E.C.
July 23rd, 1910.

P.S.—As regards your mention of patent No. 21,050 of 1900, I might here point out that this patent refers to a railway system "with sub-station," and it has since been decided that same ought not to have been mentioned in this connection, so your remarks that the Comptroller-General holds that my arrangement was not new at the time of my application in 1905, does not, therefore, stand good to-day.—W. P. D.

[In the Parsons' specification, reference was made to the previous "use of one or more steam turbines driving alternators to supply current to motors driving, or assisting to drive, the propeller shafts of a ship," and as Mr. Durtnall complained that this does not include a reference to his polyphase system, even though the word alternator occurs, it has been agreed that the words "single or polyphase" shall be inserted before "current." Further, the fifth claim of the patent is to be amended. This reads as follows:—"Combined turbo-electric ship propelling machinery comprising one or more turbines driving one or more electric generators interwound with one or more electric motors, whereby the turbines may run at a higher speed than the propeller shafts." The amendment consists in inserting "as in claims 1 and 2" after "motors"; claims 1 and 2 describe the method of interwinding the generators and motors. With regard to the B.T.-H. Co.'s patent, referred to by the Comptroller in his decision, it appears that this is for a polyphase system of railway control, with a motor on the vehicle supplied from generators with different numbers of poles. The generators are not on the vehicle, however, and Mr. Durtnall claims that he has a master patent for the self-contained system used on a boat or vehicle as a polyphase speed reduction gear.—Ed. E.E.]

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RADIATION FROM A WIRELESS TELEGRAPH AERIAL

By C. C. F. Monckton

THE surging current in an aerial circuit has sometimes been called the radiation current. It does not necessarily follow, however, that by increasing this surging current the radiation is increased. It was brought to the notice of the writer by Mr G. Barratt, the wireless operator at Tobago, that when using two sparks in series in an aerial circuit, a better spark could be obtained by placing a small helix of wire in contact with the central knob. Further trials were made. First the surging current was read under the normal conditions of sending, and then the helix, consisting of six turns of No. 20 wire, 1 in. diameter, was placed as shown in Fig. 1. The current rose from 1·5 to 1·75.

Next a large coil, having a fairly large capacity, was placed in the same position; the current rose to 2·4. The final test was

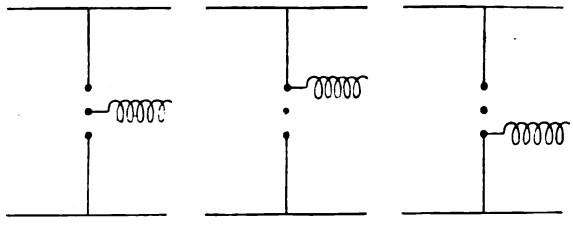


FIG. 1. FIG. 2. FIG. 3.

to transmit under the new conditions. Very little radiation was taking place, and the signals received at a station 60 miles distant were unreadable. To make certain that the increase of current was not merely apparent—due to displacement of the antinode—the large coil was placed in the positions shown in Figs. 2 and 3; the current readings were 1·4 and 1·2 respectively. The spark-gaps were each $\frac{1}{8}$ in., and the current from the induction coil was about the same throughout the experiments.

There is no doubt that the appearance of the spark, using multiple gaps, is improved; but the above experiment has led the writer to consider whether it is not possible that the real advantage may be fictitious. Further experiments seem necessary

NEW ELECTRO-MEDICAL APPARATUS

THOSE of our London readers who are interested in the applications of electricity to medicine and surgery should pay a visit to the electrical section of the Exhibition of the British Medical Association at the Imperial Institute, South Kensington, which is open to-day and to-morrow until 6 p.m. The chief feature of interest is an apparatus for a new high-frequency treatment known as Diathermy, or Thermo-Penetration, from which important results are being obtained. The treatment consists in passing a comparatively large undamped oscillatory current through the body, thus producing considerable internal heating, without any chemical or nerve-irritating effect. This heating is claimed to be highly beneficial in rheumatism, gout, and similar troubles, and if concentrated and carried to the proper degree can be caused to effect a complete destruction of diseased tissue through coagulation. Cases of tumours, cancer, and lupus have been treated; for example, a tumour or abscess can be coagulated and rendered inactive before removal, thus preventing the infection of the surrounding tissues.

The apparatus, which is exhibited by Messrs. Siemens Bros. & Co., Ltd. (Caxton House, Westminster, London), includes an oscillatory spark-gap similar to that employed in the Telefunken system of wireless telegraphy, and consisting of a series of copper discs with annular separators of thin sheet mica. This gap is connected in an oscillatory circuit supplied from a transformer, and the oscillations produced are transformed up to the required high pressure of several thousand volts by means of a Tesla air transformer. The current has a frequency of from 600,000 to one million cycles per second, and is applied direct to the patient through metal handles or suitable electrodes. For curative purposes, a very small current is used, and this produces a pleasant and beneficial warming owing to the high internal resistance of the body. For coagulation, a current as large as 3 amperes is employed, this being concentrated by the use of a small electrode near the diseased part. There is no tingling sensation and no danger of shock. The illustration of Fig. 1 shows the spark-gap, and high-frequency ampere-meter mounted on a portable stand. In the box are the low- and high-frequency transformers and the oscillatory apparatus. The removal of electrodes from the body whilst current is passing should be avoided, as otherwise the intense sparks produced would cause severe burns. Regulation of the current may be effected by adjusting a resistance in the primary circuit, or by



FIG. 1.—DIATHERMY APPARATUS.
(*Siemens Bros. & Co.*)

altering the coupling between the primary and secondary of the Tesla transformer.

A similar apparatus to the above, but employing a spark-gap of a different form, with two heavy electrodes enclosed in a chamber filled with alcohol vapour, is shown by Messrs. K. Schall & Son (75 New Cavendish Street, London). A current of 0·5 ampere at 5,000 volts from this apparatus produced a pleasant internal heating in less than one minute, without any unpleasant sensation.



FIG. 2.—X-RAY OUTFIT.
(*Siemens Bros. & Co.*)

Among the other apparatus exhibited were a large selection of heavy spark coils for X-ray work, including the complete Siemens outfit illustrated in Fig. 2, and comprising a 15-in. coil with Wehnelt interrupter, resistances and switches. The protecting screen enables the physician to regulate the tube and observe the patient without being subjected to the harmful effects of the X-rays. A fine single-flash coil, with which some excellent instantaneous photographs of the heart have been taken, is exhibited by Messrs. K. Schall, and a large selection of coils and heavy current tubes for instantaneous work is shown by a number of other firms, including the Sanitas Electrical Co., the Medical Supply Association, W. Watson & Sons, Siemens Bros. & Co., and H. W. Cox & Co. The last-named firm exhibit a new type of mercury interrupter for heavy currents. Regulation of the current is effected by varying the arc of contact between the mercury jets and a fixed blade, and the inverse current in the coil is reduced to a minimum by introducing a large resistance at the moment the circuit is made. A mercury interrupter on a new principle, with neither jets nor paddles, is shown by the Sanitas Electrical Co., who also show an outfit for instantaneous radiography (1/100 second exposure) with a mercury interrupter. Special motor-generators, with the generator winding isolated from the motor winding to avoid any possibility of shock, are exhibited by several firms. Messrs. F. R. Butt & Co. show a new interrupter with magnetically-produced rotation of the mercury.

Theft of Electricity.—A charge of stealing electricity was preferred against J. F. Churchard, of Second Avenue, Trafford Park, at the Manchester Police Court last week. The Trafford Power & Light Supply, Ltd., have installed a number of slot meters on the estate, and it was alleged that the defendant manipulated the meter by inserting a wire, and so obtaining his supply of electricity without payment. The defendant admitted having inserted a wire, but said he had done so because he could not get any light after having inserted one of the tokens supplied by the Company. A fine of 20s. and costs was imposed.

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THE BARROW HEMATITE STEEL WORKS

THE works of the Barrow Hematite Steel Co., Ltd., are situated at Barrow-in-Furness, within five miles of the extensive hematite iron mines owned by the company in that district, and cover an area, including railway sidings and reservoirs, of over 245 acres. A better idea of the size of the works, however, will be gathered from the fact that the number of employees, exclusive of those at the mines, is over 3,500. The equipment of the works comprises ten large blast furnaces, and a considerable number of hot-blast stoves; a Bessemer shop containing four 20-ton converters; a Siemens melting shop with four 50-ton furnaces; cogging, roughing and finishing mills; slabbing, plate and rail mills; five foundries, and a number of engineering shops. The whole of the iron works, engineering shops, hydraulic pumps, and rail bank machinery have now electric drive, but as yet none of the rolling mills are electrically driven. Electric power is generated in a central station in the works, containing gas-engine sets driven with blast-furnace gas, and is distributed by overhead mains. Through the courtesy of the manager, Mr. A. J. While, we were recently given the opportunity of inspecting the plant, and the chief engineer, Mr. Augustus While, who was solely responsible for the installation of the electric plant, kindly conducted our representative over the works, and supplied him with the substance of this article.

Though there are ten blast-furnaces in all, only six are in blast at present. From these the gas passes through water-sealed valves to four large dust-catchers, and from the dust-catchers through a long line of tubing to the gas-fired boilers, where the gas main is tapped to supply these; the remainder of the gas (a small portion of the whole) is delivered to the washer house. The final cleaning of the gas for the power-house engines is here carried out by five Theisen rotary washers, each dealing with 150 c.m. of gas per minute, and direct-coupled to a 70 h.p. shunt-wound G.E.C. motor running at 440 r.p.m. Besides the washers, this building contains two electrically-driven centrifugal pumps of 15 h.p. each, and an overhead five-ton, three-motor travelling crane. From the washer house the gas is conveyed to the engine house, a distance of 210 ft., in a 10-ft. pipe.

The engine-house building is 261 ft. long, 85 ft. wide, and 44 ft. high, and is served by two electric travelling cranes of 45 and 15 tons capacity respectively. It contains five blowing engines, and three electric generating sets. Two of the blowing engines are of the "Nürnberg" design, and were constructed by the Lilleshall Engineering Co., while the other three were made by the Gutehoffnungshütte Co. All these engines run at 90 r.p.m., and are capable of blowing 26,000 cubic feet of air per minute at a pressure of 8 lbs. per sq. in. The three gas engines of the generating sets were supplied by Messrs. Richardsons, Westgarth & Co., Ltd., and are of the "Cockerill" double-acting tandem type. One of these runs at 100 r.p.m., and is rated at 1,250 b.h.p., and the remaining two at 125 r.p.m., and rated at 750 b.h.p. Fig. 1 is a general view of the engine-room; the blowing engines can be seen in the background, and two of the generating sets in the foreground. The complete plant has now been running for eighteen months, and is giving every satisfaction. The substitution of the gas engines for steam plant has resulted in a saving of 1,500 tons of coal per week.

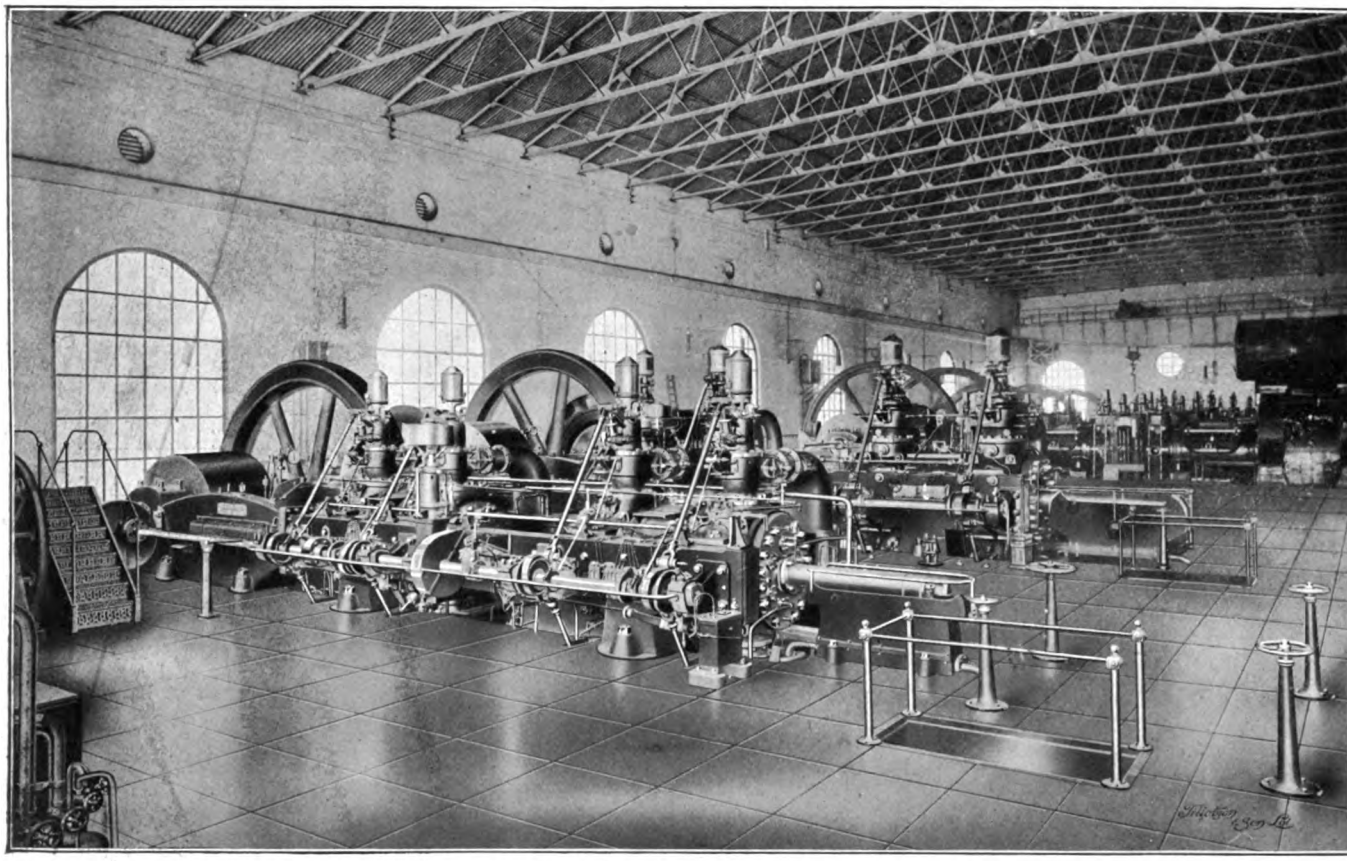


FIG. 1.—GAS-ENGINE ELECTRIC GENERATING AND BLOWING SETS RUNNING OFF BLAST-FURNACE GAS. BARROW HEMATITE STEEL WORKS.

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All the eight gas engines are provided with low-tension ignition with electromagnetic tappets; there are two plugs at each end of the cylinders. Current is supplied from one of two alternative 80 ampere-hour 30-cell Chloride batteries. The ignition circuits for the several engines are controlled from the battery switchboard. The storage batteries are under a rigorous system of supervision; each cell is tested for voltage and specific gravity every week. Two of the blowing engines are equipped with small governors which break the ignition circuits when the speed exceeds the normal by 5 per cent.; the gas supply is regulated by hand according to the load. All the other engines are provided with "Hartung" governors controlling the gas valves. All the engines are equipped with electrical barring gear, consisting of a motor of 8 or 12 h.p., according to the size of the engine, driving a pinion through worm gearing. Starting is effected with compressed air from receivers in the cellar containing air at a pressure of 220 lbs. per sq. in. Two electrically-driven compressors are installed, the larger of which, a geared horizontal type compressor, is driven by a 50-h.p. motor. The other is a horizontal compressor driven by a 30-h.p. motor.

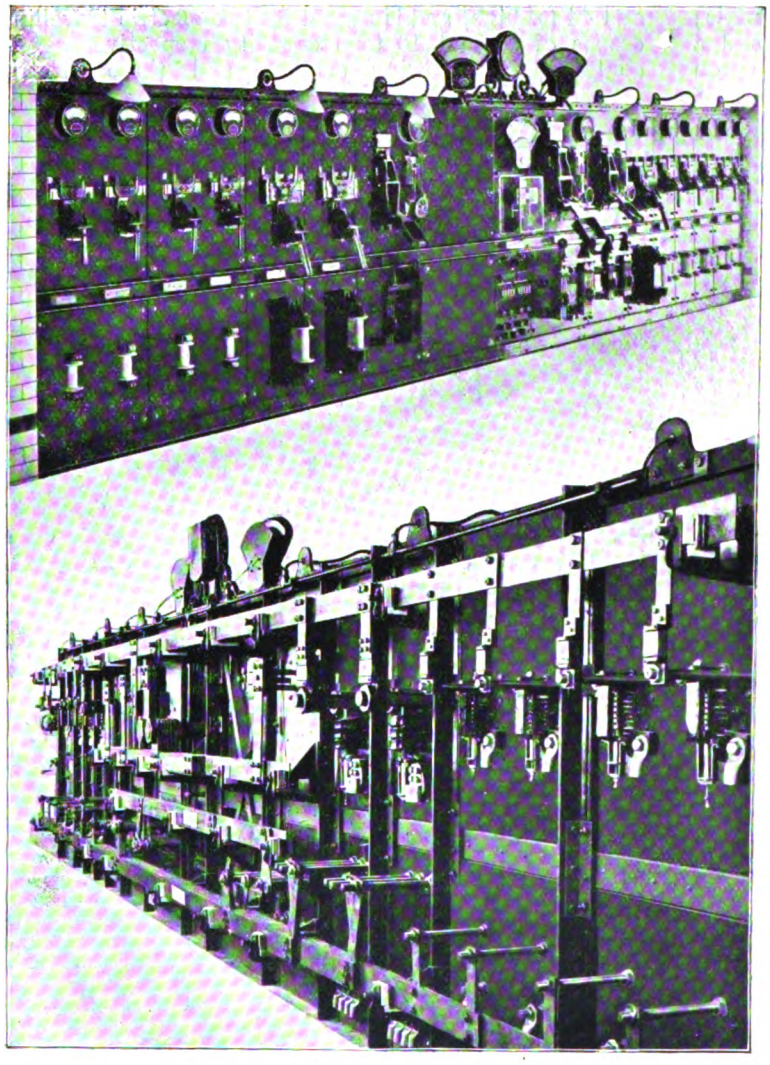


FIG. 2.—FRONT AND BACK VIEWS OF MAIN SWITCHBOARD.

An interesting part of the generating plant is the provision for water-cooling. The water, which is circulated through the jackets, valves, pistons, and piston-rods, is supplied from elevated tanks on either end of the building. The tank supplying the jackets is 46 ft. above the engine-house floor level, and that supplying the pistons 100 ft. From the engines, the water flows to reservoirs, from which it is pumped to the tanks again by electrically driven pumps. The high-pressure (40 lbs. sq. in.) water is dealt with by a centrifugal pump with a capacity of 16,000 gallons per hour driven by a 24-h.p. motor, and a pump with a capacity of 50,000 gallons per hour, and driven by a 40-h.p. motor, supplies the low-pressure (22 lbs. sq. in.) tank. Reserve sets are provided in each case. Each tank is provided with a float in connection with a row of five contacts at intervals of one foot. A seven-core cable connects the contact device with an indicator in the pump-house, there being an indicator for each tank. By looking at these indicators, the water-level in either tank can be ascertained. Further, should the water level sink below a certain level, a bell is rung to warn the attendant, who immediately switches on one of the pumps.

The three D.C. generators, direct-coupled to the "Cockerill" engines, were supplied by the General Electric Co., Ltd., and are remarkable in view of their enormous commutators. The two smaller generators are rated at 510 kw., 125 r.p.m., and the larger at 1,000 kw., 100 r.p.m., and all generate at 230 volts. All three machines are compound wound and provided with diverters to regulate the compounding effect.

The main switchboard, illustrated in Fig. 2, was built by Messrs. Veritys, Ltd., to Mr. A. While's specifications. It is arranged on a platform three feet above the floor level, and consists of 14 double panels controlling the three generators, three 2,000 amp., three 1,000 amp., and six 500 amp. distribution circuits. The 10,000 amp. 'bus-bars are carried on porcelain insulators supported on cast-iron brackets, as shown in Fig. 3. Connections are made by copper strip bolted to switch and instrument shunt terminals in such a manner that the current density at the contact surfaces nowhere exceeds 400 amps. per sq. in. Each circuit has an overload circuit-breaker on one pole and a hand-grip fuse on the other. The fuses consist of a number of wires in parallel enclosed in an asbestos-lined porcelain tube open at both ends. On the central panel is a B.T.-H. 10,000 amp. 230-volt total output meter, an illuminated dial ammeter reading up to 10,000 amp., and on either side of the clock above this panel are the illuminated dial 'bus-bar and paralleling voltmeters. Each of the generator panels includes a double-pole knife-switch on the negative side, one pole of which is in the equalising bar circuit; a reverse-current circuit-breaker in the opposite pole to that of the knife-switch; an ammeter, shunt regulator wheel, and voltmeter plugs. The provision of a switch in the equalising circuit, mechanically coupled to the main switch, ensures safe paralleling of the machines irrespective of the sequence in which the switches are closed. The main and equalising bar connections from the machines to the board are in the basement, and consist of copper rods of circular section supported at intervals on porcelain insulators. The insulators are carried on wooden supports hung from the ceiling of the basement. A board is placed on either side of the rods, and the trough so formed is covered top and bottom with expanded metal as shown in the section given in Fig. 4. In conjunction with this board is an auxiliary panel affording interconnection with a small steam-driven generating plant at the other end of the works, from which a limited amount of power can be taken in the event of the shut-down of all the blast-furnaces, and from which the gas-engine auxiliaries are supplied.

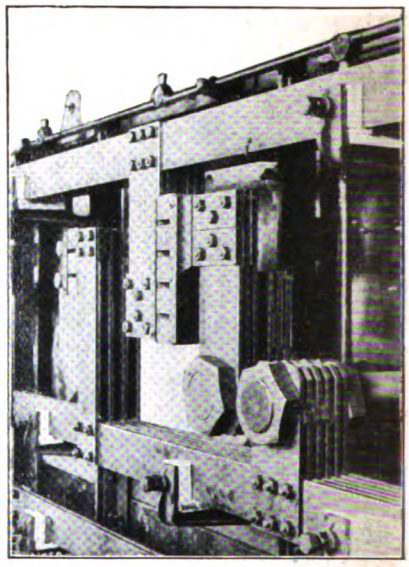


FIG. 3.—10,000 AMP. 'BUS-BARS AND MAIN WATTMETER CONNECTION AT BACK OF BOARD.

A careful record of the cleaning and repair work in connection with the gas-engine plant, and also of the electrical plant, is kept. Thus, there is a special log-book for the gas engines, and by reference to this the date of the last cleaning of any particular engine, or the duration of a shut down for any purpose, can be readily ascertained.

Before leaving the station, it may be mentioned that there is a special motor-generator set for supplying current at 100 volts for welding purposes. This consists of a Crompton compound-wound interpole motor coupled to a 60-kw. generator.

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The accompanying plan (Fig. 5) gives a good idea of the arrangement of the works and the distributing mains. Current is distributed at 220 volts on the two-wire system, the adoption of this method being decided on after much consideration. A very large number of motors for this pressure were already in use in the

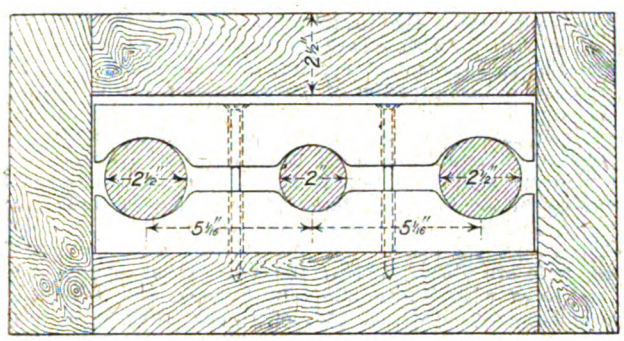


FIG. 4.—SKETCH OF PORCELAIN INSULATORS AND CARRIER FOR MACHINE CONNECTIONS.

works when the present system was designed, and further, the use of a low pressure was thought desirable, as experience had shown that motors could then be put down very rapidly, and without elaborate precautions, for temporary work. It was also thought

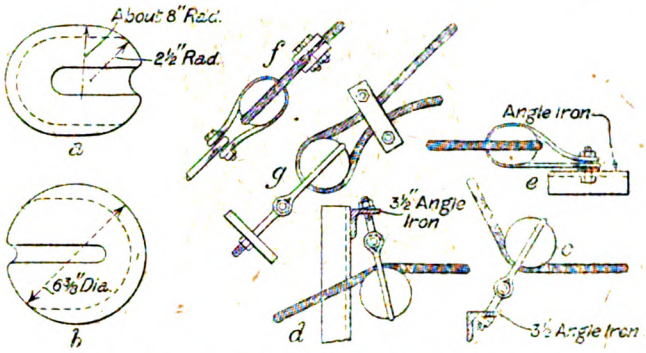


FIG. 6.—PORCELAIN INSULATOR FOR OVERHEAD CABLES.

undesirable to adopt the three-wire system, partly in view of the manner in which the motors are scattered about over a large area, rendering satisfactory balancing on the two sides of the system very difficult.

Distribution is effected by bare stranded copper cables or solid wires, carried overhead on wooden poles. Only one pattern of insulator is used. This is of porcelain and is illustrated in Fig. 6; *a* and *b* are two views of the size employed for 91/12 cable, and the other sketches indicate the various methods of using it. All the cables are strung up as shown, and since they were erected two years ago, no trouble has been experienced from slackening due to expansion. The cables pass under or over the insulators, as shown by *c* and *d*, according to circumstances, the insulators being attached by steel strips to the cross-arms of H-type wooden pole supports. The method of attachment at angles is shown by *e*, and *f* and *g* illustrate an anchor-

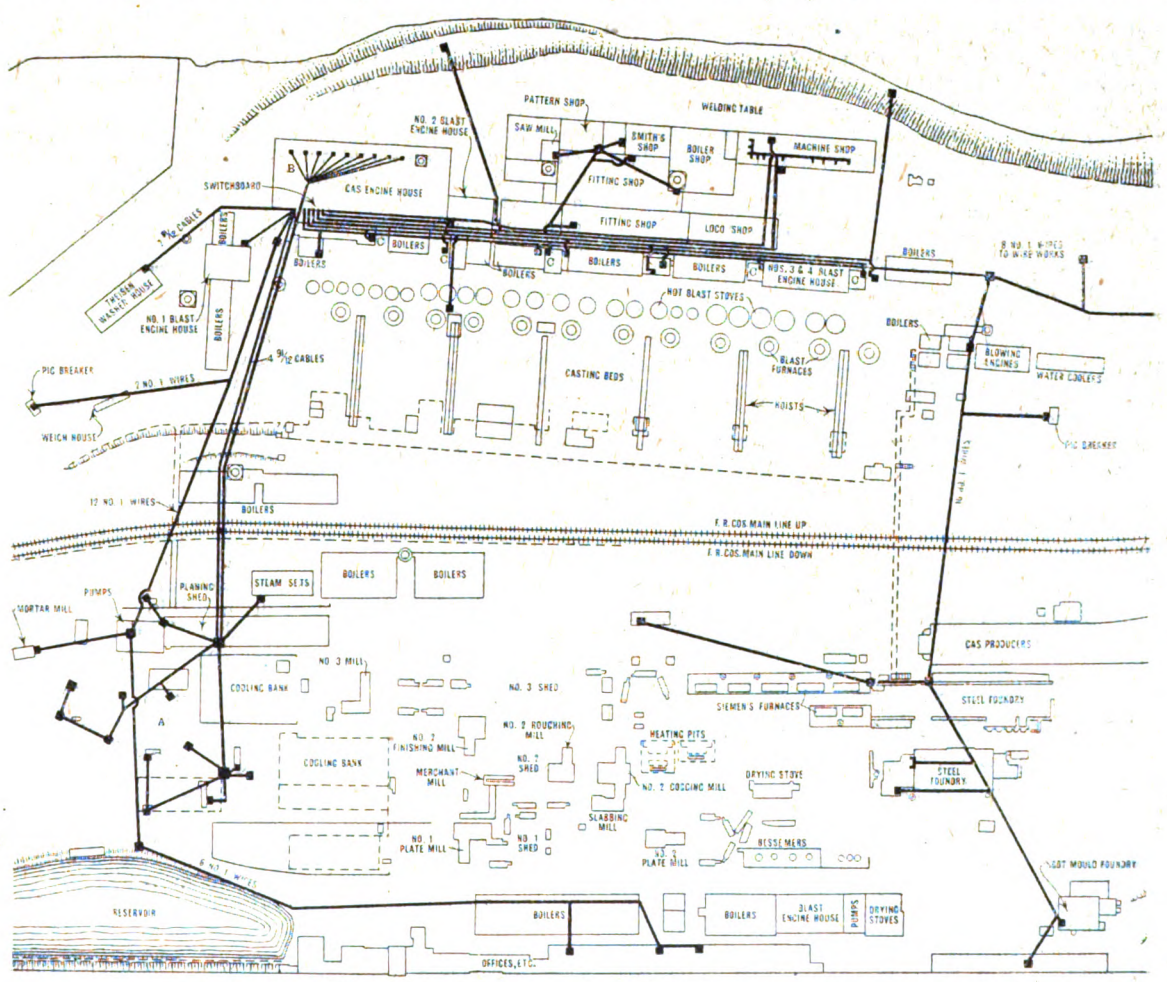


FIG. 5.—GENERAL PLAN OF BARROW HEMATITE WORKS, SHOWING MAIN DISTRIBUTION CABLES.

age at the end of a cable. In this case, the cable is passed round the insulator and fastened by means of two brass clamping pieces bolted together.

From the main switchboard a group of fourteen feeders, ten 91/12 and four 37/12 cables run out to the various motor-driven machinery in the iron works. These include drilling, shaping, and planing machines,

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circular saws, crane motors, lathes, pumps, the blast-furnace hoists, and pig-breakers. The motors of these machines are of various makes, including Messrs. Crompton Co., the Lancashire Dynamo & Motor Co., J. P. Hall & Co., Lahmeyer Electrical Co., and the General Electric Co., and number over fifty, aggregating some 1,000 h.p. The blast-furnaces are each over 60 ft. high, and are arranged in pairs in a row, as shown in the plan. The material is hauled up from the ore sheds to the tops of the furnaces in trucks running on an inclined road, there being one hoist for each pair of furnaces. Each of the five haulage gears, *C*, is driven by an 80 h.p. Lahmeyer interpole motor, provided with a 15-step lever controller, affording gradual speed control from 20 r.p.m. up to the full speed of 250 r.p.m. The pig-breaker is a machine comprising a reciprocating table which brings the pigs under breaking rams. This is operated by three motors of 10, 5, and 1½ h.p. respectively.

In the steel works proper there are some twenty motors, aggregating 370 h.p., and driving mixing, mortar, and other mills, lathes, cranes, and other machinery. Further, there are fifteen motors, aggregating some 160 h.p., and mostly of the Lancashire Dynamo & Motor Co.'s make, in use at the rail banks at *A*. These drive straightening machines, drilling machines, presses, rail-ending machines, and cold saws, and are supplied from the central station through twelve No. 1 wires. Besides this line, however, this part of the works, in which is situated the steam-generating station, is connected with the central station by four 91/12 cables. By this means the iron works could be supplied from the steam station. The various auxiliaries *B* in the gas-engine station, including crane motors, barring gear, compressors and pumps, and aggregating some 350 h.p., are supplied over this line from the steam station.

Apart from the various pumps already mentioned, there is a pumping plant comprising two large reciprocating pumps, driven by Mather & Platt 130 h.p. compound-wound motors, and two smaller pumps.

There are in all some 120 motors in use in the works, aggregating about 2,500 h.p. Besides those already mentioned there are motors by Messrs. Dick, Kerr & Co., Bruce Peebles, Electric Construction Co., and other firms. In most cases the starters and regulating gear were supplied by the makers of the motors; several examples of the "Igranic" gear, manufactured by the Adams Manufacturing Co., are in use, as well as some supplied by Messrs. Veritys, in connection with the Theisen washers.

The lighting of the works is carried out chiefly by arc lamps, of which there are 150 of the Crompton open, and Westminster Engineering Co.'s enclosed types. There are also some 1,000 incandescent lamps in use.

SURFACE-CONTACT TRAMWAYS AT TORQUAY

THE Torquay Corporation have consulted Messrs. Mordey & Dawbarn with regard to the contention of the National Electric Construction Co. that the technical difficulties in connection with the working of the Dolter surface-contact system in Torquay are such that the system should be abandoned, and the overhead trolley system substituted. The company also complain that the working expenses of the Dolter system are too high to enable them to make the undertaking commercially successful. The main difficulty has been trouble with the studs, and it is on account of the number of defective studs on the system that the Board of Trade have refused to grant a further licence for the continuation of its working. The Corporation are strongly averse to the overhead system, and unless some agreement is arrived at between the Corporation and the company, it would therefore seem probable that the tramways will cease operation in October.

Messrs. Mordey & Dawbarn were asked to state (*a*) whether the present Dolter system could be made and perfected so as to render it satisfactory, and (*b*) whether any other surface-contact system could be substituted which would be satisfactory. The reply to both of these questions is in the affirmative. Mr. Mordey has carried out an investigation of the system, and has also visited Hastings and interviewed Mr. H. Holliday, the Manager of the Hastings Tramways Co. He is of opinion that the number of faulty studs, which he admits is large on the Torquay tramways, has been largely increased by the fact that so many have been allowed to remain in a known defective condition. Three men are employed on the road by the company on the up-keeping of studs. With regard to the company's claim to abandon the surface-contact system, on the ground of high working cost, an examination of the company's own accounts and a comparison with other hilly towns where the trolley system is in use, shows, says Mr. Mordey, that the company is under a misapprehension in this matter. Figures are given showing that at Bradford, Halifax, and Huddersfield, all working on the trolley system, the units per car mile are 1·88, 1·97, and 2·25 respectively; the revenue per car mile is 10·33d., 11·08d., and 9·73d. respectively; and the costs per car mile are 7·22d., 10·5d., and 9d. These figures are then compared with Wolverhampton, Lincoln, and Torquay, all surface-contact systems, and, of course, running a less number of car miles per annum. In these cases the units per car mile are 1·56, 1·11, and 2·24 respectively, whilst the revenue per car mile is 10·47d., 9·20d., and 10·05d. The cost per car mile in the case of Wolverhampton is 6·6d., and in the case of Torquay 10d., whilst the figure for Lincoln is not given.

The report then deals with the expenditure at Torquay. It points out that the management and general expenses are high, probably due to the smallness of the company. The cost of repairs and maintenance, namely, £2,350 in 1909, is not regarded as excessive, but the cost of power at Torquay is high. The high consumption, says the report, is chiefly due to the hilly nature of the town, and would not be materially reduced by merely substituting the trolley system. The price charged to the company by the Corporation for energy is 1·57d. per unit, but this is not considered unreasonable, in view of the remoteness of Torquay from cheap coal supply and the comparatively small scale of the undertaking. The opinion is expressed that by greater care and attention the present studs could, without prohibitive cost, be made to work satisfactorily. An improved stud designed by Mr. E. A. Mitchell, who was engineer to the company when the line was put down, is regarded with favour, and if this were installed throughout the system, the total cost would be £6,500. In view of the fact that the company had expressed a willingness to spend £10,000 in order to put up the overhead system, Messrs. Mordey & Dawbarn think that they should be strongly urged to adopt Mr. Mitchell's proposal to instal the studs on a mile of track free of cost, on condition that if satisfactory they should be applied to the whole line.

With regard to the second question, whether any surface-contact system could be substituted which would give satisfactory results, Wolverhampton and Lincoln are pointed to as possessing systems which have given satisfaction to the councils in question, and also to the Board of Trade. If it were necessary to change the system in Torquay, which Messrs. Mordey & Dawbarn do not think is the case, there was no reason to doubt that either the G.B. system or the Lorain system would be satisfactory.

At the last meeting of the Council the report was discussed at some length, and a resolution passed authorising the Tramways Committee to take such further action or proceedings as may be necessary or expedient to maintain a surface-contact system of tramways in Torquay.

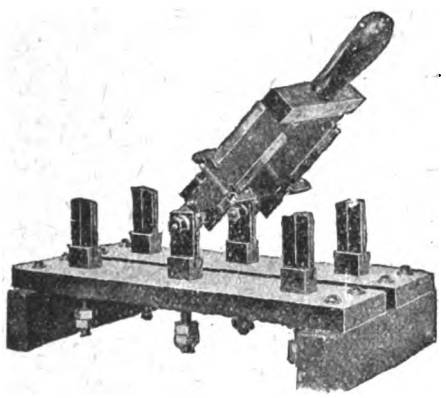
Crystal Palace School of Engineering.—Mr. J. C. Inglis, President of the Institution of Civil Engineers, will take the chair at 12 noon to-day (Thursday), on the occasion of announcing the list of certificates awarded by the examiners. An inspection of the several departments of the school will subsequently be made.

Electric Lighting Provisional Orders.—The Board of Trade have issued a special report in connection with an application for an electric lighting Provisional Order by Mr. George Balfour for the Boroughs of Ardrossan, Saltcoats, and the portion of the parish of Stevenston in the County of Ayr. The Corporation of Ardrossan refused their consent, and opposed the order on the ground that electric supply in their district would compete with the municipal gas undertaking. A local inquiry was held, and evidence produced, showing that there was a demand for electricity in Ardrossan, and in the circumstances the Board of Trade have decided to dispense with the consent of the Ardrossan Corporation, and have granted the order.

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NEW SWITCHES

A NEW line of knife switches has recently been introduced by the General Electric Co. (67 Queen Victoria Street, London). These switches are manufactured at the Witton Works of the company, and are to be known as the "Witton" type. A large number of different sizes, with carrying capacities of from 30 to 1,000 amperes, are kept in stock, and heavier switches up to 10,000 amperes capacity can be made up at short notice. The general design is illustrated in the accompanying figure, and is the same throughout the whole range, which enhances the appearance of a switchboard where several switches of different capacities are assembled together. Care has been taken that the current density nowhere exceeds 1,000 amperes per sq. in. sectional area, and 60 amperes per sq. in. surface area in the contact clips. The low value of the



DOUBLE-POLE "WITTON" CHANGE-OVER SWITCH.

latter figure is important, as most losses in switches are due to insufficient contact surface, and, moreover, it permits of the switches being run at considerable overloads without dangerous heating. As shown in the illustration, the flipper blades, which give the quick break, are fitted with steel collets where they are hinged to the main blades. The latter have steel bushes for the hinge pin, which is also of steel; the wearing parts are therefore very strong. Up to and including the 200-ampere size, the main blades are provided at the handle end with pressed steel clips for attaching the handle, or in multiple switches, the bridge. For sizes above 200 amperes solid steel ends are used. To hold the blade in the "off" position in change-over switches, or where there is no room to swing the switch right over, special shaped steel springs are provided. These are fixed to the side of the hinge contact, and act on the rounded end of the flipper blade pivot pin. Single, double, and triple pole switches for front or back connections can be obtained in this design. The switches are jig made, and all the parts are interchangeable.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

WIRING ACCESSORIES.—We have received from the Sun Electrical Co., Ltd. (118 Charing Cross Road, London), a copy of the section of their illustrated catalogue devoted to wiring accessories. This includes all the materials and small fittings for lighting installations. Wiring conduit, distribution boards, and cable are to be dealt with in a separate section. Several novelties in small switches, plugs, &c., are included.

INSTRUMENTS.—An illustrated pamphlet from the Allgemeine Elektricitäts Gesellschaft of Berlin describes a line of small portable instruments. These are for both A.C. and D.C. circuits, and have a movement consisting of two cylindrical segments of iron, one fixed and one moving, with an outer fixed coil.

LOW-VOLTAGE LIGHTING.—An illustrated leaflet, calling attention to the advantages of low-voltage metal filament lamps used in conjunction with small transformers, has been issued by the Allgemeine Elektricitäts Gesellschaft of Berlin. A description of a miniature lamp-holder transformer for single lamps is included.

ELECTRIC LIFTS.—The same company has issued a leaflet describing electromagnetic safety devices for use with electric lifts. One device prevents the motor circuit being closed unless all the gates are closed; another puts on the brake automatically on the motor supply being cut off; and another arrangement prevents the gates being opened unless the motor circuit is broken.

ELECTRIC LOCOMOTIVES.—A further leaflet from the A.E.G. gives illustrations of several small electric locomotives employed on narrow-gauge railways in connection with quarries, brickyards, large farms, &c. These are on the D.C. system with bow collectors.

DUDDELL OSCILLOGRAPHS.—A very complete list, dealing with the various patterns of the Duddell oscillograph and its accessories has been issued by the Cambridge Scientific Instrument Co., Ltd. (Chesterton Road, Cambridge). The principle of the instrument is clearly explained in the introductory pages of the pamphlet, and descriptions of the different types illustrated with photographs and drawings are given. Explanations of the methods of observing and recording the oscillograms are followed by complete instructions for connecting up and adjusting the instrument. For working with very high pressures, special asbestos woven wire resistances are employed. These are oil-immersed, and are supported on insulating stands suitable for working up to 50,000 volts. Full particulars of the constants of the instruments are given, and a complete price list is included. Some examples of oscillograms taken on various electrical circuits, including oscillatory disturbances, telephone currents, &c., are appended. We are informed that the firm has recently received two orders for Duddell oscillographs for use direct on 50,000-volt circuits; one order is from Japan and the other from Austria.

CHAIN DRIVE.—Messrs. Hans Renold, Ltd. (Progress Works, Brook Street, Manchester), have sent us a copy of a new catalogue which they have just issued. This gives a complete illustrated description of the Renold patent silent chains and sprockets for high-speed driving, with dimensions and prices of standard sizes. New features are a section dealing with the development of the Renold chain, and additions to the practical instructions for laying out and using the gear.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

LAMP-BULB LACQUERS.—A leaflet from T. Francis & Sons (Hampden Street, Bolton), calls attention to the firm's "Permanent" lacquers, especially prepared for colouring the bulbs of incandescent lamps, used for stage effects and advertising signs. These lacquers are also suitable for the glasses of arc projectors.

ACCESSORIES.—A very complete illustrated catalogue, prepared for the wholesale trade only, is to hand from the Victoria Electrical Works (7 Broken Wharf, Upper Thames Street, London, E.C.). This covers all the products of this firm, including switchboards and various classes of switches, wiring accessories, electric bells, indicators, and fire alarms, &c. In the switch section a new automatic transformer switch, constructed under Addison's patent, is listed.

MUNICIPAL PUBLICATIONS.—We have received from the Electric Supply Department of the Borough of St. Marylebone a revised edition of the booklet on "Systems of Charging," explaining the "maximum demand" and "telephone" systems of charging in a manner suitable for the non-technical reader. A new pamphlet, entitled "Other Uses," is an illustrated list of various electrical domestic devices, including ozone apparatus, vacuum cleaners, cooking apparatus, electric irons, fans, and water-heaters.

CRANE MOTORS.—The Phœnix Dynamo Manufacturing Co., Ltd. (Thornbury Works, Bradford), have sent us a new leaflet calling attention to a new series of motors for cranes and other intermittent work. These can be obtained in both the totally enclosed and protected patterns, and are fitted with interpoles. They are standardised for different load factors, the importance of which in rating a motor is explained in the leaflet.

GALVANISING.—A circular is to hand from the Cowper-Coles Galvanising Syndicate, Ltd. (82 Victoria Street, London, S.W.), calling attention to the advantages of the Cowper-Coles cold regenerative galvanising process over the non-electrical hot process. In the latter process, owing to the high temperature of the molten zinc necessary to ensure a uniform coating, the tensile strength of the articles galvanised is reduced, and the threads of bolts, nuts, &c., are also liable to be filled up. In the Cowper-Coles process, a uniform coating of zinc is deposited on the iron electrically in a cold bath, and by a special treatment the iron and zinc are caused to alloy at the surface, thus forming a more permanent protection against rust. The process is called regenerative, as the electrolyte is continuously regenerated and no zinc is wasted. The cost is claimed to be less than that of hot galvanising.

BATTERIES.—A reprint of an article entitled "Galvanic Batteries, and their Manufacture at the Woolwich Works of Siemens Brothers and Co., Ltd.," is being issued by the firm as a pamphlet.

MOTOR-GENERATORS AND CONVERTERS.—A new list from Messrs. Wright & Wood, Ltd. (Century Works, Halifax), gives standard sizes and prices of their motor-generators for technical schools, X-ray work, boosting, biographs, and battery charging. Four types of machines are included: D.C. motor-generators proper, with voltage regulation on the generator side; double-commutator single field D.C. machines without voltage regulation; rotary converters, and induction motor-generators.

Obituary.—The death is announced of Mr. T. Hurley, of Messrs. Gent & Hurley, electric wiring contractors, of Leicester.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published July 21st, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

7,121/09. **Automatic Transformer Switch.** A. F. BERRY. This is a modification of the Berry series transformer gear to render it suitable for small installations and house-lighting circuits. The primary of the transformer is permanently connected to the mains, but a reactance is inserted which practically prevents any current flowing. Directly any current flows in the secondary, however, the reactance is automatically short-circuited, and the transformer is put into action. This is effected by an electromagnetic device consisting of the reactance and an automatic switch combined. Arrangements with auxiliary transformers and connections for auto-transformers are also described. Six claims, eight figures.

12,685/09. **Protective Devices.** M. B. FIELD and FERRANTI, LTD. This patent covers the balanced system of protection for three-phase distribution networks, feeders, &c., described in ELECTRICAL ENGINEERING, Vol. V., page 599. The neutral point of the system is earthed through a comparatively high resistance, which limits the current to earth in the event of a fault. The faulty section is cut out by means of a relay operated by a current transformer. The latter delivers a current only when the balance between the phases is destroyed, and consists of a wound iron ring round the three-core cable. Eleven claims, eight figures.

15,319/09. **Compensation and Commutation.** R. POHL and THE PHŒNIX DYNAMO MANUFACTURING CO., LTD. In D.C. turbo-generators and A.C. commutator machines, where the commutation conditions are difficult, the usual compensating winding is placed in the face of the main poles, but this is designed to compensate the armature reaction under the poles only. A further compensating winding is provided in the spaces between the poles, and this is designed to produce the flux for commutation also. The compensating winding is arranged close to the armature, and an unwound commutating pole is fixed outside of the winding, or the winding may be in the face of the commutating pole. In order to vary the commutating field without altering the degree of compensation, reluctance is introduced into the magnetic circuit of the commutating poles in the form of a variable air-gap, or the poles themselves are moved transversely across the armature. Seven claims, six figures.

15,494/09. **Motor Control System.** CROMPTON & CO., LTD. J. C. MACFARLANE and H. BURGE. This patent covers the application of the D.C. rotary transformer (described in ELECTRICAL ENGINEERING, Vol. V., p. 629) to the control of motors on the Ward-Leonard system. The driven motor is connected in series with the generator half of the rotary transformer, and speed regulation and regenerative braking are obtained by adding to, or subtracting from, the line volts, the variable pressure of the rotary transformer. Both motor and generator halves of the rotary transformer are separately excited. One claim, one figure.

22,087/09. **Railless Traction System.** E. M. MUNRO and THE RAILLESS ELECTRIC TRACTION CO., LTD. In order to enable the driver of a trolley-bus to ascertain how far away the vehicle is from the trolley wire, the trolley arm is mechanically connected to a small indicator showing the angle between the wire and the arm. Contacts are provided in connection with a bell, so that an audible warning may be given to the driver when the arm is nearly at right-angles. Four claims, two figures.

24,770/09. **Wiring Fittings.** L. M. WATERHOUSE. This patent covers ceiling roses, fuse boxes, and other fittings for use in the flexible system of wiring in which connection from fitting to fitting is made by means of flexible insulated conductors supported at intervals from the ceiling or wall. Each fitting consists of an upper and a lower portion, and the cables are gripped between them when they are screwed together. If the fitting is not of an insulating material, insulating washers are interposed between the portions. Three claims, five figures.

Opposition to Grant of Patents

2,215/09. **Steam Turbines.** G. BELLUZZO. Opposition has been entered to the grant of this patent. It covers the balancing of the axial thrust by the admission of steam at an intermediate pressure to special chambers situated at the high-pressure and exhaust ends of the turbine.

7,809/09. **Condenser.** WILLANS & ROBINSON, LTD., and E. G. IZOD. The opposition to this patent has been withdrawn. It covers an enlarged receiving chamber into which are delivered the air and vapour drawn off from the main condenser by the action of a steam jet, and in which a moderate vacuum is maintained by a water-jet ejector.

Amendment of Specification

12,155/07. **Magneto-Generator.** W. ROOS. Leave has been granted for the amendment of this specification covering a method of oscillating the armature of a magneto-generator.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Names in italics indicate communicators of inventions from abroad.

Arc Lamps: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Electrodes] 18,965/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: KUTTNER [Insulation of aluminium coils] 15,896/09.

Dynamos, Motors, and Transformers: GREENWOOD and CHAPMAN [Armature windings] 17,254/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Propulsion of ships] 19,871/09; BARBOUR [Flexible brushes or collectors] 21,180/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Motor control] 28,941/09; ALLGEMEINE ELEKTRICITÄTS GES. [Motor control] 10,607/10.

Electrometallurgy and Electrochemistry: HARRIS [Electro-deposition] 24,735/09; SCHULTE [Electrolytic removal of grease] 30,463/09; SCHOTT and GEN [Annular liquid anodes] 6,596/10; BLOXAM (*E. Hoorickx & A. Hindel*) [Manufacture of mirrors by electro-deposition] 7,641/10.

Heating and Cooking: PARKINSON [Ovens, hot-plates, &c.] 6,777/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*), 7,860/10.

Incandescent Lamps: PÖPE'S ELECTRIC LAMP CO. (*Trenzen*) [Connections with leading-in wires] 16,076/09; KRAUS [Miners' hand lamp] 18,864/09.

Instruments and Meters: GRAY [Facilitating reading of instruments and meters] 12,379/09; BRITISH THOMSON-HOUSTON CO., GRAY, ROGERS, and HOLDEN [Meters] 30,142/09.

Switchgear, Fuses, and Fittings: LEITNER [Automatic regulators] 15,889/09; ELECTROMOTOR EQUIPMENT CO., and BARLOW [Lift control mechanism] 16,114/09; FERGUSON [Automatic switches] 16,273/09; WARDALE and STOREY [Prevention of over-winding of electric cranes, lifts, capstant, &c.] 17,516/09; CONNARE [Wall socket] 19,045/09; COLLINS [Switches] 24,373/09; WOODHOUSE [Wiring conduit] 25,577/09; THOMSON [Switch] 4,318/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Motor-starters] 5,261/10; SCHULTZ [Switches] 12,522/10.

Telephony and Telegraphy: BAKER and PICTORIAL NEWSPAPER CO. [Photo-telegraphy] 15,918/09.

Traction: DMITRIEW [Electromagnetic clutch for elastic drive] 20,286/09.

Miscellaneous: EVERSHED & VIGNOLES, LTD., and KILROY [Automatically indicating positions of guns] 15,487/09; PARSONS and BALL [Electric clockwork mechanism] 16,117/09; WARDZINSKI [Smoke prevention] 20,352/09; GIBB and MAVOR [Mining elevators and conveyors] 24,868/09; MOY and BASTIE [Scene-raising gear] 5,642/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: KLOSTERMANN, 15,143/10.

Dynamos, &c.: ALLGEMEINE ELEKTRICITÄTS GES. [Frame construction] 15,293/10, and [Control of electrical machines] 15,426/10, and [Machines] 15,753/10.

Incandescent Lamps: WOLFRAM LAMPEN A.-G. [Decarbonising metal filaments] 14,116/10;, ALLGEMEINE ELEKTRICITÄTS-GES. [Vacuum apparatus] 15,754/10.

Telegraphy, &c.: EGNÉR and HOLMSTRÖM [Cooling of heavy current telephone transmitters] 8,019/10; TSCHÖRNER [Photo-telegraphy] 13,104/10; GALLETTI [Production of continuous wave trains for wireless telegraphy] 15,497/10.

Miscellaneous: MASCHINENFABRIK OERLIKON [Governing of variable speed electrically-driven machinery] 4,950/10.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: J. M. WELLINGTON and W. F. DANIEL [Vertical carbon lamp] 7,095/05.

Electric Ignition: E. EISEMAN [Magneto system] 7,504/05.

Instruments, &c.: EVERSHED & VIGNOLES and S. EVERSHED [Motor meters] 9,127/97.

Switchgear, &c.: A. ROMAIN and J. D'AYGUESVIVES [Lamp adapters with fuses] 7,834/02.

Telephony, &c.: H. MANDERS and A. W. SHARMAN [Oscillation generator] 8,172/02; HENLEY'S TELEGRAPH WORKS CO. and H. SAVAGE [Telephone and telegraph cables] 7,105/05.

Traction: R. C. SAYER [Electric mono-rail system] 7,829/05.

Miscellaneous: R. A. SLOAN (*T. Cahill, New York*) [Electrical generation and transmission of music] 8,725/97, R. T. BROTHAM [Electric control of ship's steering gear] 8,112/02; W. G. LEATHER [Advertising signs] 7,173/05.

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LOCAL NOTES

BARNSTAPLE: *Electric Wiring Powers.*—The Electricity Committee report that further expenditure upon electrical exhibitions is undesirable until the Council have powers to wire premises and sell fittings.

BEXLEY: *Tramway Through Running.*—An agreement has been arrived at between the Council and the Erith Council for the through running of their respective tramcars.

BRISTOL: *Electricity Accounts.*—The total receipts for the year ended March 25th amounted to £79,572, and the working expenses were £36,751. After meeting capital charges there was a deficiency of £2,029, which, however, is covered by the balance brought forward from the preceding year, which amounted to £6,230. There was a net increase of 170 consumers during the year, and the total number of units sold was 8,142,376.

CARDIFF: *Meters on Tramcars.*—The Tramways Committee have decided to purchase 130 meters at £3 5s. each, with which the tramcars will be equipped, in order to check the current consumed on each. The firm who supplied the meters have undertaken to take them back free of cost if at least 6 per cent. of the energy is not saved in the first six months.

EDINBURGH: *Electricity Accounts.*—The annual report states that the number of units sold during the year ended May 15th amounted to 9,833,301 for lighting, and 3,589,527 for power, being an increase of 2 per cent. Over 1,000,000 units were also used for public street lighting. The total revenue was £127,853, and the total expenditure was £125,781, including £58,330 for capital charges.

ERITH: *Electricity and Tramway Accounts.*—The net profit on the electric lighting undertaking is £2,157, after meeting capital charges. The tramway accounts, however, show a loss of £3,436 on the year's working.

FALMOUTH: *Purchase of Electricity Works.*—The Lighting Committee have reported in favour of purchasing the electricity works of the Electric Supply Corporation.

HESTON AND ISLEWORTH: *Canvassers.*—The Electricity Committee have been authorised to make arrangements with any electrical contractors approved by them, for the engagement of canvassers on the following terms:—(1) The contractor to engage and pay a canvasser to devote his whole time to the work, the Council to be in no way responsible for the acts or defaults of such canvasser. (2) The canvasser to take instructions from the Electrical Engineer, and to submit to him a daily report of his work. (3) The contractor to be paid a commission in respect of each installation obtained and connected to the Council's mains at the rate of 10s. per kilowatt for lighting and 5s. per kilowatt for power. The arrangements to be terminable by the contractor or the Council at one month's notice. The Committee have come to a definite arrangement on this basis with Messrs. D. J. Macdonald & Co. Any other contractor approved by the Committee, and who would enter into a similar arrangement, will be treated in the same way.

HULL: *Telephone Undertaking.*—At a meeting of the Telephones Committee last week a statement was read from Mr. G. J. Bentham, M.P. for Gainsborough, with regard to the taking over of the telephone system of the country by the Post Office next year. Mr. Bentham expresses the opinion that if the people of Hull desire to retain their municipal telephone system, they will be able to do so. If they allow their licence to lapse, the Post Office would immediately take over the system, and the rates will at once go up. The opinion of the Telephone Committee is that Hull will desire to retain the system.

LONDON: *London County Council: Tramways.*—The new tramways in Woolwich, which have been constructed upon the four-wire system, *i.e.*, two trolley wires on each line instead of one, in order to avoid interference with Greenwich Observatory, were inspected by Major Pringle and Mr. A. P. Trotter last week, and have since been put into service.

London County Council: Tramways.—The Highways Committee report with regard to constructing certain tramways included in the Bill now before Parliament, and recommend sanction for expenditure in connection therewith. The estimated cost of construction and equipment on the overhead trolley system from Putney Bridge to the High Street, Wandsworth, line is £39,785; the reconstruction of the existing horse tramways from Tooley Street to Deptford, and the construction of authorised trams from High Street, Deptford, to Greenwich, is estimated at £6,470; and the reconstruction of tramways in Highgate Road at £38,730.

London County Council: Tramway Renewal and Reserve Funds.—Further sums belonging to the Tramways Renewals and General Reserve Funds, amounting already to £102,000, have been invested in Canadian 3½ per cent. stock and New Zealand Government 3 per cent. inscribed stock. The former was purchased at £99 per £100 of stock, and the latter at £87⅝.

Fulham: Assessment of Generating Station.—The electric lighting station and appurtenances which, according to the Valuation List in force, is now assessed at £2,850 gross, and £1,900 rateable value, has been inserted in the new Valuation List at £10,500 gross, and £4,500 rateable value. The matter has been referred to a sub-committee for consideration, and in the meantime the Town Clerk has been instructed to give notice of objection to the Valuation List. Notice of objection to the Valuation List has also been lodged by the London County Council in respect of the proposed assessment of the electric lighting station, requiring that the values should be increased to £14,000 gross and £5,600 rateable.

Wiring.—The Electricity Committee report that with a view to giving effect to the proposals for the wiring and fitting of consumers' premises, they have considered and accepted estimates from local contractors for the wiring works, to be carried out in accordance with the specification prepared by the Borough Electrical Engineer. The Committeee have also examined samples, and considered prices of requisite fittings, and approved those selected by the sub-committee.

Lighting of Small Houses.—The Committee further reported having had under consideration the terms upon which supplies of current might be afforded for the one or two lights required in the halls and staircases of maisonettes, on the basis of a fixed rate of charge. In such cases "hour" meters are to be provided instead of the usual recording meter, and, estimating that 1,640 hours per annum will cover the use of one lamp, the charge of 3½d. per unit, using an 8-c.p. carbon lamp, works out at 16s. 9d. per lamp per annum. Provision is to be made, however, that for all current consumed in excess of 1,640 hours, a further charge of 3½d. for every 30 hours, or portion of 30 hours, will be made.

Poplar: Electricity Accounts.—Mr. J. Horace Bowden points out that the average charge of 1·287d. per unit obtained at Poplar is the lowest price obtained in London during the past year. This is due partly to the supply in bulk of 1,027,429 units to Stepney. The net profit for the year was 31 per cent. greater than for the previous year.

Stepney: Rental of Time Switches.—As the cost of maintenance of time switches is considerably lessened in consequence of the improved type of instrument used, the present rental of two shillings per month is to be lowered to one shilling in the case of those consumers who are supplied with current up to 25 amperes.

MACCLESFIELD: *The Trackless Trolley System.*—The Railless Electric Traction Co., Ltd., have given notice of their intention to apply for a Tramway Provisional Order authorising the use of the trolley omnibus, and also an Electric Lighting Provisional Order for the district. The New Electricity Co. of Macclesfield, Ltd., have also given notice of a similar intention.

NELSON: *Supply in Bulk.*—At Brierfield District Council meeting on July 21st, it was agreed to enter into an agreement with Nelson Corporation for the supply of electricity at the following terms: 2½d. per unit for lighting purposes, and 1½d. per unit for motive power, to extend over three years. These terms are a reduction from 3d. to 2½d. for lighting, and from 2d. to 1½d. for motive power.

NORWICH: *Electricity Undertaking.*—The report of the Electricity Committee for last year states that while the output has remained practically stationary, there has been such a marked reduction in the working expenses that the net balance, after meeting capital charges, namely, £5,962 12s., is a record for the undertaking. This sum is £2,280 12s. in excess of that for the previous year. The sum of £2,000 has been added to depreciation.

OLDHAM: *Wiring Powers.*—A communication has been received from the Incorporated Municipal Electrical Association with regard to obtaining wiring powers for all municipalities. The Chairman of the Electricity Committee, to whom the communication was sent, said that this only opened up the whole question of municipal trading again, and the Council was strongly opposed to it. The communication was, therefore, allowed to lie on the table.

SOUTHPORT: *Electricity Accounts.*—The result of the past year's working of the electrical undertaking shows a net profit of £1,475.

STROOD: *Electric Lighting Order Revoked.*—The Board of Trade revoked the Strood and Dartford (Rural Districts) Electric Lighting Order, 1903.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ASTON.—An inquiry was held last week concerning a loan of £23,500 for electrical extensions. Of this amount, £12,515 are for plant and machinery, and £10,590 for mains and services. During the course of the inquiry Mr. H. R. Hooper, the Local Government Board Inspector, questioned the wisdom of transferring £1,500 from the previous year's profits to relief of rates, and then borrowing £1,500 for services. To borrow money with one hand at 3¼ per cent., and to pay it out as a

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bonus with the other, meant that the ratepayers had to pay the 3¾ per cent. Eventually the Town Clerk agreed to withdraw the latter sum from the loan asked for.

BLACKPOOL.—The provisional consent of the Local Government Board is to be sought to proceed with the extensions at the electricity works at once, and the machinery must be completed in time for the coming winter load, which would be impossible if the usual formalities of applying to the Local Government Board were observed.

BRIGHOUSE.—A Local Government Board inquiry into a loan of £423 for the electricity undertaking has been held.

LEICESTER.—A Local Government Board enquiry will be held to-morrow concerning a loan of £19,190 for electrical extensions.

MANCHESTER.—Tenders are invited by August 2nd, for an induced-draught plant at Bloom Street generating station. Particulars from the Chief Electrical Engineer.

ROCHDALE.—The Town Council have decided to apply for a loan of £35,933 for tramway extensions along the Whitewell Valley, and for £5,000 for extending the car depôt and offices.

SOUTH AFRICA: *The South African Mining Journal* states that Mr. Howard Pim has obtained, on behalf of the Transvaal Hydraulic Power Syndicate, the concession for the erection of a generating station at Tweefontein. It is proposed to form a company with a capital of £926,000. The same journal states that it is proposed to establish an electro-chemical works in connection with this power station.

TORQUAY.—A Local Government Board inquiry was held last week into an application for a loan of £3,500 for the Electric Light Department.

WALTHAMSTOW.—Application is to be made for sanction to borrow £1,838, the estimated expenditure for three years on main extensions, house services, &c.

YARMOUTH.—A cooling tower is to be installed at the power station at an estimated cost of £750.

Miscellaneous

BURNLEY.—The Burnley Technical Institute is to be fitted up with a complete set of apparatus, at an estimated cost of nearly £300, for the practical teaching of electrical engineering.

DENMARK.—Tenders are invited by August 2nd for the supply of electricity meters to the Copenhagen Lighting Department. Copies of the specification may be seen at the Board of Trade, 73 Basinghall Street, London, E.C.

FRODINGHAM.—The Council have decided to use electricity for street lighting.

LONDON: *London County Council.*—Tenders are to be invited for the erection of the second section of the Bow car shed.

NEWPORT.—Tenders are invited for a supply of carbon filament lamps, radiator lamps, flame arc lamps, and meters for the next twelve months. Particulars from the Borough Electrical Engineer. Deposit 10s., and tenders by August 15th.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

W.C.—Theatre, Shaftesbury Avenue and Broad Street, Holborn, W.C. (2,450 pl.). Architect, B. Crewe, 75 Shaftesbury Avenue.

S.W.—Building, Pulford Terrace, Pimlico, S.W. (52,200 sq. ft.), for the Gamage-Bell Motor Cab Co., Ltd., 78 Holborn, W.C.

The Education Committee of the London County Council propose to invite tenders for the electric lighting of the schools now being erected on the Hoxton House site.

N.—Technical institute, Ponder's End (£6,724). Builders, H. Knight & Son, Tottenham.

Sorting office, Manor Road, Stoke Newington. H.M.O.W., Storeys Gate, S.W.

E.—Alterations Education Offices, West Ham (£5,350). Architect, Education Committee, West Ham T.C.

N.E.—Extension car shed, Walthamstow. Engineer, Walthamstow U.D.C.

S.E.—Additions Eltham Cottage Hospital, S.E. Whistler & Worge, builders, 80 High Street, Eltham.

PROVINCES.

BASFORD AND SNEINTON DALE.—Schools (£31,800). W. J. Abel, secretary, Education Committee, Nottingham T.C.

BRIGHTON.—Additions, &c., municipal school of art (£721). T. Simpson & Son, surveyors, 16 Ship Street, Brighton. W. A. Field & Cox, builders, Brighton.

CANTON (Cardiff).—School, Kitchener Road (£12,261). F. Bond, builder, Beda Road, Canton.

CHICHESTER.—Reconstruction of infirmary (£20,000). The Governors.

CROWBOROUGH.—Drill hall. Secretary, Sussex Territorial Association.

CROYDON.—Enlargement of central polytechnic. J. Smyth, secretary, Education Committee, Croydon T.C.

DONCASTER.—Theatre, Hallgate and Silver Streets. Major J. H. Crosby, director, Palace Theatre (Doncaster), Ltd.

DUBLIN.—The Governors of the Royal Hospital for Incurables, Donnybrook, invite tenders for the electric lighting of the institution. The Consulting Engineer is Mr. T. Tomlinson, 16 Beresford Place, Dublin.

FLEETWOOD.—A Local Government Board inquiry is to be held into a loan of £4,100.

HANWELL.—School (£7,932). H. Knight & Son, builders, Tottenham, N.

HOUNSLOW.—A Local Government Board inquiry has been held regarding a loan of £3,600.

NORTHALLERTON.—Enlargement of grammar school (£3,200). J. C. Wrigley, secretary, Education Committee, North Riding of Yorks C.C., Northallerton.

PAISLEY.—School for defective children Renfrew Road (£9,500). Craig-Barr & Cock, architects, Paisley.

PETERBOROUGH.—Theatre, Broadway, for Mr. Fitzwilliam, architect, Peterborough.

SALTBURN.—School (£6,090). Harold Arnold & Son, builders, Doncaster.

SHORLSTON.—School (£7,800). W. V. Dixon, secretary, Education Committee, West Riding of Yorks. C.C., Wakefield.

SHREWSBURY.—Slaughterhouse (£5,275). G. H. Bickerton, builders, Shrewsbury.

STIRCHLEY.—Swimming baths (£10,000). J. P. Osborne, architect, Birmingham. E. Crowder, builder, Farm Street, Birmingham.

TOXTETH.—Alterations at workhouse (£4,500). R. A. James, clerk, Board of Guardians, Toxteth.

TENDERS RECEIVED AND ACCEPTED

LONDON: *London County Council.*—The following tenders have been received for road-work and plate-laying, exclusive of the supply of rails and special track-work for the construction, on the underground conduit system, of tramways from Battersea Park Road to King's Road, Chelsea:—Dick, Kerr & Co., Ltd., £28,210 19s.; W. Manders, £29,147 3s.; Kirk & Randall, £30,236; A. N. Coles, £30,435 2s.; and John Mowlem & Co., Ltd., £30,687 11s. The tender of the Standard Engineering Co., Ltd., at £3,610 15s., has been accepted for the heating and ventilation of the second section of the Central Car Repair Depot. The following tenders were received for the supply of an electric winch:—Ernest Scott & Mountain, Ltd., £135 1s. 6d.; Clarke, Chapman & Co., Ltd., £166, less 2½ per cent. discount; Royce, Ltd., £165 10s.; General Electric Co., Ltd., £157 15s.; and Electric Construction Co., Ltd., £202. The tender of Messrs. Ernest Scott & Mountain, Ltd., has been accepted.

Fulham.—The Borough Council has accepted the tender of the Electrical Co., Ltd., for the supply of 150 electricity meters in various sizes, at the following rates:—3-amp., £1; 5-amp., £1; 10-amp., £1; 25-amp., £1 3s.; 50-amp., £1 4s.; 75-amp., £1 9s.; 100-amp., £1 11s. 6d. The total amount of the contract is £153 10s.

Hammersmith.—The Borough Council has accepted the tender of the Standard Cable Co., at £181, for 2,500 yards of 0·025 sq. in. low-tension service cable.

Hampstead.—The tender of the British Westinghouse Co. for a 1,000-kw. single-phase exhaust steam turbo-alternator has been accepted. A 250-kw. mixed pressure turbo-alternator has also been ordered from Messrs. Willans & Robinson, with condensing plant from the Klein Engineering Co. The switchgear will be obtained from Messrs. Ferranti, Ltd., and Messrs. Siemens Bros. Dynamo Works, Ltd.

Hornsey.—The Education Committee has accepted the tender of F. Bevan & Co. (Dartford), at £284 17s. 2d., for installing electric light in the Stroud Green School. Twenty-four tenders were received.

Stepney.—The Borough Council has received the following tenders for the supply of a power board and a lighting board:—Edison & Swan United Electric Co. (*a*) power board, £123 9s.; (*b*) lighting board, £12; Kelvin & J. White, Ltd. (informal), (*a*) £130 2s., (*b*) £21 8s.; General Electric Co., Ltd. (*a*) £142 (*accepted*), (*b*) £22; Elliott Bros. (*a*) £144 10s., (*b*) £22 5s.; W. White & Co. (*a*) £154, (*b*) £16 (*accepted*); A. W. Penrose & Co., Ltd. (*a*) and (*b*), £164; Crompton & Co., Ltd. (*a*) and (*b*) £192.

Messrs. Merryweather & Sons inform us that they have recently received an order from the Lancashire & Yorkshire Railway for an electrically-driven "Hatfield" treble barrel pump, capable of delivering 600 gallons per minute at 100 lbs. pressure when running at 135 r.p.m., driven by a 60 h.p. motor through chain-gearing, for fire protection purposes at Castleton.

South African Institute of Electrical Engineers.—The *Transactions* of this institution for May, 1910, contain a Paper by Mr. A. G. Heather on "Protective Devices for Electrical Apparatus," in which the author describes the various systems of protecting machines and circuits with special reference to A.C. relays. The report of the discussion includes some remarks by Mr. B. Price, the inventor of the Merz-Price system, who was present at the meeting in Johannesburg. A Paper by Mr. W. C. Brown describing a new type of machine for the magnetic extraction of iron from ore and pulp, and the discussion of a Paper by Mr. A. E. Scott on "Rotary Converters," are also included.

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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 5s. to £57 15s. per ton (last week, £56 5s. to £56 15s.).

ST. HELENS CABLE CO.—On Saturday last, the first annual bowling competition was held on the new green at the works. There were eighty-four entries for prizes of sets of bowls, presented by Mr. T. C. Callender and Mr. James Taylor, directors. The green was constructed by the staff, without expense to the company, early this year, and is situated in a corner of the works yard.

TRADE MARK.—Certificates of Registration under the Trade Marks Act have been granted to Messrs. Hans Renold, Ltd., of Brook Street, Manchester, manufacturers of the "Renold" driving chains, for the name "Renold" and the trade mark illustrated herewith.

PLANT FOR SALE.—The Sanitary Commissioners of Gibraltar have a 25-kw. single-phase Ferranti type alternator for sale, and seven Mordey-Victoria single-phase transformers; also induced draught fan. Some particulars may be obtained from the Crown Agents to the Colonies, Whitehall Gardens, S.W.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—The trustee in the bankruptcy of George Sutcliffe, electrical engineer, 22 Church Street, Abertillery, has been released.

The trustee in the bankruptcy of Ernest Goodman, electrical engineer, 3 Hertford Street, Coventry, has been released.

DISSOLUTION OF PARTNERSHIP.—J. A. Plumb and F. A. Horsfield, electrical engineers, 64 Newman Street, Oxford Street, London, and 62 Argyle Road, Tottenham, have dissolved partnership.

AWARD AT THE JAPAN-BRITISH EXHIBITION.—A supplementary list of Grand Prizes includes the name of the Rees Roturbo Manufacturing Co., Ltd., 20 Bucklersbury, London, E.C., for their exhibits of pumps.

G. HARLAND BOWDEN & CO.—The business carried on by Messrs. G. Harland Bowden, F. C. Anderson, and C. A. Atchley, under the firm name of "G. Harland Bowden & Co.," has been dissolved. Mr. Harland Bowden, having sold his interest in the business conducted from the Manchester and Glasgow offices to his partners, Mr. Anderson and Mr. Atchley, will continue the London and South Wales branch of the late firm at Suffolk House, 5 Laurence Pountney Hill, London, E.C. Mr. Anderson and Mr. Atchley will continue the Manchester and Glasgow branches in partnership at 196 Deansgate, Manchester, and 50 Wellington Street, Glasgow, as heretofore, under the firm name of "The Harland Engineering Co."

The Prevention of Accidents.—The National Association of Manufacturers of America has recently taken up the question of prevention of industrial accidents and industrial indemnity insurance, and has sent a Commission abroad to study the methods and practices in Europe. The Commission comprises Messrs. F. C. Schwedtman, chairman of the Association's committee on industrial insurance, and Mr. J. A. Emery, the legal adviser of the Association. These gentlemen have established headquarters in Berlin and London, and will visit all the more important manufacturing centres in order to inspect the various safety devices in use in factories, workshops, &c., and to obtain information relating to schemes of industrial insurance.

The Poisoning Fatality in Neal Street, Holborn.—At the meeting of the Borough Council yesterday, the Public Health Committee reported that early on the morning of June 10th, the police gave notice to the Borough Surveyor of an escape of "gas" in several of the houses in Neal Street, and that a number of the occupiers had been poisoned and removed to hospital. The Borough Surveyor communicated with the Gas Light & Coke Co., Ltd. No escape of coal gas, however, was found, but on opening up the public way in front of some of the houses the ground was found to be very hot, and the bitumen around the cables of the Charing Cross, West End & City Electricity Supply Company in a molten condition. The Borough Surveyor communicated with that company, who found about 150 ft. of their cables opposite the houses of Nos. 48 to 68 had been fused. The Medical Officer of Health, having made some inquiries, suggested to the Town Clerk the desirability of some inquiry being made into the matter by a Government Department, and the Town Clerk addressed a communication to the Home Office thereon. The letter was forwarded to the Local Government Board, who requested Dr. Bond to make an investigation into the matter. Dr. Mott, of the Charing Cross Hospital, who investigated the cases, expressed the opinion that the symptoms were due to carbon monoxide poisoning. The Medical Officer of Health has informed the Committee that in the houses where the cases occurred the front walls of the basements were defective, and the front areas and stall boards were quite enclosed, so that the "gas" could easily enter the houses. At the other houses there were either open gratings over the front areas or in the stall boards, or the front walls were well concreted, or a combination of these conditions, so that the "gas" could not enter those houses in any quantity. The Medical Officer of Health is now reporting in detail on the matter to the Local Government Board.

APPOINTMENTS AND PERSONAL NOTES

Linesmen for extra high tension work are required by the Yorkshire Electric Power Co. (See an advertisement on another page.)

A senior assistant to take charge of the new electric generating station, a junior assistant, and a second lecture assistant, are required at the Northampton Institute. (See an advertisement on another page.)

The Alloa Town Council have appointed Mr. H. A. Tulloch Borough Electrical Engineer. The Council have acquired the generating station of the British Electric Plant Co., from which hitherto a supply in bulk has been taken.

Mr. G. D. Vickers, who, as announced in our last issue, was appointed Assistant Electrical Engineer to the Watford Council, has declined to take up the position, owing to his firm at Smethwick having granted him an increase of salary. Mr. R. B. H. Cragg, of Bermondsey, has been appointed to the post.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Montreal Light, Heat & Power Co., 1¾ per cent. for the quarter to March 31st.—Kensington & Knightsbridge Electric Light Co., interim dividend on the ordinary shares for the June half-year at the rate of 8 per cent. per annum.—Fife Tramway, Light & Power Co., interim dividend on the preference shares for the June half-year at the rate of 6 per cent. per annum.

Chelsea Electricity Supply Co., interim dividend of 4 per cent. Buenos Aires Tramways Co., 1s. 3d. per share for the three months ended June 30th. St. James & Pall Mall Electric Light Co., interim dividend for the June half-year at the rate of 10 per cent. per annum on the ordinary shares.—Bristol Tramways & Carriage Co., 4 per cent. for the half-year ending June 30th.—Central London Railway Co., 3 per cent. per annum on the ordinary shares, and 4 per cent. on the preferred shares for the June half-year, carrying forward £40,000.

Metropolitan Electric Supply Co., interim dividend at the rate of 4 per cent. for the half-year ended June 30th.

METALITE.—Subscriptions are invited for an issue of 380,000 £1 shares. The Company has been formed for acquiring the business of the Bryant Trading Syndicate, Ltd. The subscription lists close on Friday for town, and on Saturday for country. The prospectus is given in our advertisement pages.

TELEGRAPH CONSTRUCTION & MAINTENANCE CO.—Lord Selborne has accepted the position of Chairman.

Institution of Civil Engineers.—H.M. King George has been graciously pleased to become Patron of the Institution of Civil Engineers, of which Institution he was an Honorary Member for 17 years before his accession to the throne.

The "Mazda" Lamp.—It may be of interest to our readers to know that the word "Mazda," now very prominently before the public as the trade name of a well-known metal filament lamp, is not so new as might be expected. In the writings of Zoroaster, the prophet of the Indo-Eranians, who lived in Persia some 3,500 years ago, the deity is addressed as "Ahura-Mazda," "Ahura" signifying Lord, and "Mazda" All-knowing. The Aryans, who followed the prophet's teaching, were called Mazdayasnians. The religion, a very pure monotheistic one, still lives among the Parsis of Bombay. The all-knowing is a very happy appellation of a lamp which is the result of combined effort of many investigators.

The Carbon Filament Lamp Trust.—According to the *Berliner Börsen-Courier*, there is a possibility of the dissolution of the carbon filament lamp trust formed in the year 1903 under the name of the Verkaufsstelle vereinigter Glühlampenfabriken Ges., Berlin. This combination includes firms in Germany, Austria-Hungary, Sweden, Holland, Italy, and Switzerland, and was intended to continue until the year 1914. Among the 18 members are the Allgemeine Elektricitäts Ges., Siemens & Halske A.-G., and the A.G. Pintsch. No British firms are included, and the French firms which joined have since fallen out. It is stated that the total sales of the combination have remained fairly constant at 30,000,000 lamps per annum, but that the profits during the last five years have diminished by two-thirds. One cause of the reduction in the profits is stated to be the new taxation which, it will be remembered, is based on the watt consumption, and therefore falls especially heavy on carbon filament lamps. On account of the possible reduction in prices and numbers sold owing to the competition of the tungsten and other metal filament lamps, and the large number of firms which are springing up outside the trust, the continuation of the trust seems improbable. As practically all the firms inside the combination are also manufacturing metal filament lamps, however, an attempt may be made to bring the sale of these also under the control of the trust.



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NEW COMPANIES

NORTH-EAST BRAZIL DEVELOPMENT CO., 1 and 2 Milk Street, London. Capital, £17,500 (7,000 cumulative preference shares). Civil, mechanical, and electrical engineers, railway and tramway constructors, &c.

EAST KENT ELECTRIC SUPPLY CO., 36 New Street, Ashford, Kent. Capital, £30,000 in £5 shares (1,500 preference shares). Electrical engineers, contractors, &c. The subscribers include Mr. H. T. Holman, Electrical Engineer, Chantry House, Headcorn.

METALITE.—This company was registered on July 21st, with a capital of £500,000 in £1 shares, to carry on the business of manufacturers of electric lamps, filaments, radiators, stoves, meters, and fittings, and apparatus and appliances of all kinds for use with electricity, and to acquire the businesses of the Bryant Trading Syndicate, Ltd., and International Filaments, Ltd. Minimum cash subscription, 150,000 shares. The number of directors is not to be less than three nor more than nine: the subscribers are to appoint the first. Remuneration, £400 each per annum (chairman, £500), and 5 per cent. of the net profits remaining after 15 per cent. dividend is paid, divided (such additional remuneration not to exceed £5,000 in any one year).

COMPANIES' MEETINGS AND REPORTS

CROMPTON & CO.—As announced in our last issue, there was a debit balance of £23,369 on the past year's working. The report states that, in view of keeping the works employed, a considerable amount of business has been taken at cost. The completion of a large contract in the East has entailed a heavy charge on the year's accounts, whilst litigation in connection with an order for pumping plant has involved the company in special legal expenses. The actual loss for the year, after making the usual provision for depreciation and charging repairs against revenue, was £20,493, compared with a profit of £10,051 for the previous year. After meeting debenture interest and other charges, and deducting the balance brought forward, the total debit is as mentioned above. The Board have decided to write down the company's holding in the Electric Supply Corporation to £4 per share, taking the necessary amount from the reserve fund. During the past year exceptional expenditure has been incurred in connection with an invention which is likely to prove of great value to the company. With the exception of £600, the price of purchasing the patent in this connection, the whole of this expenditure has been charged to revenue. Taking all things into consideration, the directors are of opinion that by the exercise of the most rigid economy a profit can be earned, even on the basis of the present low prices. Since the close of the financial year an improvement is noticeable in the value of orders coming from Colonial and foreign sources.

EAST LONDON RAILWAY.—At the meeting on Tuesday, Lord Claud Hamilton, who presided, spoke in favour of the electrification of the line, and proposed to approach one or two of the large electrical companies with regard to the scheme of electrification on a principle of deferred payments extending over several years.

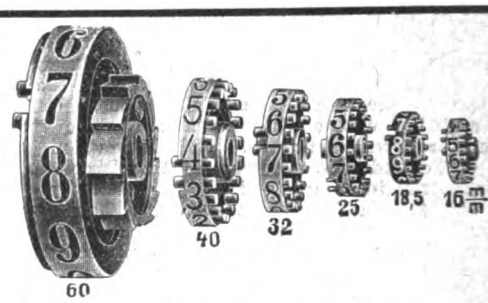
CITY & SOUTH LONDON RAILWAY CO.—Mr. C. B. Stuart Wortley presided at the annual meeting on Tuesday, when the report and accounts abstracted in our last issue were adopted. He defended the reduction in fares that have been made, and spoke at some length on the proposals with regard to the establishment of a Conciliation Board.

Electric Traction on the Metropolitan Railway.—Before the Railway and Canal Commissioners on Thursday, a dispute was heard between the Metropolitan Railway Co. and the Great Western Railway Co., with reference to the conversion to electric traction of the Hammersmith-City line. The Great Western Co. have running powers over the Metropolitan system from Bishop's Road to the City, for which an annual rental of £15.000 is paid. The Metropolitan Company's Act of 1908, which authorised the conversion to electric traction of that Company's system, provided that any dispute between them and the Great Western Co. on this matter should be referred to arbitration. The two Companies have been unable to agree as to the payment to be made to the Metropolitan Co. in connection with this conversion. Mr. Balfour Browne, K.C., for the Metropolitan Co., claimed the actual cost of the conversion, plus a reasonable profit. Sir Alfred Cripps, K.C., for the Great Western Co., contended that the payment to be made should be based on the actual saving of working expenses to the Great Western Co. The Court held that the arbitration clause of the Act of 1908. referred to above, should be construed in the manner argued by Sir Alfred Cripps. Counsel for both parties are to agree, and submit a decision to the Court.

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ELECTRICAL ENGINEERING

No. 188 [Vol. VI., No. 31] THURSDAY, AUGUST 4, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

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Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

Official Notices and Technical College Announcements are inserted at the rate of Ninepence per line (column width).

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Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

Our monthly supplement on Electrical Engineering in Mines is included in this issue. It opens with an article on colliery supply in Northumberland and Durham, outlining the work of the large power companies in that district, and a short account is given of a visit to the electrical installation at a lead mine. Some extracts follow from the reports of H.M. Inspectors of Mines, and an abstract of a paper putting in a plea for the use of earthed concentric cables in collieries is published. Further articles deal with American regulations for electricity in mines, mining cables, and accessories and mining patents published during July.

Mr. George Flett, Managing Director of Messrs. Dick, Kerr & Co., Ltd., was killed in a motor-car accident last week. (Page 504.)

At the half-yearly meeting of the London, Brighton & South Coast Railway Co. yesterday, it was stated that the South London single-phase line continues to give the utmost satisfaction, both commercially and technically. The contract with the London Electric Supply Corporation for the supply of electrical energy has been revised, and this will result in a substantial decrease in the cost of energy. The single-phase system is now being applied to the line from Peckham Rye to the Crystal Palace. (Page 504.)

The summer meeting of the Institution of Mechanical Engineers was held last week in Birmingham and London in conjunction with the American Society of Mechanical Engineers. The Papers discussed in Birmingham related mainly to general railway matters, machine tools, &c., but the Papers read in London were entirely devoted to electric traction. Mr. F. W. Carter dealt with electrification of suburban railways, giving some comparative curves for continuous-current and single-phase motors, and discussed the matter generally. Mr. H. M. Hobart took up a vigorous attitude against single-phase working for suburban lines; similarly Mr. W. B. Potter put in a plea for 1,200 volt continuous-current working even for infrequent service; Mr. L. R. Pomeroy gave some comparisons between steam and electric working for main line service, but showed that there were not the same advantages for electric traction as for suburban service. Mr. G. Westinghouse, on the other hand, was certain that electrification would ultimately extend to main lines, and emphasised the importance of a standard system to facilitate interchange of traffic, recommending single-phase working for the purpose. (Page 505.)

Judgment has been given against the West Ham Corporation in the case brought by the India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., concerning the financial management of the West Ham electricity undertaking. The judgment took the form of a number of declarations, but injunction was not granted. (Page 509.)

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The Leicester Corporation have decided not to appeal against the recent decision of Mr. Justice Neville, in which he held that the Electric Lighting Acts do not authorise municipalities to wire premises or supply fittings. The Electrical Contractors' Association have suggested to the Sheffield Corporation that they should accept this judgment. (Page 509.)

Among the specifications published by the Patent Office on Thursday last was one by the British Thomson-Houston Co. for a system of electrical marine propulsion, in which the motor is permanently connected with the generator, the reversal being obtained by running a reversing element of the main turbine.—Messrs. J. H. Holmes & Co. and W. A. Clatworthy have applied for leave to amend their patent for the electric driving of printing presses by substituting a new claim for the two first claims which were stated to be invalid by the Appeal Court last January.—A patent by J. Schmidt for a steam turbine rotor disc with radial slots in which to fix the blades, expires on Sunday after its full life of fourteen years. (Page 510.)

According to the annual report on the work of the Public Health Department of the Corporation of London, new flame arc lamps have been substituted for some of the old open-type lamps in use in the City for street lighting, but the total number of arc lamps has not been increased. The number of gas lamps has decreased by ten. Experimental arc lighting is still in progress. (Page 511.)

Two 3,000-kw. Curtis turbines have been started up at the Bradford electricity works.—There was a deficit of £2,029 upon the Bristol electricity undertaking last year.—Cardiff tramway accounts show a net profit of £11,032 for last year, and Derby tramway accounts £3,626.—At St. Pancras, the net profit last year upon the electricity undertaking was £9,506.—An additional steam generating-set is to be installed at Launceston (Tasmania) in preference to a Diesel engine.—West Bromwich Corporation have refused an offer from a power company for a supply of electricity in bulk. (Page 511.)

A new storage battery is to be installed at Accrington; cable is required at Barking; a loan of £52,000 is being applied for by the West Ham Corporation, and extensions are to be carried out at Heston and Isleworth, Hounslow, Leicester, Southampton, Southend, Stoke-on-Trent, and Wrexham.—The Amsterdam municipality propose to erect a power station. (Page 512.)

A dividend of 14 per cent. is recommended by the A.E.G. (Berlin) for 1909.—A contract has been entered into for the extension of the Central London Railway to Liverpool Street.—An interim dividend at the rate of 5 per cent. per annum is recommended by the Rees Roturbo Development Syndicate.—Dividends of 6 per cent. are declared upon both preference and ordinary shares of the Dublin United Tramways Co. (Page 514.)

OBITUARY

George Flett.

Mr. GEORGE FLETT, Managing Director of Messrs. Dick, Kerr & Co., Ltd., had so many personal friends in the electrical industry that the announcement of his death will come as a shock to many of our readers. On Wednesday last week, in Birmingham, he was being driven in a motor car to New Street Station, and was seated next to the driver. A child suddenly ran across the road, and, in swerving to avoid him and simultaneously applying the brakes, the driver tilted the car over. The body of the car fell on Mr. Flett, who was killed.

George Flett was born in January, 1855, in the town of Wick, N.B. He received his early training in Glasgow, and entered into active life in London some 28 years ago, when he became associated with Messrs. Dick, Kerr & Co., Ltd. From his early days in London he had been intimately connected with tramway contracts in this country, and saw the gradual extinction of the horse tramways, the partial adoption of cable traction, and the general use of electric traction. While his early experience was chiefly gained in contracting, he had been for the last 12 or 13 years closely concerned with the manufacturing side of electrical engineering, and in this connection had been associated with some very notable developments. One of the most important schemes in which he was deeply concerned was the electrification of the Liverpool and Southport section of the L. and Y. Railway, while contracts for electric tramways and railways at home and abroad were constantly engaging his attention. Having made during his career prolonged journeys abroad, it was natural that he should have become associated with electrical schemes, and at different periods had succeeded in carrying through important electrical contracts in Japan and the Far East. In addition to being Managing Director of Dick, Kerr & Co., Mr. Flett was a director of the Metropolitan Amalgamated Railway Carriage & Wagon Co., Ltd., the Patent Shaft & Axletree Co., Ltd., the Projectile Co., the British Aluminium Co., Ltd., the Rio de Janeiro Tramway Light & Power Co., the Mexican Light & Power Co., Ltd., the Monterey Railway Light & Power Co., and the British Engineering Co. of Egypt. Although Mr. Flett never contested a Parliamentary election, he was a keen and outspoken advocate of Tariff Reform. Being a broad-minded man, he chafed against the problem having become too much of a party one, viewing the desirability of Tariff Reform from the wide imperialistic point of view, and as a means of strengthening the tie between the Colonies and the Mother Country. He was a member of Mr. Joseph Chamberlain's Tariff Reform Commission.

ELECTRIC TRACTION ON THE BRIGHTON RAILWAY

The continued success of the South London single-phase railway was the chief point of interest at the half-yearly meeting of the London, Brighton & South Coast Railway Co. yesterday, and the work of converting the existing line to the Crystal Palace has actually been commenced. The scheme of extension consists of the railway from Peckham Rye, where a junction is made with the South London Railway, through Tulse Hill to the Crystal Palace, and from Battersea Park, where the South London line is joined again, through Clapham Junction, Balham, and Streatham Hill to West Norwood, where the first-mentioned line is met. These lines form a very important part of the company's suburban system, and serve some of its most populous districts, most of which are intersected by the London County Council tramways. The large increase in the number of passengers carried on the South London Elevated Electric Railway during the first few months of operation has been maintained, whilst the officials have nothing but praise for the system from the mechanical point of view.

Consideration has had to be paid to the cost of electrical energy, which apparently has been felt to be too high a percentage of the total working costs. It is admitted, however, that the introduction of the single-phase system was a big experiment, and without experience either on the part of the railway company or the London Electric Supply Corporation, who supply the energy, it was difficult to arrange very close contracts. Now, however, that it has been decided to extend the system, the company have been able to revise the arrangement with the London Electric Supply Corporation upon a more favourable basis, which will substantially decrease the cost of current. There was an increase during the half-year of £9,092 in locomotive power expenses, which is attributed to the cost of electric energy. The company carried 2,000,000 more passengers during the half-year, and due credit is given to the electric line for this, although the main line traffic has also increased.

Lord Bessborough, who presided at the meeting, expressed the regret of the Board at the death of Major Cardew, who was a director of the company for a short time. The report and accounts were adopted without any discussion beyond an expression of satisfaction on the part of one shareholder that the single-phase system had proved satisfactory in spite of the doubts that were being cast upon it.

Serious Fire at Accrington.—It is rumoured that a serious fire at a large drapery establishment last Saturday at Accrington was electrically caused, although as the building was completely gutted, there is no reliable evidence. It appears that the shop was packed with inflammable material from floor to ceiling, even in contact with flexible wires used for window lighting.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

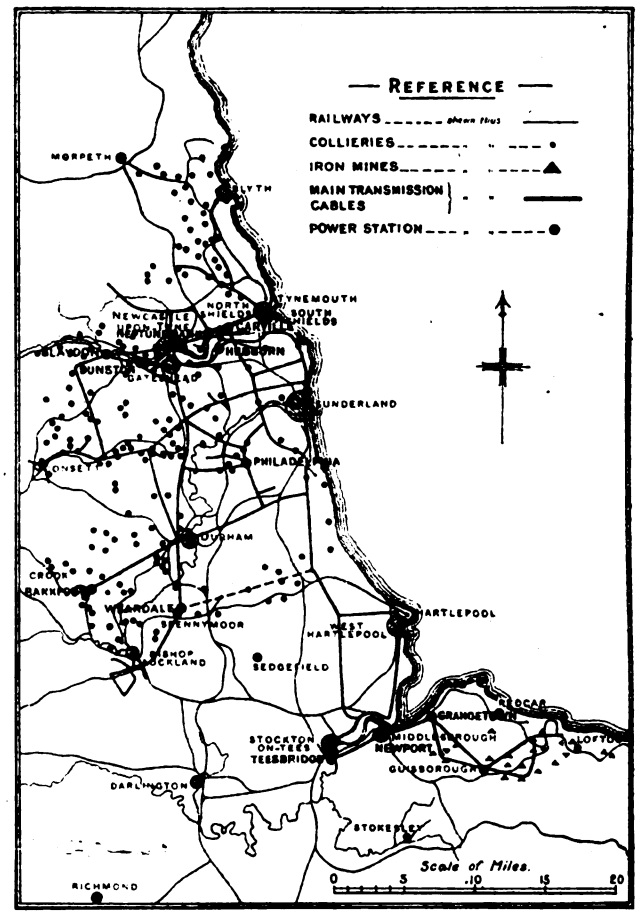
Letters should be addressed, "The Editor, Electrical Engineering, 203-206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

COLLIERY SUPPLY IN NORTHUMBERLAND AND DURHAM

THE system of co-operation in the north-east of England between the supply authorities and consumers, such as iron works and collieries with coke ovens who have large amounts of waste heat to dispose of, has been from time to time referred to in these columns. In particular, reference may be made to the Papers by Mr. C. H. Merz (Electrical Engineering, Vol. IV., p. 505) and by Mr. A. B. Gridley (Electrical Engineering, Vol. V., p. 38). The power companies concerned are the Newcastle-upon-Tyne Electric Supply Co., Ltd.; the County of Durham Electrical Power Distribution Co., Ltd., and the Cleveland & Durham County Electric Power Co. These three companies have their own coal-fired generating stations, but also buy electric power in bulk from a company called the Waste Heat & Gas Electrical Generating Stations Co., Ltd., which owns many of the waste-heat stations. All the power generated in these stations is taken by the three companies and distributed amongst their consumers, and the companies pay a small price for the energy, besides paying all the operating and maintenance costs connected with these stations. Continued progress is being made in the district, and the reports for 1909 of the two larger companies record an increase in the horse-power connected of 23,420 h.p. over that at the end of the previous year. The connections to the Newcastle Co.'s system at the end of 1909 amounted to 129,219 h.p., and those of the Durham Co. to 35,024 h.p. This progress has been made in spite of the depression in manufacturing business generally, and the unsettled state of the coal trade.

As illustrated in the accompanying map, the network of mains now spreads over a large area between Blyth in Northumberland and Loftus in Cleveland. It consists of some 300 miles of three-phase H.T. cables laid underground on the solid system and some overhead lines. The cables from Blyth run through the eastern portion of the Northumberland coalfield, through Tynemouth and North Shields into Newcastle. The main cables south run through the East Durham coalfield to Billingham, and from there through Stockton into Middlesbrough. Duplicate cables run from Middlesbrough to Grangetown, and from there into the iron mines district. Another route from Newcastle runs along the main road from Gateshead to Durham. From Durham a 20,000-volt cable connects the northern systems and the southern system at Weardale. These two main lines running north and south are interconnected at various points. Other connections have been made, so that there are duplicate routes interconnecting the north and south systems. The chief coal-burning power stations are Carville, Philadelphia, Neptune Bank, Dunston, Hebburn, and Grangetown. At Blaydon, Newport, Weardale, Bankfoot, and Tees-



GENERAL MAP OF NORTH-EAST COAST POWER SUPPLY SYSTEM.

bridge, there are waste heat stations running at their full capacity day and night.

The Newcastle Company is hurrying on the completion of the 30,000 h.p. generating station at Dunston, as the demand for power is steadily increasing. This station will bring the total horse-power of the generating plant under the control of the company up to 115,000 h.p. During 1909, a trunk main was laid connecting the Carville power station with the Cleveland & Durham Power Co.'s system in Middlesbrough. The main overhead line between Durham and Crook, and the power station at the latter place installed for utilising the waste heat from the coke ovens of Messrs. Pease & Partners (who have motors installed aggregating 1,800 h.p.) have also been completed. An extension of the company's mains has been made in the

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Northumberland area, where an additional cable has been laid between the Carville station and Blyth.

It is hardly necessary to point out that where a district has been covered with mains, there are usually considerable advantages in taking a supply from a power company over a private plant. In the north of England, even where collieries or works have waste heat, it usually pays to make an arrangement with the power company. This is obviously so where collieries have a surplus of waste heat, and make an arrangement with the power company for disposal of what would otherwise go to waste. Again, where they have not sufficient waste heat for their own requirements, it may pay to make an arrangement with the power company, as the latter can often make up the difference more economically than the collieries could, by installing separate plant. The same may also apply in the case of some iron works. In such cases the power company's system acts as a regulator to the consumers' installation. If at any time of day there is a surplus of waste heat, it is taken by the company, if at other times of day the consumers want rather more power, they take it from the company. The power company's system also acts as an efficient standby, and thus avoids the necessity of the consumer spending a large amount of money on spare plant. This standby is particularly useful at week-ends and on holidays, when possibly a consumer only requires a very small amount of power, and where it would not pay to keep the men and labour necessary to run private plant.

It may here be of interest to quote the remarks of Sir Hugh Bell, in summing up the discussion on the Paper read by Mr. Merz at the meeting of the Iron and Steel Institute in Middlesbrough two years ago. Sir Hugh Bell recommended that anyone putting down his own generating plant should adopt the same system, as regards periodicity, for example, as that of the power company in the district, because, he said, "If he (the manufacturer) had any electricity to spare, the power company would buy it from him; if he wanted any electricity in addition the company would give it to him . . . if he liked to go to the company of the district and invite them to put down his power plant for him, they would put it down if they thought it would pay; if he thought he could make more money by putting it down himself and selling his surplus supply they were quite content." Even if a colliery or iron works, having a certain amount of waste heat, could find a consumer for it other than the power company, it would be difficult to get such a consumer to use his energy exactly when it was available, and in any case the consumer would be liable to be shut down at any time by strikes, or accidents at the colliery or works. Even if these difficulties were overcome, the colliery could not agree to supply anyone whose requirements were not well below the supply available, whereas by running in parallel with the power company's system no such margin is necessary, and it is possible to dispose of the whole of the waste energy.

There are now as many as fifty collieries taking power from the combined companies' mains. Foremost among these is the Harton Coal Co., Ltd., who have some 9,500 h.p. installed in motors distributed over five pits. The Lambton Collieries, Ltd., have some 1,000 h.p. in motors connected at Sherburn Colliery, and amongst the other collieries supplied are Messrs. Pease & Partners, Ltd., the Priestman Collieries, Ltd., and the Hetton Coal Co.

Where the colliery takes power only, and has no waste-heat plant, a small sub-station for transforming the current down from the supply pressure of 6,000 volts to the distributing pressure of 600 volts, is provided. This comprises four compartments, two transformer chambers, and two switchgear chambers, one containing the supply company's switchgear, and the other the consumer's switchgear. The supply is in duplicate, and one transformer and its switchgear can be isolated while repair work or cleaning is being carried out. Fireproof construction is used, and the transformer chambers are carefully ventilated.

Compensation for Colliery Fatality.—Judgment has been given by Sheriff Thomson, of Hamilton, in an action brought against Messrs. A. Russell, Ltd., for compensation for the death of J. Wallace, who was killed by electric shock in Dechmont Colliery, Cambuslang, in December, 1909. The deceased was working in a motor room underground, and came in contact with a coil of live cable which was hanging up. The judge stated that though the accident happened in the course of the deceased's employment, he had had difficulty in deciding that it had arisen "out of" his employment. In the absence of evidence that he was wrongfully contravening a rule of the pit, however, he felt constrained to draw the inference that it was so. He therefore found that the pursuers were entitled to compensation, which he assessed at £300.

ELECTRIC POWER IN A LEAD MINE

ON Monday, July 25th, the members of the Cumberland branch of the Association of Mining Electrical Engineers visited the Glenridding Lead Mines, Ullswater. The power station is equipped with two water turbines of 100 b.h.p. each, working under a 300-ft. head of water obtained from Helvellyn, about two miles distant, through 15-in. cast-iron pipes. The turbines were supplied by Messrs. Gilkes; one is a 1,000 r.p.m. vortex-type turbine and was installed in 1891, and the other, a pelton wheel running at the same speed, was supplied in 1898. The generators are 70 kw., 600-volt D.-C., compound-wound, belt driven at 600 r.p.m. Each feeds two pairs of mains, 19/15 B.W.G., which carry the current to the mines 2¼ miles distant, part of the line being overhead. The cables in the mine are rubber insulated and carried on insulators. Underground there is an air compressor supplying air for rock drills at 60 lbs. pressure, and belt-driven by a 40 b.h.p. compound-wound motor. A 40 b.h.p. winding motor hoists the ore in cages from the lower levels to the adit level, where an electric locomotive takes the loaded wagons a distance of 1¼ miles to the surface. The locomotive is capable of hauling a load of 20 tons. The total depth of shaft is 450 ft. At the 60-fathom level there is a three-throw pump working under a 360 ft. head, pumping 3,000 gallons per hour, driven by a 10 h.p. motor; at the 90-fathom level there is a similar pump. The whole of the pumping water runs out of the adit by gravity. Underground there is a sub-station to convert from 600 volts to 250 volts for the locomotive, which derives its power from two overhead hard-drawn copper lines of 000 B.W.G. section. The locomotive has a series wound 20 b.h.p. motor, and attains a speed of five m.p.hr. loaded. The current is collected by two trolley-arms. The whole of the mine is lighted by electricity above and below ground. There has never been any person injured by electric shock since the introduction of electric power into the mines, and no serious breakdowns have occurred. At the surface is a generator supplying current at 300 volts for driving the locomotive, should any repairs be necessary to the sub-station underground; this machine is driven by a turbine, and the armature is so constructed that, when in series, it will give the higher voltage, and when in parallel, 150 volts for lighting the works at the surface. The various dressing machines are driven by water power.

After the visit Mr. W. H. Borlase, senr., of the Glenridding Mines, stated that in 1890 it was discussed as to which was the most economical power to use in working the mines. The Company had tried hydraulic power and compressed air, and after some discussion and a visit to an electrically equipped mine, it was decided—in March, 1891—to instal electric plant at a cost of £5,000, and by Christmas of that year the plant had saved the company £300 on their previous working. The plant had now been working for twenty years. Some few years ago it was decided to purchase an electric locomotive at a cost of £1,200. At the end of twelve months the locomotive effected an economy of £800, and since its installation had never lost a day's working.

Colliery Accidents.—On July 21st last, W. J. Barrett, a miner, was killed by electric shock at the Blaydon Burn pit of the Priestman Collieries, Ltd. It appears that a steam pipe which had been recently placed in the pit had pressed upon and broken another iron pipe containing a power cable, with the result that the insulation of the cable was damaged, and an adjacent telephone wire made alive at 260 volts. The deceased received the shock from the telephone receiver, and although the current was immediately cut off, artificial respiration proved of no avail. At the inquest, a verdict of accidental death by electric shock was returned.

An inquest was held at New Tredegar recently concerning the death of W. H. Brown, who was killed by electric shock at the Elliot Collieries of the Powell Duffryn Co. Evidence was given to the effect that the deceased had attempted to remove the oil tanks from some oil-switches underground without first having the current switched off, and that his hand had come in contact with the switch blades. A verdict of accidental death was returned.

A similar verdict was given at an inquest, held at Hengoed, on the death of J. Rossiter, a sinker, who was killed by electric shock at the Penallta Colliery, Cylla Valley. The deceased was moving a power cable from a spot where some shot-firing was to be done, and touched a portion of the cable where the insulation had been worn off.

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REPORTS OF THE INSPECTORS OF MINES

ALL the reports of H.M. Inspectors of Mines for 1909 have now been issued, and it is of interest to note the increasing space which is taken up by electrical matters. We give below notes from portions of the reports dealing with electrical working taken from the general digest issued by the *Colliery Guardian*. We have not repeated details of accidents already fully reported in ELECTRICAL ENGINEERING.

East Scotland District.

Mr. R. McLaren reports that in this district 198 of the 283 coal-cutting machines in use are electrical, and of these, 128 are of the disc type. There were no fatal accidents due to electricity, but three non-fatal accidents took place. A drawer who was proceeding out-bye with a loaded tub, which left the rails and struck the cable, is said to have received a slight shock. While a coal-cutter attendant was lifting a new face cable, a short-circuit took place, causing a flame, whereby he was burned. Two men engaged at a coal-cutter received a shock by the machine becoming live, due to a faulty plug and socket. Two prosecutions were taken for contraventions of the electrical rules, but in neither case were the defendants found guilty.

West Scotland District.

Here again electric coal-cutters preponderate, being 153 out of 206; of these, 83 are disc, 58 are bar, and 12 are chain machines. An explosion of fire damp due to a plug connecting two lengths of cable being withdrawn when current was on occurred at Ferniegair Pit (see ELECTRICAL ENGINEERING, Vol. V., page 723). In addition to this accident, at which three persons lost their lives, Mr. Mottram reports three other fatal accidents due to electricity, entailing the loss of three lives during the year. In one case at Auchingeich Colliery an "unauthorised" man was handling a coil of wire with defective insulation (see ELECTRICAL ENGINEERING, Vol. V., page 742). In the second case a man at Dechmont Colliery, Lanark, made accidental contact with a live part of a lighting circuit fed by an autotransformer, and received the full voltage. The third fatality at Polmaise, Stirlingshire (see ELECTRICAL ENGINEERING, Vol. V., page 151), was due to a defective controller and insufficient earthing.

Newcastle District.

In the Newcastle district only 45 electrical coal-cutters are used against 178 compressed-air machines; 20 are of the disc type, 17 of the bar type, and 8 of the chain type. Mr. J. B. Atkinson does not mention any electrical accidents in his report.

Durham District.

Mr. Bain writes that the number of coal-cutters has decreased by 40 since the previous year; 67 are driven electrically, and 68 of compressed air; the disc and bar machines are about equally divided. There were two fatal and three non-fatal accidents due to electricity underground. In one fatal case, at Shildon Lodge Colliery (see ELECTRICAL ENGINEERING, Vol. V., page 833), a man attempted to tighten up a live terminal nut behind a switchboard. At Murton Colliery a man received a shock when removing an adapter from a lamp-holder, but was revived by artificial respiration; another non-fatal case was due to a coal-cutter driver allowing his machine to run over and damage the trailing cable. A case of an oil-immersed controller catching fire is also reported.

Yorkshire District.

In Yorkshire 123 electric coal-cutters, mostly of the disc type, were in use, against 135 compressed-air machines. A larger proportion of the machines are electrical than formerly, but the total number of them has decreased. Mr. Pickering has in previous reports expressed an unfavourable opinion as to the dangers of electrical working, and points to the Ackton Hall Colliery explosion (see ELECTRICAL ENGINEERING, Vol. VI., pages 8 and 120), which was caused by a defective switchbox, to corroborate his fears. He does not, however, report any other electrical accident in his district.

North and East Lancashire and Ireland District.

Thirteen electric cutters are now in use in the Manchester district, against 111 compressed-air machines, and one electric cutter is used in Ireland. One electrical accident is recorded by Mr. Gerrard, and this only entailed slight injury to a man who carelessly touched a live part of a switch at Bradford Colliery. At Mr. Nelson's inquiry into this occurrence, several unsatisfactory features of the installation were discovered, and have been rectified.

Liverpool and North Wales District.

Mr. H. Hall remarks that the use of coal-cutting machines makes a larger output possible for a more limited area of working face, and in thin hard seams effects a considerable economy. The managers of a particular group of collieries express themselves satisfied with the practical results obtained by machine coal cutting, and are disposed to rely more and more upon that method in preference to manual labour. The Inspector considers that compressed-air coal-cutting machines might be applied more economically if advantage was taken of the electric haulage motors to work compressors underground. These motors are not required for haulage during the night, and they are thus at liberty to be coupled up to air compressors. The total number of coal-cutters in use in the district is 139, but only 13 are driven electrically. The only electrical accident mentioned is that at Wynnstay Colliery, Ruabon, of which particulars were given in ELECTRICAL ENGINEERING, Vol. V., page 237. Electric haulage, remarks the Inspector, is becoming very general in the mines, and greater care and skill have been exercised in the more recent installations. Electric power has great advantages; it is easily applied and very reliable; and where the mineral is being worked at long distances from the shaft, the haulage can be done in steps, thus avoiding the necessity of using very long and heavy ropes. Perhaps the gravest danger in connection with the application of electricity for motive power in collieries is the possibility of fires being started in main intake air-ways through accidental damage to the conducting cables and consequent short-circuiting.

Midland District.

In this district 106 electrically driven coal-cutters are at work, compared with 89 compressed-air machines; 48 of the electrically driven cutters are of the disc type, and there are 25 bar, 30 chain, and three rotary heading machines. Four persons were killed by electric shock in three accidents. One of these at Newdigate Colliery was due to a haulage rope becoming live through leakage. The second accident was that at Clifden Colliery, described at some length in ELECTRICAL ENGINEERING, Vol. V., page 667. The third accident, at Denby Colliery, was described in ELECTRICAL ENGINEERING IN MINES, December 2nd, 1909, page xiii. Among five non-fatal cases of shock is mentioned one caused by an inquisitive man putting his thumb into an empty lampholder, forming part of a circuit of several lamps in series. Another fatal accident is mentioned which was probably due to shock from a gate-end box of a design that has since been superseded. Mr. Walker remarks that there is a tendency amongst users of electricity, when it is pointed out to them that their systems do not comply with the requirements of the electricity special rules, to reply that as the installations were in use before the rules came into force they do not apply to them. It seems that, seeing the rules have now been established close upon five years, there has been ample time to bring the old installations up to the standard required by the rules, and there should now be no installations which do not comply with them. In many cases such small matters as the protection of fuses not placed within 2 ft. of the floor, providing efficient gate-end boxes and earthing same, have not received any attention. He has, in consequence, in some instances, given the agents and managers notice to comply with the rules. At many collieries the management, in addition to complying with the electricity special rules under the Coal Mines Act, have drawn up instructions for the guidance of those who have charge of the plant on the surface and in various parts of the mine.

Stafford District.

Mr. H. Johnstone records the use of 25 electrical coal-cutters, and 28 compressed-air machines. At Hamstead Colliery a deputy was injured by the exploding of an electric relighter when lighting a safety lamp. The apparatus consisted of the usual cubical cast-iron box, surmounted by two concentric cylinders, the inner of which, in which the lamp to be lighted was placed, could be revolved within the outer one. The cast-iron box contained the accumulators and a zinc box enclosing the induction coil, and was closed by a gas-tight door. It is believed that in moving the apparatus about some of the acid in the accumulators had been spilled, and had come in contact with and corroded portions of the zinc box. Sufficient hydrogen had thus been evolved to render the air in the cast-iron box explosive, and the spark from the induction coil, resulting from the passing of the current to light the lamp, ignited the mixture. The explosion burst the box, the sides of which were $\frac{3}{8}$-in. thick. Since this accident occurred, the makers have radically altered the design of the apparatus with a view to the elimination of the risk of similar accident. Only one non-fatal accident by electricity on the surface was reported. A motor driving a coal screen and belt was stopped on full load for some temporary purpose. When signalled to re-start, the motor-man thoughtlessly neglected to shift the driving belt on to the loose pulley, and attempted to start against the load by throwing the switch over into the "running" position. Realising his mistake, he switched off at once, causing an arc and flash which burned his hand and wrist.

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Cardiff District.

Only six electrically driven coal-cutters and 21 compressed-air cutters are in use, and Mr. F. A. Gray remarks that coal-cutting machines have not made much headway in the district. They are not needed in the thick steam coal seam, as generally the coal is easily worked, and in some seams there is considerable difficulty in keeping it up until required down. A serious fire at Blaenant Colliery was probably caused by a short-circuit on a motor, setting fire to some oily woodwork, but neither underground nor on the surface was anyone killed or injured by electric shock.

Swansea District.

Mr. J. Dyer Lewis writes that the introduction of labour-saving coal-cutting machines is not so rapid as in the other districts. The many thin seams of the district where holeing is a laborious and dangerous operation could be more economically and safely performed by the different types of machines now on the market. The number of electrically driven cutters was 18, against six compressed-air machines. A fatal explosion of fire damp at Caedan Colliery, which appears to have been due to sparks from a motor, was described in ELECTRICAL ENGINEERING, March 3rd, page 151. Another accident, said to have been partly due to electricity, was that at Tareni Colliery, where an in-rush of water had carried away the supports of the cables, and some men, in endeavouring to escape from the water, are reported to have received shocks, although there is some doubt upon the matter (see ELECTRICAL ENGINEERING, January 27th, page 56). Two other fatal electrical accidents are reported in the district. One of the fatal cases at Ynyscedwyn Colliery was due to a hauler attempting to connect a broken lighting cable. The other fatal case, in which two lives were lost, was at Cribbwr Fawr Colliery, Cornwall, owing to a cable having been damaged by a runaway tram (see ELECTRICAL ENGINEERING, Vol. V., page 766). Two non-fatal accidents are also reported. An electrician was injured at Maesteg Deep Colliery power station by a short-circuit between two brushes, causing a flash, which burned his fore-arm. A pumpman at Tirydail Colliery, Carmarthen, also received a shock, owing to a signal wire becoming live by contact with a cable that had been damaged by a tram.

Southern District.

Mr. Martin gives the electrical coal-cutters in use as nine, and the compressed-air machines as 14, and states that no fatality from electricity occurred.

EARTHED CONCENTRIC CABLES FOR COLLIERIES

A PAPER entitled "The Earthed Concentric System for Direct-Current Colliery Cables," by Mr. W. Bolton Shaw, was read on May 28th before the Lancashire Section of the Association of Mining Electrical Engineers. The author commenced with some general remarks on the covering of cables, laying stress upon the necessity for adequate protection of the insulating material, especially underground. The most obvious way was the provision of a metallic covering. The objection to lead for this purpose was that, of all ordinary metals, it was least able to resist cutting, puncture, abrasion, or deformation. Iron or steel strips distributed the effect of a blow over a larger area of the insulation beneath, but added nothing to the longitudinal strength of the cable. Wire armouring wound with a long lay was the best form of protection, and allowed the cable to be strongly gripped by clamps for anchoring purposes. Armouring, however, added in some ways to the danger from shock unless efficiently earthed. Concentric cables were preferable to separate cables for each pole, on the score of cheapness and compactness, as well as less self-induction; they were also preferable to single cables with twin conductors.

If the outside earthed metallic layer or armouring is used as one of the current-carrying conductors, the cable can be made as a single-core armoured cable, and it was this arrangement that the author favoured for direct-current colliery work. It practically halved the fuse and switchgear, making it single-pole, and reduced risk of breakdown and cost of repairs. It also reduced the risk of danger by making continuity of the armouring one of the essentials to supply. The system had been largely applied in Scotland, and also to a considerable extent in this country. Leakage was easier to detect, as it led to a complete short circuit quicker, and isolated the faulty circuit, and in the author's opinion the risk of fire from a momentary short-circuit confined within an earthed envelope was less than from continued leakage. The armouring also provides a substantial visible conductor to which motor frames, switches, cases, &c., can be connected for earthing. The principal disadvantage of the system is the fact that, as the armouring carries current, there is a fall of potential along it. If, therefore, the system is earthed only at the negative bar on the main switchboard as it ought to be, there will be an appreciable difference of potential between the far end of the armouring and earth, and this may be sufficient to cause slight sparking on contact between the cable and pipes, rails, &c. A light form of insulation, such as a layer of compounded jute, can be used to obviate this, although, if motor frames are earthed to the cable, the objection may still apply. The author is doubtful, however, whether the risk involved is really appreciable. At the colliery with which he was formerly connected the system was in use, and earthing of the coal-cutters to the cable was at first avoided for this reason, but later experience with them earthed in this way has not shown that the fear was justified.

A substantial earth connection should be made to the negative bus-bar on the main switchboard, and taken to two independent earths. The negative terminals of the generators should be connected to the bar through circuit-breakers, but there must be no other joint on the negative side where the circuit can be broken. All motor-starters, &c., must, of course, be on the positive side.

The author passed on to a consideration of coal-cutter trailing cables, which are a fruitful source of accident. They should be as flexible as possible, able to withstand crushing. Ordinary armouring is too stiff, but a concentric layer of fine copper wires used as the return will give the required flexibility. It is desirable to have a thick padding of jute or other soft and tough material between the insulation of the inner conductor and the outer, and also to lap the insulation of the outer conductor with a similar padding, and to have over all a durable covering that will not easily cut. The plugs must be so designed that it is impossible to get them into the sockets the wrong way.

So far, no mention has been made of lighting. The concentric system has the same advantages when applied to lighting as for power, so far as the larger main cables are concerned, but for the branch circuit wires, which have to be tapped and jointed at frequent intervals, the large number of bonds required and their flimsiness, owing to the small size of the armouring, introduces considerable risk of discontinuity, and it is preferable to carry out this portion of the installation with ordinary insulated wire on both sides.

It was an open question whether a separate lighting system should be put down, or lamps run in series from the power mains. The former was in many ways preferable, but involved much great cost in the provision of separate cables.

DISCUSSION.

Mr. R. AINSWORTH said that he had been under the impression that the concentric system was a thing of the past, owing to difficulties of jointing at the boxes. He thought that a separate lighting installation was ideal, but too expensive, and in this the next speaker, Mr. W. WINSBOROUGH, agreed.

Mr. S. LEA had seen a number of installations on the concentric system in Yorkshire working well, and several in Lancashire which were just the reverse. He thought that concentric cables were difficult to repair, and pointed out that it was impossible on the earthed concentric system to watch any change in the insulation of the system, as could be done with the ordinary system on a leakage indicator. He also referred to the possibility of sparking from the coal-cutter wheel and firing the finely divided coal dust.

Mr. STEVENSON spoke of a case where the earthed concentric system had been given up owing to consulting engineers advising its replacement by three-phase working. The drop of potential on the armouring sometimes amounted to as much as 45 volts.

Mr. NEWTON referred to where a fatality was due to a portion of an earthed concentric system having been replaced by two single insulated wires. Accidents had also been caused through fuses being placed on the negative side.

One or two other members also spoke, and Mr. Shaw, in reply to Mr. Lea, pointed out that the leakage indicator was of little help in telling which circuit the fault was on, and dwelt at some length on the greater safety and durability of the system which he was advocating.

AMERICAN REGULATIONS FOR ELECTRICITY IN MINES

ENDEAVOURS are being made by the Mine Inspectors' Institute of the United States, to bring about uniform legislation relating to electricity in mines throughout the United States, on the lines of the mining laws of the State of Ohio, which came into force during last June.

According to the *Electrical World*, the code of electrical rules laid down by the Ohio Legislature requires that mine inspectors shall have a practical knowledge of the uses and dangers of electricity as employed at mines. Although in general, inspectors have the right to order any condition around a mine which they deem dangerous to be changed, the approval of the chief mine in-

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spector must be obtained before changes in electrical wiring or electrical applications can be required. Among the safety appliances stipulated by the Ohio law is a supply of portable electric lamps energised from storage batteries. No steam boilers are permitted within 60 ft. of a mine opening or a wooden building communicating with the mine opening. Trolley wires in mines must be carried at least 6 in. outside of and parallel to the track rail, must be separated by at least 6 in. from the roof timbers, and be supported at intervals not exceeding 25 ft. No trolley wire shall be extended into a room which is being used as a working place. Switches and circuit-breakers must be installed to control the electric circuits at all important points in the mine. No electric wires shall be extended into any room unless a cable 150 ft. in length will not reach the face of the room. Positive machine feed wires must not be extended nearer than within 4 ft. of the track, and must be disconnected when not in actual use. The return or negative line may be bonded to pipes or rails, but a pipe must not be exclusively used for the return circuit.

The voltage of direct-current circuits used to operate gathering locomotives, mining machines, shearing machines, drills, and other apparatus in working places, must not exceed 325 volts measured at the switchboard. In the case of mines newly equipped with electricity, no alternating current shall be used underground to operate any machinery other than that necessary to convert the alternating current into direct current. Alternating-current mains must be provided with a separate conduit way which is not traversed by men or animals. Where haulage locomotives, pumps, or machinery are not located in or about working places of the mine, direct-current pressures exceeding 325 volts may be used, in case the entry or passage ways where lines are carried are not permitted to be used as a principal course of travel. However, no pressure above 650 volts at the switchboard shall be used underground under any circumstances.

MINING CABLES AND ACCESSORIES

THE British Insulated & Helsby Cables, Ltd. (Prescot, Lancs.), have sent us an extremely interesting volume of 160 pages, which, although nominally a catalogue of bitumen cables and mining accessories, contains a large amount of useful information.

As is well known, bitumen-insulated cables have a great advantage for use in shafts, owing to their being comparatively light and easy to handle. The company state the special properties of their vulcanised bitumen enable them to use a thinner dielectric than is usual with this class of material, with a consequent saving in diameter. The dielectric strength is, however, high, and the cables pass the tests prescribed by the Engineering Standards Committee. If desired, stranded conductors have the interstices filled with compound to prevent water travelling along the conductor from the ends or in case of breakages. The company's multi-core cables are normally supplied with wormings of jute impregnated with a special wax, but if desired these wormings are made of vulcanised bitumen as the remainder of the insulation.

The book is extremely well illustrated with coloured drawings of the various types of cables, and we particularly admire four excellent reproductions of four different types of V.R. trailing cables, hard, core braided, close spiral wire armoured, steel strip armoured, and spiral roped. Wires for shot firing are also included, with descriptions of the various types, and also cables with weatherproof braiding for overhead use on insulators. In the latter part of the book, various accessories are described, including a special pattern of shaft cleat, and junction boxes in which particular attention is paid to the method of bonding. This latter is illustrated by a clear drawing. A good portion of the list is also devoted to overhead material, and there are sections on mine exploders, bells, telephones, &c. The last pages of the volume contain the Home Office special rules for the installation and use of electricity in mining.

We have no doubt that the British Insulated & Helsby Cables, Ltd., will be only too pleased to send copies of this list to any of our readers who have charge of the erection or maintenance of electrical work in mines.

MINING PATENTS OF JULY

AMONG the patents of interest to electrical mining engineers, published during last month, was No. 14,352 of 1909, by W. C. Georgi and A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, Durham, for a method of ensuring the immediate disconnection of a faulty three-phase feeder, and is especially suitable for mines where a fault between core and armouring may result in an external flame, and cause explosion of fire damp or coal dust. The generator neutral is earthed at the station, and the armouring of each cable is connected to the earthed neutral through an electromagnetic device which throws out the feeder switch in question should there be any leakage current.

Specification No. 28,532 of 1909, by H. J. Robinson and Messrs. Kynoch, Ltd., Witton, describes an improved electric fuse or detonator for blasting. This has a head of lead pressed on to the conducting wires, the head being enlarged where it is secured to the tubular body of the fuse. An extension of the head forms a recess for the flashing mixture, and a sealing disc is provided for retaining the mixture in position in the recess.

A third specification, No. 18,864 of 1909, by S. Kraus, of Berlin, describes an electric miners' safety lamp constructed so that it can be opened only by means of a magnet in a special enclosed chamber. A glass cover over the lamp can only be removed when the lamp casing is opened. Other details are described, including an adjustable reflector and lamp holder.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during July.

July 7th.—Supplement on "Electrical Engineering in Mines," opening with an article on the International Mining Congress at Dusseldorf, where a number of Papers relating to electrical mining work were read. Reports are also given of two papers read and discussed before the Mining Institute of Scotland at Dunfermline, one by Messrs. Crawford and Moores on gas-driven generating plant, and the other by Mr. F. Anslow on electric power in collieries. A description of an electrical winding plant in France is also given. Attention is drawn to a recent discussion upon inspection of mines in Parliament, and a report is given of the discussion on a Paper by Mr. W. Maurice on the battery plant at the Hucknall Collieries, and a short account of a discussion on earthing of colliery apparatus at a meeting of the Association of Mining Electrical Engineers. Some notes are also included on recent electrical mining patents.

July 14th.—Discussion on mains testing and fault localisation. Details of a new design of controller, and description of new electrical supplies and accessories.

July 21st.—Reviews of new books. Note on a method of testing feed-water.

July 23rd.—Illustrated description of the electrical equipment at the Barrow Hematite Steel Works. Particulars of a new line of knife switches.

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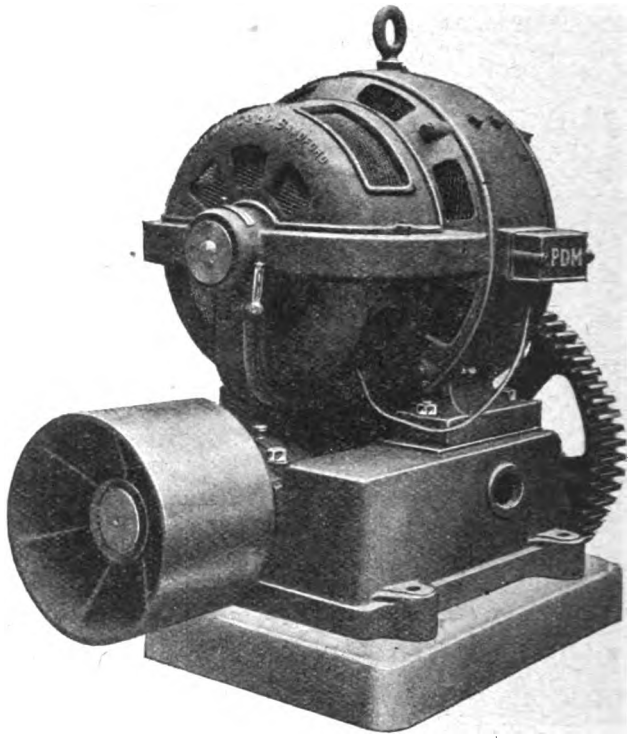
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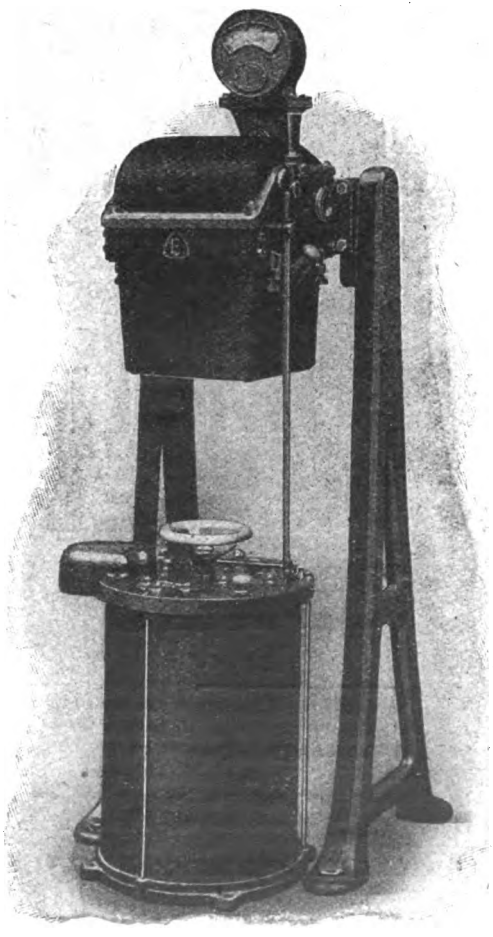
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SUMMER MEETING OF THE INSTITUTION OF MECHANICAL ENGINEERS

THE summer meeting of the Institution of Mechanical Engineers was held last week in Birmingham and London, in conjunction with the American Society of Mechanical Engineers. At the meetings on Tuesday and Wednesday last week, in Birmingham, there was not much of electrical interest. In a paper on "English Running Shed Practice," by Mr. Cecil W. Paget, General Superintendent of the Midland Railway, Derby, the question of English running shed lighting was referred to, and the opinion was expressed that metal filament lamps will eventually supersede gas for this purpose, as hitherto such large units of light as arc lamps have not been required for this purpose. In a paper on "High-Speed Tools and Machines to Fit Them," Mr. H. I. Brackenbury discussed to some extent the application of electricity to the driving of machine tools mainly in relation to variable speed motors, and pointed out that such motors worked on the direct-current three-wire system give a large range of speed, but at certain speeds with light cuts the efficiency of motor and machine might be far from good. Curves were given of the electrical horse-power at various speeds for a large lathe, which showed that there is a drop in efficiency at the change from the low voltage to the high voltage, and an extra gain in efficiency when a change is made from the high voltage and high gear-ratio to the low voltage and low gear-ratio, the result being that practically the same amount of power has to be paid for at cutting speeds of 18 and 33 ft. per minute. The motor was rated at 40 h.p. on the high voltage, so that in one case the motor was giving from 50 to 75 per cent. of the full load, and in the other case from 25 to 35 per cent. of the full load. The conclusion drawn by the author was that heavy lathes required to do both light and heavy turning should have the gear-ratio arranged so that the full range of speed may be obtained from either voltage, and that builders of such heavy machines should give the total efficiency of the lathe and motor at various speeds and loads.

Electrification of Suburban Railways.

Mr. F. W. Carter (Rugby) in this Paper, pointed out that many of the railways of this country have, so far as their suburban passenger traffic is concerned, been affected very adversely in recent years by the great and increasing competition of tramcars and motor-omnibuses. The companies concerned appear undecided at present between giving up a great portion of this class of traffic permanently and endeavouring to regain it by electrification of their suburban lines. The latter expedient, although an expensive one, has hitherto invariably been found successful in regaining much of the lost traffic, and the problem confronting a company in regard to any section of its suburban lines is than of determining whether the expected gain from electrification will justify the expense to be incurred. He indicated a method founded upon the theory of probability by which the profit likely to accrue could be roughly predicted from the results of known undertakings which, while subject to considerable uncertainty, is likely, if properly interpreted, to be of much greater value than a figure derived from a simple estimate of the increase of traffic. It has generally been found hitherto that the increase in traffic due to electrification has exceeded the estimates formed of it, and examples of this are given from the cases of the Lancashire and Yorkshire North Eastern Railway, and was also mentioned that on the electrically worked section of the London, Brighton and South Coast Railway the increase in passengers carried during the first two months was, as compared with the corresponding months of the previous year, 63 per cent. The electrification of a steam railway can, of course, be considered commercially expedient only when the estimated net profit under electrical operation exceeds that under steam operation by more than the interest on the extra capital involved. It is chiefly the burden of capitalisation which limits electrification to lines of heavy traffic.

An indispensable requirement to the success of any system for working suburban traffic is immunity from all forms of breakdown competent to delay the service. In this respect modern electric railway apparatus, the design and construction of which has been developed by arduous experience, if chosen with reference to the nature of the service and maintained with care, leaves little to be desired. Figures are given in some detail to show that the delays from all causes, electrical and mechanical, for the month of December, 1909, averaged about 33 seconds per day per train on the District Railway, and only 2½ seconds per day on the Underground Electric Railways tubes. The total cost for maintenance and repairs of rolling stock on these lines does not exceed 0·6d. per car-mile.

The railways in this country operated wholly or in part electrically are eighteen in number, working over a total of approximately 200 miles of route and 410 miles of track. The trains are worked by 87 locomotives and 821 motor-coaches. The aggregate nominal power of the driving motors is approximately 360,000 h.p. Brief summaries of the principal features of these lines, all of which have been described from time to time in the technical press, are given in the Paper.

In suburban service the greater part of the energy-input is used in accelerating the train, and the energy-consumption per ton-mile depends principally on the nature of the schedule. Thus the figures derived from test of 42 watt-hours per ton-mile for the energy-consumption of the Central London Railway, and 137 watt-hours per ton-mile for the Liverpool Overhead Railway, indicate no more than totally different services on totally different railways. A better measure is the uniform acceleration that would cause the train to reach the mean running-speed in a distance equal to the average distance between stations. This acceleration is greatest for the Liverpool Overhead Railway's schedule, a fact which explains the high energy-consumption per ton-mile. The following table gives some characteristic schedules arranged in order of the specific acceleration :—

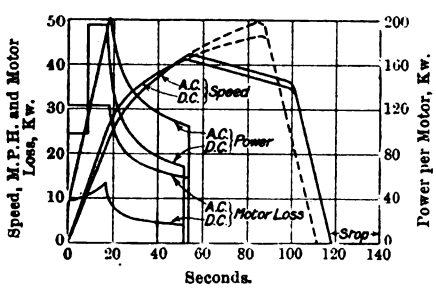


FIG. 1.—COMPARATIVE CURVES FOR A.C. AND D.C. MOTORS.

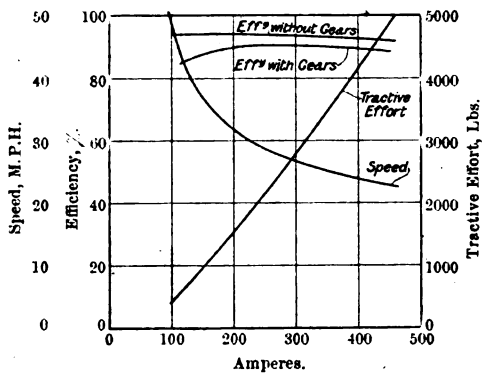


FIG. 2.—CONTINUOUS-CURRENT MOTOR CHARACTERISTICS.

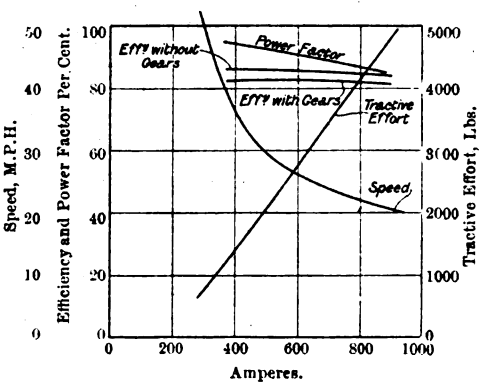


FIG. 3.—ALTERNATING-CURRENT MOTOR CHARACTERISTICS.

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Line.	Average distance between stops.	Schedule speed.	Time of stop.	Average speed excluding stops.	Specific acceleration.
	feet.	m.p.h.	secs.	m.p.h.	m.p.h. per sec.
Liverpool Overhead	2,145	19·5	11	22·9	0·179
Liverpool-Southport	6,535	30	15	33·4	0·125
Underground, Inner Circle ...	2,555	15·7	20	19·2	0·106
Baker Street and Harrow ...	5,000	23	20	26·6	0·104
South London Elevated ...	4,540	21·5	20	20	0·101
Hammersmith and City ...	2,830	16	20	19·2	0·096
Central London	2,540	14·7	20	17·7	0·090
North-Eastern, Tynemouth	6,000	20·5	30	24·1	0·071
Midland, Heysham-Morcambe	23,500	26·7	120	33·4	0·035

The performance of a given electric train under given conditions of suburban service can be closely predetermined. Schedule calculations, however, are inadequate by themselves to determine the question of the suitability of an equipment, as the limiting features are usually connected with the heating of the motors, which again depends on the energy-loss in the motors. The ultimate temperature rise of the hottest accessible part of an ordinary railway motor, totally enclosed and without forced ventilation, as measured by Centigrade thermometer after continuous service, is approximately equal to $7 W w^{-\frac{2}{3}}$, where W is the mean motor loss in service (not including gear loss) in watts, and w is the weight of the motor in lbs., excluding gear and gear case. The motor losses in suburban service usually take from 6¾ per cent. to 7 per cent. of the input to the driving equipment in the continuous-current system, and from 15 per cent. to 18 per cent. of this input in the single-phase system. The equipment losses during acceleration are of the same order of magnitude in the continuous-current and the single-phase systems, in spite of the rheostat losses in the former system. The great motor losses incident to the single-phase system form the foundation of all the objections raised to the use of this system for suburban service. The heating of the motors has always been a limiting feature in this class of service, and means of dealing with it are well understood. The use of forced draught for cooling the motors, whilst practicable for locomotives and single cars, is out of place on multiple-unit trains, where, since the equipment may not be inspected for hours together, it cannot, in the author's opinion, fail to lead to breakdown.

Fig. 1 gives speed, power and motor-loss curves corresponding to typical suburban schedule runs with continuous-current and with single-phase equipments, the former of which carries 20 tons per motor and the latter 23 tons. Figs. 2 and 3 show the corresponding motor characteristics. The great difference between the systems is in the motor loss, which amounts to 6·75 per cent. of the input in the continuous-current case and to 17·8 per cent. in the single-phase case. Although both motors are dynamically capable of working the service, the former alone has sufficient thermal capacity for the purpose, the other having to dissipate three times as much energy as it can get rid of by natural cooling.

There appears little prospect of general electrification of the railways of this country, as no advantage is apparent which would in any way justify the expense. It is only in the case of heavy suburban service that there is prospect of commercial advantage accruing from electrification, and whilst there may be other local opportunities for electrical working, there is at present no indication that the steam-locomotive can be superseded with advantage for ordinary main-line work.

Continuous-Current v. Single-Phase Equipments for Suburban Traffic.

Mr. H. M. Hobart contributes a paper in which he compares the commercial results which may be expected to be obtained with continuous-current and single-phase trains respectively on certain schedules. The author considers that in this country, where coal is comparatively cheap, steam traction is more economical for long-distance through trains and general traffic, but that electric traction has proved its superiority for suburban passenger service. Assuming that the cost of the electrical equipment of the track is the same for both the continuous-current and single-phase systems, Mr. Hobart proceeds to compare the total charges in connection with the rolling stock alone. He takes the cost of the electrical energy delivered at the trains at 0·72d. per kw.-hr. for the single-phase system and 0·90d. per kw.-hr. for the continuous-current system, the cost delivered to the substations being 0·65d., and the differences representing the charges in respect of substations and the contact conductor losses.

With trains consisting of three double-bogie coaches, the gross receipts are usually, continues the author, some 40d. to 60d. per train mile. The cost of the electrical energy consumed, and the capital and other running charges, amount to from 35 to 40 per cent. of these gross receipts, and it is these which are influenced by the electrical system employed. As an example, the case of two 150-foot trains, each consisting of one motor-coach with two motors, and two trailer-coaches, may be taken. The continuous-current train is that employed on the Piccadilly tube in London and weighs 61 tons, and the single-phase train is that of the Heysham and Morecambe line of the Midland Railway and weighs 77 tons. Mr. Hobart shows that though the services are different, the average output to the axles is about the same in the two cases, and on the assumption of an average overall efficiency of 70 per cent. in both cases, figures are deduced from the published weights of the electrical equipments (8·0 and 14·9 tons respectively) to prove that the average output in service per ton of electrical equipment is 10·9 h.p. in the case of the continuous-current equipment, as against only 6·0 h.p. for the single-phase equipment.

Continuing, the author makes an analysis of two 180-ft. trains, each composed of two motor-coaches with four motors each and one trailer coach. The continuous-current train is that of the Southport line, weighing 118 tons, and the single-phase train is that used on the South London Elevated, with a weight of 138 tons. The services are somewhat different, and the author states that the power required at the axles is 42 per cent. greater in the case of the Southport train, notwithstanding the greater weight of the South London Elevated train. The weights of the electrical equipments are 30 and 44 tons respectively, and the average horse-power output to the axles per ton of electrical equipment works out at 10·6 h.p. for the Southport train and only 5·12 h.p. for the South London Elevated train. Thus in the two cases dealt with, the single-phase equipments weigh about twice as much as the continuous-current equipments. It has been asserted, continues the author, that this does not seriously affect the total train weight, but the electrical equipment of the Southport train amounts to 25·4 per cent. of the total weight, as against 32 per cent. of the total weight for the much less severe South London Elevated service. If the Southport service were run with single-phase trains, the electrical equipment would, Mr. Hobart estimates, weigh 45 per cent. of the total weight of the train. Conversely, a continuous-current equipment for the South London Elevated service would weigh only 35 per cent. of the present single-phase equipment, or less than 12 per cent. of the total weight of the train.

Turning to the cost of these equipments, the author assumes a figure of £125 per ton in both cases, which makes the single-phase equipment for the South London Elevated service cost £5,500, as against £1,910 for a continuous-current equipment for the same service. The total costs of the two trains work out at £11,325 and £7,515 respectively.

In comparing the running charges, Mr. Hobart takes two different services, one with a schedule speed of 30 miles per hour and an average distance between stations of 1·32 miles, and another with a schedule speed of 22 miles per hour and an average distance between stations of 0·88 mile. The annual average mileage per train is taken at 54,000 miles and 48,000 miles respectively. The annual charges for interest, depreciation, repairs and renewals for the trains only are assumed at 15 per cent. of the cost. Gross receipts are taken as 50d. per train mile, and from these figures Mr. Hobart concludes that the percentage of the gross receipts which could be set aside as profits would, for the 30-mile-per-hour service, be 12·45 per cent. greater with the continuous-current than with the single-phase system. For the 22-miles-per-hour service they would be greater by 6·7 per cent. Thus, for suburban traffic where the service is severe the continuous-current system has a very decided advantage. In conclusion, the author refers to the fact that recently some single-phase equipments in America have been replaced by 1,200 volt D.-C. equipments, which would show even better results than the above 600-volt D.-C. equipments.

The 1,200-Volt Direct-Current System.

Mr. W. B. Potter, Chief Engineer of the General Electric Co., of Schenectady, contributed a paper in favour of direct-current working. With regard to a universal system, he asserts that this is out of the question on account of the difference in the requirements of a congested suburban service and the comparatively infrequent main-line service. He

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insists on the higher first cost of alternating-current equipments, and asserts that the total energy consumption of a single-phase system is often nearly the same as that of a corresponding direct-current system, the greater weight and the lower efficiency of the single-phase equipments offsetting the rotary converter and third-rail losses of the direct-current system. After enumerating the conditions which should determine the choice of the system, the author points out that for grades up to 1½ per cent. there is little difference in the relative value of the systems; with steeper grades the conditions will be more favourable to the A.-C. systems. Light trains with multiple-unit working are favourable to the D.-C. system, but, except where locomotives are used, A.-C. working is more suitable for heavy trains. Frequent service is best dealt with by D.-C. working, infrequent service by A.-C. working. Variations in schedule make little difference ordinarily, but in the extreme case of high schedule speed with short runs, D.-C. working is imperative. In the author's opinion, the comparative results obtained up to the present are in favour of D.-C. working. For main-line service, he continues, a pressure of 1,200 volts D.-C. will be used, but a still higher pressure will be required for heavy intermittent service, and whether this will be 2,400 volts D.-C. or 11,000 volts A.-C. cannot yet be determined.

Continuing, the author asserts that the application of the single-phase system has been arrested in the States owing to a general recognition of its limitations, among which he places excessive weight and cost of rolling stock, high maintenance charges, increased energy consumption, rapid depreciation, and increased cost of maintenance of track. He then works out in detail the cost of converting a 100-mile interurban line with a low traffic frequency of one train in each direction per hour. Three systems are considered, 600 volt D.-C., 1,200 volt D.-C., and 6,600 volt A.-C. Particulars of the equipment, capital cost, and maintenance figures are given in each case, and the conclusion is arrived at that the 1,200 D.-C. system is the most economical. The annual cost of operating the line, including both capital and running charges, is given as £35,200 for the 600-volt D.-C. system, £30,400 for the 1,200-volt D.-C. system, and £38,500 for the 6,600-volt A.-C. system. Concluding, the author states that a great increase in the adoption of the 1,200-volt D.-C. system may be expected for this class of interurban line, and that it will not be surprising if the single-phase interurban system is entirely discarded in America unless some marked improvements are made and more economical equipments are available. The liability of breakdown and delay is centred, he says, principally in the equipment of the rolling stock, and this, therefore, should receive special consideration.

The Electrification of Trunk Lines.

Mr. L. R. Pomeroy (New York) at the outset of his paper with the above title, stated that whatever system of electrification is adopted, a very large outlay has to be faced, and no case for electrification can be made out unless an increase in net receipts or decrease in the working expenses can be secured more than sufficient to pay interest on the extra capital involved.

The author proceeds to a comparison of the relative cost of coal for steam and electric operation, based on coal at 9s. per ton for the steam locomotive, and 6s. per ton for the power house, and finds a saving of about 50 per cent. in favour of electricity, a figure borne out by the results on the Mersey Railway. On steep-grade railways the showing is still more favourable to the electric side.

Examples are worked out giving the cost of coal for a certain steam service at 4s. 10d. per 1,000 ton miles and 3s. 7d. for an equivalent electric service in one case, and 2s. 10d. and 2s. respectively in another case. Taking, however, the price of coal for the locomotive as 7s. 10d. per ton, the difference is slightly in favour of steam.

These figures apply to an undulating profile, when coasting is occasionally possible.

An article by Mr. C. L. De Muralt gives the annual saving that would be obtained by electrification of the Pennsylvania Railway as over £950,000, and for the New York Central as £787,000, on the basis of a saving in fuel of 10 per cent., water saved entirely, other supplies 50 per cent., wages, &c., 25 per cent., and repairs to locomotives 40 per cent. Large as these alleged savings are, yet they would not amount to more than 2½ to 3 per cent. on the necessary increase in capital to electrify the roads on which the foregoing savings apply.

It is further claimed that, with electric operation, greater mileage is possible with the electric locomotive and that fewer units are necessary to perform the same service. Stress is laid on the fact that the ordinary freight locomotive makes only 3,000 miles per month, against which is put forward the ability of the electric locomotive to perform practically continuous service, suggesting the propriety of comparing electric and steam operation on the basis of ton miles per annum each is able to make and also the relative weight on driving wheels and not their total weight.

The impression is quite prevalent that if 100 steam locomotives are required to operate a certain division, if operated electrically, a power station capacity the equivalent of 100 locomotives would be necessary, whereas the generator capacity, barring the installation of spare units, would be of such size as to meet the average load.

Some advantages which electric locomotives possess for moving freight trains faster in places where traffic is dense, are dwelt on, but electric operation as compared with steam shows to greatest advantage in urban and suburban passenger service. Here, if multiple unit trains are employed, so that a considerable fraction of the total weight is carried on the driving wheels, a schedule speed quite impracticable in steam operation can be maintained. A more frequent service can be given without a proportional increase in expense, whilst in times of light traffic small trains can be run, the energy consumption per train in such service being almost in proportion to the number of coaches.

Passing on to some examples, the author quotes authorities to show that the road service costs per 1,000 car ton miles on the New York Central were 13s. for steam against 8s. for electric working. The fixed charges on the power plant and the transmission system are 8s. 2d. per 1,000 car ton miles, or about the same as the saving, so that if the train movement were but one-half the assumed amount (averaging 6,000 horse-power at the rails, or 6,000 kilowatts at the station) the cost for electric service would be slightly higher than for steam.

The Manhattan Elevated, with about 38 miles of road, was electrified at an expense of £3,400,000. The operating ratio under electric conditions has been reduced from 61 to 46 per cent. of gross receipts. The net result after taking care of the increased capital, &c., shows 15 per cent. profit, but it is a significant fact that the increase in business was 46 per cent. (carrying about 250,000,000 people per annum, 690,000 per day average, or 28,800 per hour).

Another example is the Mersey Railway. The net profit, allowing interest, &c., on the increased capital due to electrification, amounted to 15 per cent., but it took an increase in traffic of 55 per cent. to make this operating result possible. Ton miles increased from 43 to 67 million, or 55 per cent. Total expenses, which include operating expenses and interest on electric capital (but not depreciation) equal 2s. 4d. per ton mile. Interest equals 5·1d. per ton mile, or 22 per cent. of operating expenses.

President Harahan, of the Illinois Central, reports the results of the investigation that has been made relative to the proposed electrification in the following words: "Our suburban traffic is the only service which would in any degree be adapted to electric operation, but even in this particular service it can be readily shown to be unjustifiable at the present time. Our suburban traffic is not sufficiently dense to warrant the expense necessary to electrify these lines, there would not be an increase in traffic sufficiently large to offset the annual loss from operation."

With regard to the New York, New Haven, and Hartford Railway, the following extract from a letter from the President of the Company is given: "We believe we are warranted in saying that our electric installation is a success from the standpoint of handling the business in question efficiently and with reasonable satisfaction, and we believe we have arrived at the point where we can truthfully say that the interruptions to our service are no greater, nor more frequent, than was the case when steam was in use. But we are not prepared to state that there is any economy in the substitution of electrical traction for steam; on the contrary, we believe the expense is very much greater."

Plea for a Universal System.

The paper contributed by Mr. George Westinghouse, President of the American Society of Mechanical Engineers, emphasises the necessity for the early selection of a comprehensive system of electric traction which shall be standardised and accepted universally by all railway companies in order to ensure a continuance of the interchange of traffic now so general. The author expresses his firm belief that the increased capacity, economy, and other advantages obtained by conversion, will gradually bring about the systematic electrification of all railways, and insists that a universal system is essential to avoid trouble in the future. After referring to the heavy expense incurred in changing the

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gauge of many railways to the now uniform one of 4 ft. 8½ in., he enumerates the following requirements for interchange of traffic:—Standard gauge and coupling and uniform brake, heating and signalling apparatus, further uniform contact line pressure and supply frequency, standard trolley-wire construction, and standard multiple-unit control apparatus. The author then describes in detail the characteristics of the three systems, single-phase, direct-current, and three-phase, and is evidently of the opinion that the single-phase system is the most suitable of the three. The choice of frequency is, he says, a most involved, difficult, and important problem. In America, the favourite frequency is 25 cycles, but he mentions that 15 cycles permits of a marked reduction in motor weight, and has been adopted in France, Austria, and elsewhere. Locomotives, he continues, on each of the three systems have proved their reliability, and though there are differences in weight and cost, these are, in many cases, more than offset by the differences in other parts of the system. In his opinion, the controlling factor in the cost of electrification, in nearly all cases, is the transmission and distribution system, and not the rolling stock. The requisites for a universal system are as follows:—The locomotives should practically duplicate the present steam locomotives in speed and power characteristics, but should exceed the latter in capacity; the system should adapt itself to passenger and freight, main, branch, and suburban line services; the contact conductor construction should be simple and reliable, and should interfere as little as possible with the track maintenance. Electric traction will necessitate alterations in practices, such as the composition, speed, frequency and weight of trains, the movement of freight, &c.

In appendices to his paper the author gives particulars of a number of electric locomotives, the more recent of which have already been described in ELECTRICAL ENGINEERING, and also a brief description of the electrical equipment of the New York, New Haven, and Hartford Railway. He states that during the past year the electric service has surpassed in efficiency all records previously obtained on that line with steam locomotives. The line consists of twelve miles with 650-volt D.-C. third-rail equipment, and twenty-one miles with 11,000 volt trolley-wire single-phase equipment. The forty-one locomotives have been in operation for twenty-two months, and the average number of miles run per locomotive per breakdown during the past year exceeds 12,000. Many of the motors have run over 100,000 miles without turning or sandpapering the commutators, and the brushes show an average life of 40,000 miles. The officials of the railway claim that the cost of maintenance per mile is less than with the steam locomotives. The final appendix gives some diagrams illustrating the relative capital costs, running costs, and losses for the three systems in the case of a proposed line, the results being favourable to the single-phase system in all respects.

The five Papers dealing with electric traction were discussed together.

Mr. H. F. PARSHALL (Consulting Engineer to the Central London Railway) pointed out that both the New York Central and New Haven Railroads were handling a class of traffic that could not be handled by steam; but he did not consider that the New Haven Railroad could be compared with our electrical systems since the usual safeguards as to reliable operation had been most studiously eliminated, and the system as it stood would not be possible in Great Britain. With reference to Mr. Westinghouse's Paper, it was erroneous to regard transmission as the principal element to be considered. Owing to the regulations of the Board of Trade in this country, the transmission system as a whole was a great deal more expensive than in the United States, and the cost of the transmission system, including energy losses, and capital charges, was about 15 per cent. of the total as against 45 per cent. chargeable to the electro-motive outfit, and 35 per cent. to the power station charges. He pointed out that the cost of the transmission system, even under the extravagant conditions obtaining in Great Britain (which did not obtain in America), was but one-third of the cost of the electro-motive installation, and that in applying the difference commonly recognised and proved, the difference between single-phase and continuous current motors would more than wipe out the whole 15 per cent. in the transmission system. He further pointed out that if the energy were transmitted single-phase, the cost of copper, with the same power factor, would be one-third more for the A.C. system than for the D.C. system: also that allowing for 10 per cent. additional loss for the rotary converter of the D.C. system, for equal current density, the cost of copper with 0·75 power factor would exceed by 60 per cent. that of the D.C. system, and for equal energy loss would be double that of the D.C. system, always on a basis that the A.C. train outfit was as efficient as the D.C. outfit. Further, owing to the compensating properties of the rotary converter, it would justify its existence considering the economy effected in having unity power factor in the transmission system. In conclusion, he stated that the D.C. system was the only one known in the present state of the art that could compete with steam in the classes of installation to which electricity is generally applicable, that is, to urban, suburban, and dense interborough traffic.

Mr. J. DALZIEL (Midland Railway Co.), who has been jointly responsible for the design and equipment of the single-phase line between Heysham and Morecambe, believed that the electrification of main line railways was comparatively imminent. It was certainly commercial to find a general system to be adopted universally. The single-phase certainly did not possess all the disadvantages which were attributed to it by Mr. Hobart. The general conclusion arrived at at the recent International Railway Conference at Berne was in favour of the single-phase system. Much expense could be saved in avoiding the doubling of main line tracks by the adoption of electricity. Again, it would be possible to burn a cheaper quality of coal in a central power station than on locomotives. The Midland Company's single-phase line had only had four breakdowns in two and a half years, and none of these were due to the use of the single-phase system. Dealing with Mr. Hobart's figures of comparison between the continuous current and single-phase systems, he pointed out that the general conditions assumed in order to get the comparison were not those under which the Morecambe-Heysham line was working.

Mr. STONE referred to the excessive rail wear on lines using the multiple unit system, and remarked upon the fact that on the City and South London Railway, where electric locomotives are used, the wear was not so marked. He thought this pointed to the necessity of having a greater proportion of the driving power on the front motors, and so keep all the draw bars tight instead of as at present with the multiple unit system having them slack, which resulted in a crushing up of the carriages at the moment of starting.

Mr. C. F. SCOTT (Westinghouse Electric & Manufacturing Co., Pittsburg) thought that Americans had devoted more attention to systems rather than the general features of the application of electricity to railway working. The reason for using electric motors was not to save power, but in order to use more power efficiently. He looked to the electrification of railways as a means of saving much expensive widening of tracks. He rather deprecated such comparisons as Mr. Hobart had made, because the slightest error in the assumptions led to very erroneous results, and it rather looked as if there were some errors of this sort in Mr. Hobart's case. A matter which needed some consideration was the cost of power, which, in Mr. Pomeroy's Paper, was given as 60 per cent. of the total cost of working. He disagreed with Mr. Potter's suggestion as to the number of cars necessary for running a service, namely, two in the sheds for every one running. In his opinion, for pure trunk line working the single-phase system was the only one, and it was interesting to note that the only real trunk line being operated in America by electric traction, namely, the New York New Haven line, was now purchasing new locomotives and making extensions upon the single-phase system.

Mr. PHILIP DAWSON sent a telegram regretting his inability to be present, and asserting that all Mr. Hobart's comparisons had been founded on erroneous data, which vitiated all his conclusions.

Mr. H. M. HOBART, referring to Mr. Potter's Paper, agreed that perhaps for the 100-mile line mentioned, single-phase might beat continuous current, but it was in those cases where single-phase was cheaper than continuous, that steam would beat them both.

Mr. ANGUS SINCLAIR (United States) did not think that there was much possibility of electricity beating steam for goods traffic in the United States for a long time to come.

Mr. J. G. WILSON (Great Eastern Railway), did not think it would be wise at present to standardise a system of electric railway working. It seemed to him that on railways having a heavy suburban traffic, such as the Great Eastern, the direct-current system would be cheapest, whilst on a line such as the Great Northern, with a heavy mineral traffic, the single-phase system would be the best. In view of the immediate advantages of the electrification to individual lines he did not think it wise to postpone general electrification for the sake of the problematical advantages of a standard system in the future, which would enable interchange of traffic to take place.

Prof. HUTTON (Honorary Secretary, American Society of Mechanical Engineers) thought the conditions of railway working in cities needed consideration before the long lines running into the country. He thought it would be a long time before the latter would need to be converted to electric traction.

Mr. J. A. F. ASPINALL (General Manager of the Lancashire and Yorkshire Railway) said that his experience was that heavy electric locomotives with large bearing surfaces and large journals based upon steam locomotive practice, were becoming necessary. At present the centre of gravity was very low, and the weight was not spring borne; hence the wear and tear on the rails was excessive. No general manager could afford to close his eyes to the possibilities of all systems of electric traction in order to utilise the rolling stock to the greatest extent. The feature of railway working at present was the extraordinarily small amount of time that the locomotives were doing useful work. Figures had been got out to show that for only 28 per cent. of their time were locomotives in commercial use.

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WEST HAM ELECTRICITY UNDERTAKING

Overdrafts Declared Illegal

MR. JUSTICE NEVILLE delivered judgment on Friday in the action taken by certain ratepayers in West Ham, principally the India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., of Silvertown, against the Corporation in regard to the financial management of their electricity undertaking. The general charge against the Corporation was that monies have been borrowed in the form of overdrafts from the London County & Westminster Bank in respect of the electricity undertaking for which the sanction of the Local Government Board had not been obtained, and that consequently the interest paid to the Bank, amounting to £14,000, was illegal, and must be repaid. A further charge was made that deficits upon the electricity undertaking have been carried forward from year to year instead of being met out of the current rate as provided for by the Acts of Parliament relating to municipal government, and also that proper provision has not been made for sinking fund in repayment of previous loans. The hearing of the action was reported at length in our issues of July 14th and 21st.

The judgment, which was against the Corporation on all points, took the form of a number of declarations as follows: (1) the overdraft obtained from the Bank for general purposes in respect of borrowing powers granted for specific purposes was *ultra vires* and illegal; (2) the application of money due to the Consolidated Loans Fund in repayment of such an overdraft was *ultra vires* and illegal; (3) the borrowing of money from the Bank for the purposes of electricity account otherwise than in the exercise of borrowing powers with the sanction of the Local Government Board was *ultra vires* and illegal. The Corporation and the Borough Treasurer were ordered to pay the costs of the action. During the action the case against the London County & Westminster Bank in respect of the interest, the return of which was claimed, was settled on the Bank agreeing to pay back the sum of £7,000.

It will be noticed that an injunction has not been granted, and in a short discussion at the conclusion of the judgment Mr. Justice Neville stated that he did not know of any means by which a declaration can be enforced.

MUNICIPAL WIRING

THE Leicester Corporation have decided not to appeal against the recent judgment of Mr. Justice Neville to the effect that municipalities may not wire premises or supply fittings except under special Parliamentary powers.

We understand that the Electrical Contractors' Association have made a proposal to the Sheffield Corporation for ending the dispute between them as to the wiring of premises, &c., which has been going on since 1898. The Sheffield Corporation in 1898 acquired the undertaking of the Sheffield Electric Light & Power Co., and £6,000 of the purchase money was paid specifically in respect of the house-wiring department. When the undertaking was taken over by the Corporation, the local contractors objected to this department being continued, but the Corporation resisted their demands, and they have continued the wiring of premises, &c., ever since. In the meantime the Electrical Contractors' Association have threatened to apply for an injunction to restrain the Corporation. Since the decision in the recent Leicester case, which is not to be appealed against, the Electrical Contractors' Association have suggested to the Sheffield Corporation that their dispute should be ended by the Corporation agreeing to an injunction against themselves, but no decision has yet been come to by the Corporation.

The question of municipal wiring was discussed at the Glasgow Convention of the Incorporated Municipal Electrical Association this year, and the Council were instructed to proceed in the matter of promoting a Bill in the next session of Parliament for conferring wiring powers upon all municipalities (ELECTRICAL ENGINEERING, June 23rd, p. 420). Acting upon this, a letter has been sent round to all municipalities in order to see to what extent such a Bill would be supported, and a number of Corporations have discussed the matter and come to a decision. The Dundee Corporation have agreed to support the Bill (ELECTRICAL ENGINEERING, July 21st, p. 483); at Oldham no action is being taken, as the Council are opposed to this form of municipal trading (ELECTRICAL ENGINEERING, July 28th p. 499); at Belfast the Electrical Engineer is to report upon the proposal; a motion to financially support the promotion of a Bill has been rejected at Stoke-on-Trent; the West Ham Electricity Committee propose to support the Bill; and the Middlesbrough Corporation, whilst agreeing with the need for such a Bill, will not financially support it.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

WELDING APPARATUS.—A leaflet from James McMillan & Co. (Clun House, Surrey Street, Strand, London), gives prices and particulars of apparatus for autogenous welding with acetylene or lighting-gas and oxygen.

FANS.—Messrs. Matthews & Yates, Ltd. (Swinton, Manchester), have sent us a leaflet calling attention to their "Cyclone" fans, blowers, and exhausters. The firm have recently introduced a motor especially designed for fan work, and constructed in sizes ranging from 3/16 b.h.p. to 5 b.h.p.

ELECTROMEDICAL APPARATUS.—Four new leaflets are to hand from Messrs. Siemens Bros. & Co. These describe respectively the "Skiafix," an apparatus for holding parts of the body during X-ray exposures; an improved pattern of X-ray outfit, with rotating high-tension rectifier; a small motor-generator set mounted on a portable table for providing current for cautery and other electrical treatments; and a new series of tantalum dental instruments. The special feature of the small motor-generator set is that it is so designed and constructed that it is impossible to obtain a shock from any of the regulating devices, or from the low-voltage cautery circuit. A flexible shaft is provided for vibration-massage and surgical operations.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

REFLECTORS.—A leaflet is to hand from the Reflector Syndicate, Ltd. (82 Victoria Street, Westminster), describing the Cowper-Coles patent gold mirrors, which are manufactured by depositing a film of gold on a glass surface. Motor-car headlights, searchlights, reflectors for general lighting, advertisement signs, and other adaptations are referred to.

INSULATORS.—We have received a comprehensive list of porcelain insulators, containing illustrations of a large number of patterns, both for overhead lines and interior wiring, insulating tubes, ceiling roses, fuse bases, &c., from the Paul Rauschert Porcelain Works of Huettengrund-Huettensteinach, Thuringia, Germany.

PUMPS.—Two illustrated lists are to hand from Messrs. Frank Pearn & Co., Ltd. (Manchester), giving dimensions and other particulars of a variety of steam and electrically driven pumps. Another leaflet from the same firm describes the Pearn patent high-speed surfacing and milling machines. These lists are issued in accordance with the system of the Engineers' Standardised Publications Association, and an index card printed with the name of the firm and the articles listed is supplied with the leaflets.

SWITCH-FUSE BOXES.—Messrs. A. Reyrolle & Co. Ltd. (Helburn-on-Tyne), have issued a revised list of their switch-type fuse boxes, which are now manufactured with capacities up to 400 amperes. The fuse-holders are attached to the lid, and, in order to replace a fuse, the holders must be withdrawn from all contact with the circuit.

Birmingham Tramways Dispute.—The action of certain shareholders against the City of Birmingham Tramways Co., who object to a proposal passed at an extraordinary general meeting to repay £4 per share on certain £5 shares in order to leave all the paid up shares as £1 shares, has been settled. In the Chancery Division the decision of the company was approved, and notice of appeal was given by the shareholders in question. When the case came on in the Appeal Court last week, however, it was stated that a settlement had been arrived at.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published July 28th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

18,965/09. **Arc Lamp Carbons.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). When carbons contain titanium carbide, particles of the substance are thrown off from the arc and adhere to the glass globe, and cannot be cleaned off. To prevent this, four and a half per cent. of free sulphur is mixed with the titanium carbide. The sulphur fuses with the carbide to form a compound which does not stick to glass. Four claims.

19,045/09. **Wall Socket.** J. M. Connare. The interior of this socket is similar in construction to an ordinary bayonet lamp-holder, the plug being in the form of an adapter. The flange has slots to allow the pins of the adapter to pass, and a disc cover is loosely rivetted at one side so that it will fall over the socket when the plug is withdrawn. Two claims, three figures.

19,871/09. **Electrical Marine Propulsion.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). It has been proposed to reverse by changing the connections between polyphase motor and generator, but the machines will get out of phase during the change over, and on closing the circuit a heavy current will flow unless resistances are used, which is undesirable. According to this invention, the motor and generator are permanently connected, and reversal is obtained by reversing the turbine, which is provided with forward running and reversing elements. If a forward running exhaust steam turbine is fitted on the propeller shaft, the supply of steam must be cut off before reversing, all the work being done by the reversing element of the main turbine. Four claims, three figures.

7,860/10. **Heating Apparatus.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). A number of wire heating spirals are stretched between two terminal blocks, and are connected in parallel. To strengthen the combination, several transverse stiff metal strips are connected to the spirals at points of equal potential. Three claims, three figures.

10,607/10. **Driving of Rolling Mills.** Allgemeine Elektricitäts Ges. In the Ward-Leonard system, a main lever is provided for effecting control of the speed of the driving motor from zero to rated full speed by varying the applied voltage, and in order to increase further the speed during the last stages of a pass, the field of the motor is weakened by means of an auxiliary lever. The two levers are usually interlocked to prevent the field being reduced until the maximum pressure is applied, but in spite of this the second is often operated too soon. To prevent this, the release of the second lever is made dependent upon the speed or back E.M.F. of the motor having reached a predetermined value. Two claims, two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Proctor, 16,924/09; Gebrüd. Siemens & Co. [Protective coating for carbons] 12,425/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Insulating compounds] 23,225/09.

Dynamos, Motors, and Transformers: Livesay [Generating systems] 20,587/09.

Electric Ignition: G. Roth A.G. [Combined electric and percussion primer for cartridges] 4,449/10.

Electrometallurgy and Electrochemistry: Flood [Electrolytic cell] 15,960/09; Corby [Electro-deposition] 2,002/10; Crocker [Electrolytic cells] 2,032/10.

Heating and Cooking: Ross [Heaters] 16,547/09.

Incandescent Lamps: Salzer [Supports for metal filaments] 6,658/10.

Storage Batteries: Marseille and Gouin [Alkaline cell plates] 3,733/10.

Switchgear, Fuses, and Fittings: Berry and Markham [Iron-clad switch-fuse] 13,443/09; Leitner [Automatic battery-charging switch] 15,888/09; A.-G. Brown, Boveri et Cie. [Regulation of installations] 16,630/09; Walker [Switches] 20,786/09; Podszns [Vapour apparatus] 22,827/09; Leitner [Reversing switch for generators] 23,042/09; Murray [Cut-outs] 23,227-8-9/09; Carrigan [Switches] 24,109/09; Down [Lamp-bracket for hospital operation theatres] 439/10; White and Carichoff [Electrically-operated switchgear] 4,697/10; Partington [Multiple fuse] 10,961/10; Lange [Portable lamp] 13,828/10.

Telephony and Telegraphy: Edwards (*Rosen*) [Telegraph transmitting machines] 18,954/09; Siemens & Halske A.-G. [Telephone exchanges] 26,269/09; Siemens Bros. & Co., and Riber [Telephone apparatus] 467/10; Fessenden [Wireless telegraphy] 10,817/10 and 11,155/10; Howard and Coad [Telephone mouthpiece] 11,333/10.

Traction: McCollum [Signalling] 16,541/09; Jackson [Trolley head] 16,682/09; Cunliffe and Alderman [Signalling] 19,399/09; Jones and Nelson [Actuating tramway points] 20,780/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Signalling systems] 24,017/09.

Miscellaneous: Viry [Controlling movements from a distance] 18,624/09; Dickie [Temperature alarm] 24,997/09; Elektriska Aktiebolaget, A.E.G. [Submarine mines] 1,206/10; Soc. Magic. Publicity [Luminous signs] 1,547/10; Stachow [Magnetic ore separators] 3,314/10; Lux [Electrical control of valves] 3,697/10; Kukiolka [Fire-alarm] 9,644/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrometallurgy, &c.: Herold [Primary batteries] 13,739/10; Hering [Furnaces] 15,139/10; Badische Anilin & Soda Fabrik [Manufacture of nitrides] 16,368/10.

Incandescent Lamps: Krause [Elastic supports for metal filaments] 349/10.

Switchgear, &c.: Schafer [Mercury-vapour rectifiers] 15,720/10.

Telephony, &c.: Rosenthal [Transmitter for submarine telegraphy or telephony] 15,837/10; Cerebotani and Silbermann [Printing telegraph] 16,253/10.

The following amended Specifications can now be obtained.

W. Roos [Magneto-generator] 12,135/07; R. Hopfelt [Manufacture of metal filaments] 8,146/09.

Opposition to Grant of Patents

6,177/09. **Electrical Marine Propulsion.** C. A. Parsons, G. C. Stoney and A. H. Law. This patent has been granted in spite of the opposition by Mr. W. P. Durtnall. (See Electrical Engineering, July 21st, p. 476, and July 28th, p. 491.)

15,151/09. **Controllers.** R. C. Lyness. Opposition has been entered to the grant of this patent, which covers a contact finger for controllers. The finger is sprung into a bracket on the contact base, and is provided with a renewable tip sprung on to the finger.

Application for Amendment

9,802/98. **Electric Driving of Printing Presses.** W. A. Clatworthy, and J. H. Holmes & Co. desire to amend this patent in respect of which they recently brought, and lost, an action for infringement against the Associated Newspapers, Ltd. (Electrical Engineering, (Vol. V., pp. 915,936). An appeal (Electrical Engineering, February 3rd, 1910, p. 74) was dismissed. The Appeal Court decided that claims 1 and 2 were too wide to be valid, and the patentees desire to substitute the following: "Apparatus for electrically driving a newspaper printing machine or the like at very diverse speeds, consisting of a main motor coupled or geared direct to the main shaft of a driven machine in combination with an auxiliary high-speed motor, a power gear arranged between the main motor and auxiliary motor, a self-releasing clutch arranged between the power gear and main motor shaft, and a combination switch for controlling both motors, all arranged so that by the operation of the combination switch the auxiliary motor must be used both for the purpose of driving the printing machine at a slow and steady rate when required and for starting the printing machine from rest to enable the main motor to gather up power and drive without shock or excessive current, substantially as described."

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

17,481 of August 7th, 1896. **Steam Turbines.** J. Schmidt. This patent covers rotor discs provided with radial slots at the outer periphery to receive the blade shanks. The inner end of each slot is enlarged to receive a corresponding enlarged portion of the blade shank.

The following are the more important Patents that have become void through non-payment of renewal fees.

Electrometallurgy, &c.: H. Newton (*Farbenfabriken vorm. F. Bayer & Co.*) [Electrolytic manufacture of dyes] 7,708/99.

Storage Batteries: H. Leitner [Plates] 7,720/05; W. Fennell and W. P. Perry [Plates] 7,903/05.

Switchgear, &c.: J. Y. Johnson (*Voigt & Haeffner A.-G.*) [Automatic synchronising apparatus] 7,591/05.

Telephony, &c.: P. M. Justice (*Rowland Telegraphic Co., U.S.A.*) [Printing telegraphs] 8,487/02; W. Hjorth [Push-button telephone switch] 8,491/03.

Traction: F. H. Higley [Single-line signalling system] 8,421/04.

Miscellaneous: C. Junge (*W. Pierce*) [Boiler-tube scraper] 9,379/97.

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STREET LIGHTING IN THE CITY OF LONDON

A REPORT on the work during 1909 of the Public Health Department of the Corporation of London, published last week, contains some information with regard to street lighting in the City. The number of arc lamps in use was not increased, or decreased, during the year. At the end of the year there were 366 of the original open-type arc lamps in use, at a total cost of £26 per annum per lamp, 32 of these lamps in Old Bailey, Ludgate Circus, and St. Paul's Churchyard having been replaced by cheaper flame arc lamps. In addition to these there were 63 Oliver flame arc lamps, costing £17 10s. per annum per lamp, and 18 Reason enclosed arc lamps, costing £12 10s. per annum per lamp, in use. Of the 63 Oliver lamps, 21 have been installed experimentally in Holborn by the City of London Electric Lighting Co., who are also responsible for the Reason lamps, also erected experimentally in Farringdon Street. The Charing Cross Co. continued their experimental lighting of Cannon Street with ten Oliver flame lamps, centrally hung. The number of defective lamps reported during the year was 52.

The number of gas lamps, including experimental lamps, paid for by the Corporation at the end of the year was 2,720, being a decrease of ten during the year. The 17 high-pressure inverted Keith lamps, installed in Fleet Street in December, 1908, were maintained during the year, the annual charge per lamp now being £15 2s. 6d. The number of defective gas lamps reported during the year was 1,841, viz., 1,495 ordinary, and 346 high-pressure lamps.

Finally, some extracts from the report of the deputation of the Streets Committee which visited several continental towns in March, 1909, are given. This report was abstracted and commented upon in ELECTRICAL ENGINEERING, Vol. V., July 15, 1909, p. 645.

LOCAL NOTES

ABERDEEN: *Industrial Advantages.*—A well got-up pamphlet has been issued by the Industrial Development Committee of the Corporation dealing with the Industrial and other societies of the City of Aberdeen. Particulars are given of the electric supply service, together with the charges for lighting and power, and an interesting list is included of the various industries at present carried on in the City and neighbourhood.

Tramways Accounts.—The accounts of the Corporation tramways for last year show a decrease in revenue of £558. The cost of electrical energy, however, has decreased by £1,124, but there was a deficit on the year's working of about £80. As, however, the introduction of universal 1d. fares represents a concession to the public of £2,554, the result of the year's working may be considered very satisfactory.

ARGENTINE: *Telephones in Rosario.*—According to the *Review of the River Plate*, the Rosario Municipality, in endeavouring to secure improvements in the service of the United River Plate Telephone Co., propose to put the company upon a new basis in regard to its concession. The Council claim that the company at present has only a permit which was granted in 1886, and it is now proposed to make the company pay the Corporation 5 per cent. of its gross receipts. If the company refuses to accept this offer, it is proposed to annul the permit and call for tenders for a telephone service in Rosario. Our contemporary adds:—"We are inclined to believe that the intention to tax the company has been uppermost in the minds of the authorities more than improving the service."

AUSTRALIA: *Sydney: Electricity Accounts.*—The report of the City Electrical Engineer for 1909 states that the number of units sold was 11,914,720, against 8,673,942 in the previous year. The large increase in output is partly due to the large number of consumers taken over from the purchased companies. The horse-power of motors connected increased from 8,290 to 10,978. The demand for motors on hire continues to increase, whilst the increase in the number of arc lamps on hire was greater than the increase in the previous year by 18 per cent. The rapid increase in this branch, however, is not looked forward to, as metal filament lamps are displacing arc lamps in many places. The total revenue was £118,275, and the working expenses, after adding 4 per cent. for depreciation, was £72,249.

BELFAST: *Electric Wiring.*—A letter from the Incorporated Municipal Electrical Association regarding the proposal made at the annual convention at Glasgow in June, that a Bill should be promoted in Parliament conferring electric wiring powers upon all municipalities, has been referred to the Electrical Engineer for his observations.

BRADFORD: *Plant Extensions.*—The two 3,000-kw. Curtis turbines which have been erected in the Valley Road power station were put into operation on Thursday. All the work has been carried out under the superintendence of Mr. T. Roles, City Engineer, the chief contractors being the British Thomson-Houston Co., Ltd., Worthington Pump Co., Ltd., Messrs. Pearn & Co., Messrs. Aiton & Co., and Messrs. Babcock & Wilcox, Ltd.

BRISTOL: *Electricity Deficit.*—The presentation at the last meeting of the Council of the accounts of the electricity undertaking for last year, which show a loss of £2,029, gave rise to considerable discussion and criticism. The whole of the loss is attributed to the use of metal filament lamps, for the number of consumers has increased, together with the output. Alderman Pearson, Chairman of the Electricity Committee, replying to his critics, gave many instances in which bills for electric light have been halved by the use of metal filament lamps. If the committee had seen fit to add a small fraction of a penny to the price per unit they could have put this right, but he did not think this was the proper policy to adopt.

CANADA: *Montreal: Street Lighting.*—A dispute has been in progress between the Council and the Montreal Light, Heat & Power Co. for some time concerning payment in respect of street lighting. It has now been decided to appoint Professor Herdt (of McGill University), Mr. A. Black (a civil engineer of Toronto), and Mr. A. Dion (Chief Engineer of the Ottawa Electric Railway Co.) as a Committee to arbitrate upon the matter.

CARDIFF: *Electric Lighting Accounts.*—There was a net profit of £1,124 upon the electricity accounts for last year. The revenue increased by £1,219.

Tramway Accounts.—After meeting capital charges, the tramway accounts for the past year show a net profit of £11,032, of which £6,937 has been transferred to depreciation and £4,094 to reserve. The number of passengers carried, namely, about 26,000,000, was a reduction of 24,000 from the total of the previous year, and the results show an increase in income with less mileage and fewer cars.

CROYDON: *Home Office Regulations.*—The Electrical Engineer reports that the new Home Office regulations will necessitate an estimated expenditure at the power station of £1,176.

DERBY: *Tramways Accounts.*—The net profit for the year to March 31st was £3,626, against £3,734 in the previous year.

FROME: *Transfer of Electricity Undertaking.*—Subject to the consent of the Board of Trade the Council's electricity undertaking is to be transferred to Messrs. Edmundsons' Electricity Corporation, who originally erected the works, and who have been carrying them on for the Council. The Council are to pay to the company the outstanding balance of £8,278 on capital account now due to them. The Council also agree to take current for street lighting purposes until 1928. Provision is made for the undertaking to be taken over again by the Council if thought desirable on arbitration terms, but the price is not to exceed £70,000.

LAUNCESTON (Cornwall): *Electric Lighting.*—The Board of Trade have written threatening to revoke the Electric Lighting Order granted in 1903, and now in the hands of the Electric Supply Corporation. The Council are in communication with the company on the matter.

LEITH: *Tramway Accounts.*—There was a loss of £1,625 upon the tramways undertaking last year, compared with £3,857 in the previous year.

LIMERICK: *Management of Electrical Undertaking.*—Mr. Aubrey V. Clayton, of London, has been appointed by the Council to investigate the general position and management of the electrical undertaking.

LLANELLY: *Electric Supply.*—Work has been commenced upon the buildings for the new power station of the Llanelly & District Electric Lighting Traction Co.

LONDON: *Hammersmith: Olympia Exhibition.*—The New Olympia Co. applied for permission to generate their own current at an electrical exhibition, to be held in September, 1911. At the present time the Company are under an agreement with the Council to take all current required for lighting and power from the Council's works, in consideration of which current is supplied at a low charge. The permission asked is only required in order to demonstrate the practicability of isolated country house generating plants. In 1906, for a similar exhibition, the company was allowed to generate continuous current, on which they paid the Council a royalty of ½d. per unit. In the present instance a royalty of ¼d. per unit is to be charged.

St. Pancras: Electricity Accounts.—The accounts of the electricity undertaking for the year ended March 31st show an increase in revenue of £1,613 over last year. The net profit is £9,506, as compared with £7,126 in the previous year. The Electricity Committee have adjourned to their next meeting the consideration of the disposal of the balance.

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MARKET HARBOROUGH: *Electric Lighting Order Revoked.*—The Board of Trade have revoked the Market Harborough Electric Lighting Order granted in 1906.

PAIGNTON: *Tramways.*—The Council have been in communication with the National Electric Construction Co. with regard to the construction of the tramway on the overhead system between Torquay and Paignton. As they seem to be unable to get any satisfactory reply from the company, application has been made for the deposit of certain sums of money as provided for in the Act of Parliament authorising the extension.

PLYMOUTH: *Motors on Hire.*—The Electrical Engineer was recently instructed to report as to the desirability of making arrangements for letting motors on hire. He has now informed his committee that no scheme can be drawn up, because the Corporation have not the necessary Parliamentary powers.

SOUTHGATE: *Electricity Supply.*—The agreement between the Council and the North Metropolitan Electric Power Co. has been sealed.

TASMANIA: *Launceston: Electrical Extensions.*—Mr. R. J. Strike, the City Electrical Engineer, has presented comparative estimates of the cost of extending the power station by means of a Diesel engine and steam plant. It is proposed to install a three-phase alternator working in parallel with existing alternators driven by hydraulic turbines, and Mr. Strike has only been able to discover one instance where the Diesel engine is working under these conditions, namely, at St. Moritz, in Switzerland. Taking a Diesel engine capable of driving a 400 E.H.P. three-phase alternator, and the necessary enlargement of power station, &c., the capital cost is put at £10,851 15s., and the cost of oil at £5 per ton. For generating 875 units per day for 30 days during the summer, when the supply of water for the water-power plant diminishes, the costs are put at £620. The capital cost of steam plant is put at £6,059, and the working expenses at £450 14s. Consequently Mr. Strike is in favour of installing steam plant with coal firing rather than oil engines or steam engines with oil fuel.

WATFORD: *Trolley Omnibus.*—The Middlesex County Council propose to promote a Bill next session for powers to adopt the trackless trolley system for the Watford district.

WEST BROMWICH: *Supply in Bulk.*—An offer of the Shropshire, Worcestershire, & Staffordshire Electric Power Co. to supply electricity in bulk has been declined after careful consideration by the Electricity Committee.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-stations, Mains, &c.

ACCRINGTON.—A new storage battery is to be installed at the electricity works.

AUSTRIA-HUNGARY.—H.M. Consul of Buda-Pesth reports that the negotiations for the acquisition by the Council of the two electric supply companies in Buda-Pesth have failed, and the municipality are proposing to erect a separate power station.

BARKING.—Tenders are to be invited for the supply of cable.

BRAZIL.—The *Financial Times* states that the Brazilian Electric Power Co. has been granted a concession for the supply of electric power in Rio Janeiro in competition with the Rio Janeiro Tramway, Light & Power Co. As a result of this concession, the latter company have obtained an injunction in the High Court in the Brazilian Republic restraining any interference with their rights.

HESTON AND ISLEWORTH.—An inquiry was held last week concerning a loan of £3,600 for electrical extensions.

LEICESTER.—A Local Government Board inquiry was held last week concerning a loan of £19,190 for electrical extensions.

NETHERLANDS.—The Amsterdam Municipality propose to enlarge their generating station.

The Municipality of Deventer has decided to establish an electric power station.

SOUTHAMPTON.—In connection with the proposed duplication of the high-tension feeder to the Portswood district a small sub-station is to be erected in the Portswood tramway depôt.

SOUTHEND.—An inquiry was held last week concerning a loan of £20,467 for electrical extensions. This sum includes £3,000 for meters, and £1,000 for street lighting purposes, but the Inspector recommended that these should be paid for out of revenue.

STOKE-ON-TRENT.—A committee has been formed to consider the question of extensions.

TURKEY.—The Belgian Vice-Consul at Tripoli states that the municipal authorities are considering the erection of an electric generating station for lighting and tramways.

WEST HAM.—A Local Government Board inquiry has been held into an application by the Corporation for a loan of £52,000 for electrical extensions. The India Rubber, Gutta Percha & Telegraph Works Co. were represented, and somewhat heated discussion again took place between Mr. Elvy Robb, the solicitor for them, and the officials of the Corporation upon details of contracts entered into, but, as on the previous occasion, the Corporation refused to give any information on these points. The loan asked for includes £20,600 for prospective extensions of mains, and £5,000 for services; a new substation is being erected; more motors are required for hiring out; £19,400 are required at the generating station, and £2,000 for a crane and elevator. As a result of the answers given, the Inspector mentioned that he would take the advice of the Local Government Board as to whether the inquiry should be adjourned in order that the questions raised by the Silvertown Co. should be further investigated.

WREXHAM.—An application is to be made for a loan of £3,345 for electrical extensions.

Miscellaneous

ABERDEEN.—The car shed accommodation is to be increased at an estimated cost of £1,625.

LONDON: *London County Council.*—Tenders are invited for covering with asbestos tape certain electric cables (see an advertisement on another page).

St. Pancras.—Two additional feeder pillars are to be obtained, at an estimated cost of £221.

NEW ZEALAND.—Tenders are invited by the Minister of Telegraphs, Wellington, by December 15th, for the erection of wireless telegraph stations at (1) Doubtless Bay, (2) Gisborne, (3) Capt Farewell, (4) Sumner, near Christchurch, (5) and Bluff. Copies of the specifications, &c., may be obtained on application to the Office of the High Commissioner for New Zealand, 13 Victoria Street, London.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

W.C.—Alterations and extension of Italian Hospital, Devonshire Street, Queen Square. E. & A. Roome & Co., builders, 36 Basinghall Street, E.C.

S.W.—Extension of South-Western Polytechnic, Chelsea, S.W. The Governors.

Adaptation part of Fitzalan House, Arundel Street, W.C., for accommodation of L.C.C. Staff. Architect, L.C.C., Spring Gardens, S.W.

Adaptation of part of Hamilton House, Temple Avenue, and 35 Spring Gardens, for accommodation of L.C.C. Staff. Architect, L.C.C., Spring Gardens, S.W.

E.—Schools, Tollit Street, Mile End. Architect, L.C.C. Education Committee, Victoria Embankment, E.C.

E.C.—Bank premises, Threadneedle Street, H. A. Pelly, architect, 25 Gresham House, Old Broad Street, E.C.

N.—Public slaughterhouses, Metropolitan Cattle Market, Islington, N. (£19,050). F. Sumner, engineer and surveyor, City of London Corporation, Guildhall, E.C.

PROVINCES.

BARROW.—Proposed fire station (£2,380). J. W. Smith, Borough Surveyor.

BRADFORD.—School, Thornbury (£6,000). R. S. Kirkby, City Architect.

BRIDGWATER.—Police station and court-house, Northgate (£7,778). F. Parr, Surveyor, Bridgwater Town Council.

BRIDLINGTON.—Proposed isolation hospital. J. Haggett, Borough Surveyor.

CANTERBURY.—The workhouse is to be wired for electric lighting. The City Electrical Engineer is preparing a scheme.

CROYDON.—Electric theatre and offices, North End. Architects, Gilbert & Constandures, 43 Finsbury Square, E.C.

DEWSBURY.—Central disinfecting station. Surveyor, T.C., Dewsbury.

DOVER.—School (£4,400). Secretary, Education Committee.

DUBLIN.—The Technical Education Committee invite tenders for the wiring of the Bolton Street Technical Schools. Particulars from the City Electrical Engineer, and tenders by August 9th.

ECCLES.—Extension school and Patricroft hospital. J. Knight, architect, South King Street, Manchester.

FALKIRK.—Extension fever hospital (£1,500). Surveyor, Eastern District of Stirlingshire C.C.

FOOTSCRAY.—Enlargement of Longlands Council School (£1,570). Builders, Friday & Ling, Northend Works, Erith.

GRIMSBY.—Council school, Strand Street (£8,796). Architect, H. C. Scaping, Court Chambers.

MALVERN.—Parish hall (£2,000). Churchwardens of Holy Trinity Church, Malvern.

MANCHESTER.—Theatre (1,000 places). Managing Director, Victoria Picture Theatres, Ltd., Manchester.

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MANSFIELD.—Electric theatre, Leeming Street, for the Palace Electric Theatre Co.

MIDDLESBROUGH.—Archibald Schools, Ayresome Green Lane (£14,150). Clarke & Moscrop, architects, Middlesbrough.

NEWCASTLE-ON-TYNE.—Alterations to school, Westmoreland Road (£1,434). J. C. Hope, builder, 7 Meldon Street, Newcastle.

PAISLEY.—School (£9,500). Craig, Barr & Cook, architects, 15 St. James's Place, Paisley.

PONTYPRIDD.—Additions, Hopkinstown Schools (£2,500). W. C. Lowe, architect, Pontypridd.

SALISBURY.—Joint isolation hospital (14,187). Thos. Higgs, builder, Northampton.

SUNDERLAND.—Building at workhouse (£4,000) for consumptives. R. Thompson, Clerk, Guardians.

WEST HAM.—Cinematograph theatre, High Street, Stratford. Emden, Egan & Co., Architects, 2 Lancaster Place, E.C.

WEST HARTLEPOOL.—Completion of St. Aidan's Church (£3,000). J. H. Marsion & Son, architects, Bank Chambers.

TENDERS RECEIVED AND ACCEPTED

BRIDLINGTON.—A tender has been placed with the British Westinghouse Co. for the supply of metal filament lamps for twelve months.

CHELMSFORD.—Tenders have been received from the Electric Supply Corporation and the Chelmsford Gas, Light & Coke Co. for street lighting for three or five years, but they have been referred to a committee for a report. The Electric Supply Corporation's price for flame arc lamps is £25 5s. per annum, and for 100-c.p. metal filament lamps, £3 3s. per lamp per annum. The tender offers a higher candle-power at the same rate as is now being paid, the previous metal filament lamps being only 32 c.p.

EALING.—The Council have accepted the tender of Willans & Robinson at £2,332 for condensing plant.

HENDON.—The Council have accepted the tender of Messrs. Waring and Gillow for the electric wiring of the whole of the Council's offices, which are now lighted by gas.

LEYTON.—The Council have accepted the tender of Headland & Headland at £9 10s. for a supply of 32-c.p. tantalum lamps. An order has been placed for a further 25 public lighting lanterns with the Electrical Joint Box Co.

LONDON: *St. Pancras.*—The Council received the following tenders for 21 flame arc lamps: Electrical Co. (incomplete), £86 13s. 6d.; Foster Arc Lamp Co., £116 7s. 6d.; Abbey Electric Co., Ltd. (incomplete), £165; Arc Lamps, £183 8s.; Gilbert Arc Lamp Co., £184; Beck Flame Lamp Co., £189; Maxim Lamp Works. £210; Johnson & Phillips, £213; Union Electric Co. (accepted) (Excello), £216 11s.; Crompton & Co., Ltd., £222; Oliver & Co., Ltd., £250; General Electric Co., £300; British Westinghouse Co., £308; Jandus Arc Lamp Co., £315 9s. 6d. The Chief Electrical Engineer states that he found the Excello, Crompton, and Johnson & Phillips lamps the most suitable for the Council's purposes, and of these three he recommended the Excello lamp offered by the Union Electric Co., as the patent methods applied for carrying away the products of combustion and keeping the globe clean had proved most advantageous.

The tender of Messrs. Edwin Danks & Co. (Oldbury), Ltd., for an additional boiler at £2,600 has been accepted.

SOUTHAMPTON.—The Council have accepted the tender of Messrs. Willans & Robinson at £392 for an air pump for the 300-kw. alternator.

WEST HAM.—The Council have placed an order with the British Thomson-Houston Co., at £83 for a Tirrill regulator; they have also accepted the tender of the British Westinghouse Co. for switchgear at £573.

Messrs. Willans & Robinson, Ltd., have recently received a large number of orders for surface condensing plants, the principal of which are set out below:—One set for dealing with 100,000 lbs. steam per hour for the East Rand Mines; two 64,000 lbs. sets for Sydney Corporation; two 41,000 lbs. sets for Australia; one 36,000 lbs. set for Cardiff Corporation; three 34,000 lbs. sets for Canada; one 30,000 lbs. set for Eastbourne Corporation; one 30,000 lbs. set for South Africa; one 28,000 lbs. set for Belfast Corporation; two 22,000 lbs. sets for Devonport Dockyard; two 21,000 lbs. sets for Midland Railway, Derby; two 20,000 lbs. sets for Pleasley Colliery; two 17,000 lbs. sets for Baldwins, S. Wales; two 15,000 lbs. sets for Calcutta Electric Supply Co.; one 13,000 lbs. set for Carlisle Corporation; two 7,500 lbs. sets for Swansea Harbour Trust.

APPOINTMENTS AND PERSONAL NOTES

In consequence of the appointment of Mr. C. H. Yeaman as Electrical Engineer to the new County Borough of Stoke-upon-Trent, the electrical engineers at Burslem, Longton, and Stoke have been given three months' notice to terminate their agreements.

Mr. George Westinghouse has resigned the presidency of the Westinghouse Electric & Manufacturing Co., Pittsburg. Mr. E. F. Atkins succeeds Mr. Westinghouse.

Mr. George G. L. Preece, for 15 years with Messrs. W. T. Glover & Co., Ltd., Electric Cable Manufacturers, Trafford Park, Manchester, and for the last few years acting as their technical and special outside cable expert, has now joined the firm of Messrs. Bruce Peebles & Co., Ltd., of Edinburgh.

Taunton Corporation invite applications for the post of Borough Electrical Engineer. The commencing salary is £200 per annum. Applications to the Town Clerk by August 4th.

Mr. Jas. R. Wilkinson, B.Sc., son of Mr. Geo. Wilkinson, Borough Electrical Engineer, Harrogate, has just passed out of University College, London, with distinction. During the College course Mr. Wilkinson was a member of the Officers' Training Corps; he is to be gazetted within the next few days, after which he joins his regiment at Salisbury Plain for four months' military training. He will then take a three years' course of practical engineering in Woolwich Arsenal.

The Right Hon. James Tomkinson, Chairman of the North Wales Power & Traction Co., Ltd., who died in April last, left estate of the gross value of £115,156, with net personality £75,059.

Mr. W. R. Dick, a director of the Craigpark Electric Cable Co., Ltd., who died early this year, left estate of the gross value of £40,000 with net personality in the United Kingdom valued at £35,493.

The late Major Philip Cardew, who was at one time Electrical Adviser to the Board of Trade, left estate of the gross value of £30,330, and net personality of £10,925.

The late Mr. Alfred Colson, Electrical and Gas Engineer to the Leicester Corporation, left estate of the gross value of £23,220, with net personality of £18,384.

Mr. C. F. Butler, who has acted as Managing Engineer to the Lewes & District Electric Supply Co. for the past four and a half years, has been appointed Resident Electrical Engineer to the Citenhage Electric Lighting & Power Co., Cape Colony.

MISCELLANEOUS CITY NOTES

DIVIDENDS ANNOUNCED.—Westminster Electric Supply Corporation, interim dividend for the June half-year at the rate of 10 per cent. per annum.—Metropolitan District Railway Co., 4 per cent. on the guaranteed stock, and 3 per cent. per annum on the 5 per cent. extension preference stock, placing £10,000 to renewals, and carrying forward £8,527.—Dublin & Lucan Electric Railway Co., 5 per cent. on the preference shares for the June half-year.—Hove Electric Lighting Co., interim dividend on the ordinary shares at the rate of 8 per cent. per annum.—Chelsea Electric Supply Co., interim dividend at the rate of 4 per cent. per annum.

Brompton & Kensington Electricity Supply Co., interim dividend for the June half-year at the rate of 9 per cent. per annum.—Vickers, Sons & Maxim, interim dividends for the June half-year of 2½ per cent. on the preferred 5 per cent. stock, and 5 per cent. preference shares, and 1s. per share on the ordinary shares, free of tax.

Charing Cross, West End & City Electricity Supply Co., interim dividend at the rate of 5 per cent. per annum on the ordinary shares on the West End undertaking.

Telephones on Trains.—A successful experiment in train telephony was made last week by permission of the London, Brighton & South Coast Railway Co., by Mr. H. von Kramer, of Birmingham. Full technical particulars of Mr. Kramer's system are not yet available, but it appears that the instrument on the train is connected to a large coil of insulated wire in a longitudinal vertical plane, completely encircling one coach, and that the speech currents in this circuit are reproduced in a stationary circuit comprising two insulated wires laid parallel with the track between the rails, by magnetic induction. The lowest part of the large coil is eighteen inches from the stationary wires, and there are, of course, no rubbing contacts. The wires were laid along a four-mile length of track between Horley and Three Bridges, and a van of a fast Brighton train was put at Mr. Kramer's disposal. Conversation was carried on between the train, running at full speed, and the signal-box at Three Bridges, and is stated to have been most clear and distinct. We understand that the chief difficulty in developing the system has been the elimination of disturbances due to the telegraph wires along the track. According to the *Daily Mail*, the Brighton Company will equip the line between London and Brighton on this system next winter, so that passengers travelling by the express trains will be able to send or receive telephone messages during the journey. The consent of the General Post Office will have to be obtained, however. A possible application of the system will be its use for communication between trains and signal-boxes in time of fog.



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MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 15s. to £58 5s. per ton (last week £57 5s. to £57 15s.).

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—An application will be made on October 13th at the Court House, St. Thomas' Street, Portsmouth, for the discharge of H. K. Barham, trading as the South of England Electrical Engineering Co.

The last day for receiving proofs in the bankruptcy of A. E. Felgate & W. Storey, trading as Felgate & Storey, electrical engineers, 10 Queen Victoria Street, Reading, is August 5th. The trustee is B. P. Allnatt, 2 Forbury, Reading.

W. L. Grimsley, electrician, Shelley Road, Boscombe, Hants, has been adjudicated bankrupt. The first meeting of creditors will be held at the Arcade Chambers, Bournemouth, on July 30th, at noon, and the public examination will take place at the Town Hall, Poole, at 11.30 a.m., on August 26th.

CANADIAN AGENCY.—A London firm manufacturing arc lamps, transformers, and metal filament lamps wishes to appoint reliable agents in Ontario and Manitoba. Particulars from the High Commissioner for Canada, 17 Victoria Street, London, S.W.

ELECTRICAL FOOTBALL LEAGUE.—There are a few vacancies in this league for clubs connected with the electrical industry. Full particulars from Mr. C. Phillips, 140 Minet Avenue, Harlesden, London, N.W. Referees with vacant dates please write to Mr. Fraser, 100 Bishop Road, Fulham, London, S.W.

COMPANIES' MEETINGS AND REPORTS

ALLGEMEINE ELEKTRICITATS GES., BERLIN.—A dividend of 14 per cent. is proposed, as against 13 per cent. in the previous year.

METROPOLITAN RAILWAY CO.—The receipts for the June half-year show an increase of £12,000 over the corresponding period of last year, and the expenses £776. There is a net revenue of £146,379 after placing £10,000 to electrical renewal and depreciation fund. After payment of the preference dividend and £1 5s. per cent. per annum upon the ordinary stock, a balance of £6,043 remains.

The meeting was held on Wednesday last week, Sir Charles McLaren, Bart., M.P., presiding. The installation of automatic signalling between Baker Street and Neasden will soon be completed, and the Pullman car service between Aylesbury and the City had proved satisfactory. The proposed L.C.C. tramways from Swiss Cottage to Marylebone Road, and from Marble Arch to Baker Street, were referred to as introducing serious competition with the company, and the board have decided to strenuously oppose the proposals when they go before Parliament.

CHATHAM & DISTRICT LIGHT RAILWAYS CO.—There was a net profit of £6,090 on the June half-year's working. After meeting the 5 per cent. preference dividend, and 2 per cent. per annum on the ordinary shares, the sum of £2,090 is carried forward. The traffic receipts show an increase of £1,242.

UNITED RIVER PLATE TELEPHONE CO.—At the annual meeting last week it was stated that by the end of the present year the principal exchanges in Buenos Aires will have been changed over to central battery working.

REES ROTURBO DEVELOPMENT SYNDICATE.—The royalties for the June half-year amounted to £1,610, compared with £1,108 in the corresponding period of last year. The experiments with air pumps and condensers conducted at the works of the Rees Roturbo Manufacturing Co. during the past six months have been fruitful in results, and the latter company are now placing these machines on the market. An interim dividend at the rate of 5 per cent. per annum is declared.

DUBLIN UNITED TRAMWAY CO.—The directors' report for the half-year ended June 30th gives the amount available for division as £45,191 4s. 8d., out of which it is recommended that dividends be paid for the half-year at the rate of 6 per cent. per annum, less income tax, on both the preference and ordinary shores, and that a sum of £4,000 be set aside towards the renewal of cars. The dividends and the sum set aside will absorb £37,000, leaving £7,291 4s. 8d. to be carried to next account.

CENTRAL LONDON RAILWAY CO.—The report for the June half-year states that the number of passengers carried was 20,664,869, compared with 18,989,109 in the corresponding period of last year. A contract has been entered into for the construction of the extension to Liverpool Street, and also for the making of the public subway between the Bank Station of the Central London Co. and the booking hall of the City & South London Co. in King William Street, the cost of which will be borne equally by the two companies. The net revenue for the half-year was £70,711, compared with £64,140 in the corresponding period of last year. After meeting dividends of 5 per cent. on the undivided ordinary stock and 4 per cent. on the preferred stock, a balance of £45,805 is carried forward.

HARPER ELECTRIC PIANO CO.—The report for the year to June 1st mentions that the new company has gone to allotment, and that the purchase of the company's assets by the Harper Electric Piano (1910) Co. takes place as from June 30th. A dividend at the rate of 15 per cent. per annum is declared upon the deferred shares, making 10 per cent. for the year, and a balance of £1,888 is carried forward.

CROMPTON & CO.—At the annual meeting last week Mr. John Trotter said that although politically he was not a protectionist, he had to confess that, with regard to the electrical industry, there seemed little hope under present fiscal conditions of our manufacturers reaping proper rewards.

NATIONAL TELEPHONE CO.—At the half-yearly meeting last week, reference was made to the coming acquisition of the company's business by the Post Office. Negotiations are proceeding for the preparation of the inventory of the company's plant, and it is hoped that an agreement minimising the contentious objections will be come to. Mr. George Franklin, the President of the company, emphasised their determination to maintain the plant in an efficient state to the very last, as it was to the company's advantage to do so.

GREAT NORTHERN & CITY RAILWAY CO.—There was a loss of £3,163 on the past year's working, which has been met, as usual, from outside sources, in order to meet fixed charges. The number of passengers carried was 5,966,114, against 6,041,755 for the corresponding period of last year.

LANCASHIRE ELECTRIC POWER CO.—Mr. H. F. Parshall presided at the annual meeting last week, and stated that the load had increased by 1,750 h.p. during the year. The average consumer's installation was about 200 h.p., and the bulk of the business was done with cotton mills. There are at present about 2,800 h.p. contracted for, but not connected. As a result of the recent Board of Trade decision with regard to Radcliffe, the directors hope to be able to come to satisfactory terms with that Council, as they were certainly not able to supply power at reasonable terms.

Wireless Telegraphy.—The compulsory wireless Act, which has just become law in the United States, provides that "after July 1st, 1911, it shall be unlawful for any ocean-going steamer of the United States, or of any foreign country, carrying passengers and carrying 50 or more persons, including passengers and crew, to leave or attempt to leave any port of the United States unless such steamer shall be equipped with an efficient apparatus for radio-communication, in good working order, in charge of a person skilled in the use of such apparatus, which apparatus shall be capable of transmitting and receiving messages over a distance of at least one hundred miles, night or day." Steamers plying only between ports less than 200 miles apart will be exempt from the Act. The apparatus will not be deemed efficient unless it is possible to exchange with it messages with shore or ship stations using other systems.

At a meeting last week, at Newcastle, of the North of England Steamship Owners' Association, consideration was given to the Bill now before the House of Commons for compelling ships leaving British ports to carry wireless apparatus. After some discussion, the matter was referred to a sub-committee to draft a resolution embodying objections to the provisions of the Bill.

The British Acting Consul-General at Rio de Janeiro (Mr. E. Hambloch) reports that, according to the *Jornal do Commercio* of June 28th, in view of the excellent results that have attended the trials of wireless telegraphy on the Madeira-Mamoré Railway, the Minister of Public Works has been authorised by the President of the Republic to receive proposals for the installation of radiographic stations (Marconi system) in the three prefectures of Acre. The Acting Consul-General adds that there may or may not be a public call for tenders in this connection.

Parliamentary.—The London County Council (Tramways and Improvements) Bill was read a third time in the House of Lords on Thursday.

London Electric Supply Bill was read a second time in the House of Lords on Wednesday last week.

Royal assent was given last week to the following Bills:—Dunfermline & District Tramways (Extensions) Order Confirmation Act, 1910; Wemyss Tramways (Extensions) Order Confirmation Act, 1910; Electric Lighting Orders Confirmation (No. 3) Act, 1910; Bishop's Stortford, Harlow, and Epping Gas & Electricity Act, 1910; Yorkshire Electric Power Act, 1910; Reading & District Electric Supply Act, 1910; London Electric Railway Amalgamation Act, 1910; Metropolitan Railway Act, 1910; Nottingham Corporation Act, 1910; Belfast Corporation (Tramways) Act, 1910; Wimbledon & Sutton Railway Act, 1910; and Baker Street & Waterloo Railway Act, 1910.

In the House of Lords on Wednesday last week a new Standing Order was agreed to by which plans of all works affecting street traffic in the metropolis, forming the subject of Bills, must be deposited with the Commissioner of Police by November 30th in each year. The object of this new Standing Order is to facilitate the work of the Commissioner of Police in making his reports to the Home Office on traffic questions in London. An amendment was moved, substituting the Traffic Branch of the Board of Trade for the Commissioner of Police, but this was negatived, and the new Standing Order was agreed to.

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ELECTRICAL ENGINEERING

NO. 189 [VOL. VI., NO. 32] THURSDAY, AUGUST 11, 1910. [PRICE ONE PENNY.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

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The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

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Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

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Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

A LETTER from a station engineer complains of the action of a gas company which is alleged to have removed street metal filament lamps "for testing." Mr. W. P. Durtnall writes further regarding his recent opposition to a patent. We have received a letter from an ex-employee of the National Telephone Co. with regard to the dismissals of the staff which have taken place in view of the expiry of the company's licence and the transfer of the undertaking to the Post Office at the end of 1911. (Page 516.)

A SHORT article discusses a suggestion for the formation of an Association of Motor Manufacturers on the lines of the Cable Makers' Association. (Page 512.)

A PAPER read by Mr. J. M. Jockell before the Junior Institution of Engineers contained some interesting notes on the care of commutators. (Page 517.)

A SAFETY device to enable repair work to be done on overhead lines at pressures up to 7,500 volts is to be introduced into this country. It consists of a thick rubber trough or mat, and one is placed over each of the wires near which the man is working. (Page 518.)

WE publish some remarks made by Mr. Corbet Woodall at the half-yearly meeting of the Gas Light & Coke Co., with regard to the competition between gas and electricity for street lighting. (Page 518.)

OUR monthly article on new electrical supplies and accessories appears in this issue. Illustrations are given of a new tubular tantalum lamp and a useful extended shade ring. The latest forms of the "Tricity" cooker, which is suitable for continuous as well as alternating currents, are also described, and other apparatus mentioned includes small accumulators and appliances for charging them. (Page 519.)

THE following books are reviewed in this issue: "Electrotechnics," by J. Henderson; "Continuous-current Dynamos and Motors and their Control," by W. R. Kelsey; "Elementary Electrical Calculations," by T. O'Conor Sloane; "First Stage Sound, Light, and Heat." (Page 520.)

A SHORT communication describes the aims and objects of the newly formed Association of Consulting Engineers. Membership is limited to corporate members of the Institution of Civil Engineers. (Page 521.)

MR. C. C. F. MONCKTON contributes an account of some experiments on harmonics in wireless telegraphy. (Page 521.)

AMONG the specifications published by the Patent Office on Thursday last is one by Dr. Forbes Ross for a heater for liquids consisting of a resistance spiral wound on a porcelain core and enclosed in a quartz tube with a packing of plaster of Paris.—C. B. Walker describes a slow-working quick-break movement for automatic battery regulators and motor-starters.—Dr. F. Salzer protects the wire supports of metal filaments by covering them with an electrolytically deposited coating of chromium.—A patent by R. Jahoda covering the use of silver and copper to strengthen metal fila-

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ments during manipulation before sintering is opposed. —K. Maxaner has been granted a patent for a centrifugal fan in spite of opposition. (Page 522.)

An Electrical Conduit and Fittings Association has been formed; the majority of electrical conduit firms have joined it, and the prices of several firms supplying interior conduit have been raised to the level of those of the firms whose prices were higher previously. The proposal of the I.M.E.A. for a Bill to give all municipalities wiring powers is being considered by various local authorities all over the country. We comment also on the position of the wiring contractor in regard to the pending metal filament patent action. (Page 523.)

An important announcement has been made which points to a concentration of interests by the A.E.G. and the Lahmeyer Co. in Germany. (Page 523.)

A new type of tramcar, requiring only one official, is to be tried at Glasgow.—The Halifax tramway undertaking shows a profit of over £13,000 for the past year. —The Rochdale electricity undertaking has resulted in a profit of £5,171.—The South Shields electricity undertaking has been adversely affected by the metal filament lamps, and a loss of £106 has been made on the year's working.—The foundation stone of the extensions to the Wigan Electricity Works was laid last week. (Page 524.)

Local Government Board inquiries have been held for loans at Fleetwood (£4,100); Leicester (£19,190); and Wimbledon (£6,600). Switchgear is required at Eccles, and tenders are invited for the reconstruction of permanent way at Bournemouth. (Page 524.)

The Metropolitan District Railway has made a profit of over £62,000. The Great Northern & City Railway shows a small credit balance. Dividends of 3 per cent. and 2 per cent. on the "A" and "B" ordinary shares are recommended in the case of the Baker Street & Waterloo Railway, and ¾ per cent. for the Charing Cross, Euston & Hampstead Railway. For the Great Northern, Piccadilly & Brompton Railway a dividend of 1½ per cent. is recommended. (Page 526.)

CORRESPONDENCE

GAS COMPANIES AND METAL FILAMENT LAMPS.

To the Editor of Electrical Engineering.

Sir,—Electrical engineers whose Councils are considering the lighting of their streets by metallic filament lamps, or who at present use this means of lighting, are warned that recently a gas company in London was found to temporarily remove the lamps from columns during lighting hours, their object in doing so being stated to be "for testing."

Viewing the fragile character of the metallic filament lamp, it cannot be stated to be just competition to tamper with such apparatus; moreover, the fact that all tests as to efficiency of lighting can be carried out without interfering with the source of light, whether it is gas or electric, renders such an action unjustifiable. Although one cannot but admire the persistence with which the gas companies are waging a hopeless warfare in endeavouring to recapture street lighting, I think they have overstepped the bounds of commercial morality and have, at the same time, committed a breach of the law.

Yours faithfully,
Station Engineer.

SLOW-SPEED MOTOR DRIVE.

To the Editor of Electrical Engineering.

Sir,—We require a ¼ h.p. electric motor, continuous-current, 200 volts, fitted with reduction gear to reduce speed to about 18 r.p.m., and, if possible, emitting no greater noise than that caused by an ordinary electric motor. We have written to the firms advertising in your paper, but as it is quite possible you may know of other firms who make a motor of this description, perhaps you will be able to give us the name of a most likely house. It is quite possible that a clockwork motor would be obtainable for fulfilling these requirements, and as the machine for which the motor-power is required may be used in country districts (where electric power is not available), a motor of this type would be preferable. Could you give us the names of any firms who make spring or clock motors of this character?

Yours faithfully,
Goodhouse, Ltd.
L. Hill.

165 Fleet Street, E.C.
August 8th.

[Perhaps some of our readers may be able to give the desired information.—Ed. E.E.]

ELECTRICAL MARINE PROPULSION.

To the Editor of Electrical Engineering.

Sir,—I notice in your last issue that you again refer to matter of the recent opposition that I made in connection with the application of Mr. Parsons and others for a patent for the above method of ship propulsion.

May I again draw your attention to the fact that Mr. Parsons' patent is sealed on the understanding that it refers to a method of *winding* the generators and motors *only* in such systems of ship propulsion.

The question of the combination of a high-speed turbo-generator with stationary armature, and a slow-speed induction motor, forming a speed reduction gear for ship propulsion, is the subject of my master patent, No. 17,248—1905. The opposition that I made was not in connection with Mr. Parsons' *winding*, but in connection with the fact that such an electrical speed-reduction gear had been proposed before in my above patent; as the matter stands to-day no specification has been put up which shows a similar arrangement to that proposed in my invention of the above combination, and for the above purpose. Mr. Parsons' patent is not for a system of propulsion, but a method of *winding* only.

I shall be obliged if you will kindly publish the above, as you state that the above patent was granted, in spite of my opposition, which is not a correct statement of fact for the above reasons.

Thanking you in anticipation,

Yours faithfully,
William P. Durtnall.

August 8th, 1910.

THE NATIONAL TELEPHONE CO.'S STAFF.

We have received an extremely long letter, signed "Telephonist," complaining of the dismissals of the company's constructional staff which are occurring in view of the expiry of the company's licence and the acquisition of the undertaking by the Post Office at the end of next year. The letter states that "whereas in the ordinary course of business the company would be carrying on their constructional works and be providing for the replacement of the more antiquated of their exchanges by the modern central battery system, they are now closing down all these constructional works and dismissing and placing upon 'short time' those of their staff who would have been employed upon these very necessary works." The writer further states that "proposals have been made by the Postmaster-General which, if accepted by the company, would have allowed of the uninterrupted carrying on of such works, and have allocated to the company and to the Post Office due proportions of the cost according to the benefit derived by the parties from the new plant erected and the plant replaced, . . ." but that the Board of the National Telephone Co. have refused these offers, and have thereby caused extreme hardship to their staff, many of whom are threatened by years of unemployment after having served the company for periods of five, ten, and twenty years. The writer, who states that he is an ex-employee of the National Telephone Co., also contends that, unless some immediate action is taken, the spare plant at the disposal of the Post Office for new telephone lines will be altogether insufficient if the telephone system continues to expand at the same rate as during the past five years, as he estimates that the time taken to enlarge a telephone exchange or to reconstruct underground or overhead line routes varies from twelve months to two years, according to the size and character of the job. He points to the risk that, when the Post Office is in a position to do the necessary constructional work themselves after the end of 1911, the skilled staff which will be required will have been dispersed, and it will be found impossible to gather together a sufficient number of practical men to cope satisfactorily with the arrears of work which will have accumulated due to the present policy of the company.

Supply Meters.—The M.H. type continuous current ampere hour meter of the British Thomson-Houston Co. has been approved by the Board of Trade.

Penny-in-Slot Lamp-posts.—A correspondent of the *Daily Mail* writes that the local authorities of Jocketa, a village in Saxony, have recently installed electric light in the streets of the village and have provided a novel addition in the form of penny-in-slot machines attached to certain lamp-posts. The lamps are switched off at 11 p.m. every night, but should a resident in the village return home later than this, he can insert a penny in a slot machine and light up the whole village for a short time.

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PRICES AND RATING OF MOTORS

ONE of the worst features of the manufacturing side of electrical engineering is the excessive price-cutting which has characterised the sale of electrical machinery during the last few years, an evil which appears to be showing very few signs of diminution. It is even said that motors are being offered in this country at prices which must be below the bare cost of material alone. Along with this cutting down of prices in the race to obtain orders there comes naturally a tendency to cut down quality and to adopt absurd ratings and unduly high speeds. We propose here to examine a suggestion, which has been made to us, of a possible means whereby this state of affairs can be alleviated to some extent.

The suggestion is that, as far as small and moderate-sized motors are concerned, some sort of association might be formed between the leading British manufacturers, analogous to the Cable Makers' Association, with the object of drawing up a standard specification of such motors and coming to an agreement as to the prices at which these are to be sold. This would have the dual object of ensuring that the customer, even if he was paying more than he is at present, was really getting his money's worth, and not a "cheap and nasty" machine, and making it possible for the manufacturer to earn a fair profit. It would probably be advisable to allow members of the association to be free to manufacture "non-association" brands of motor as well. A system such as this should have the effect not of removing competition, but directing it into matters of quality rather than price; nor would it in any way take away the incentive to practising economies in manufacture. The matter is probably of more moment to the small manufacturer who does not build heavy plant and has few strings to his bow than to the large firm which thinks it good policy to sell part of its manufactures below cost to keep down the percentage of standing charges, and looks for its profit in other directions.

The arrangement of such a scheme is, however, not such a simple matter as it appears at first sight, as it is largely bound up with questions of rating. Unless a standard range of standard outputs and speeds were agreed upon, there would be a tendency for an order to go, as is often the case at present, to the firm who listed a standard machine nearest to the output specified. On the other hand, it would be out of the question to ask all the manufacturers to go to the length of re-designing and re-standardising their lines of machines. Again, the exact form of the rating specification is of great importance, as the temperature rise allowed, the length of the test run, and the magnitude and duration of the overloads all influence the design of the motor which best fulfils it. For different classes of work, motors of widely different characteristics are required, and very different specifications should be drawn up for motors for continuous running on constant load, or variable load and for intermittent running. The difficulties in the last case are considerable, as has been shown in a recent Paper by Dr. R. Pohl before the Yorkshire Local Section of the Institution of Electrical Engineers. (*See* ELECTRICAL ENGINEERING, March 31st, page 217.) It may perhaps be said, however, that the utmost refinements of rating and testing are often completely thrown away owing to the extreme vagueness of the requirements and the difficulty of predetermining the actual work a motor will have to perform.

The success of the scheme largely depends on the details of the rating specification, as the slightest irregularity will make the customer take refuge in a non-association machine and defeat the ends of the arrangement. It would, however, always be to the interest of the manufacturers to sell an "association" rather than a "non-association" motor, and this in itself should act as an incentive to keep the standard specification up to date and in accordance with requirements, while the presence of the non-association machines on the market would prevent the prices being raised above figures allowing a fair margin of profit.

THE CARE OF COMMUTATORS

IN the course of a Paper read recently before the Junior Institution of Engineers, entitled "Notes on the Running of an Electricity Works," Mr. L. M. Jockel made some remarks founded on practical experience on the care of commutators.

The surface of the commutator must be kept clean and smooth if good commutation is to ensue. When the machine is on load the commutator can be kept clean by the occasional application of a pad or cloth soaked with benzine, and afterwards finishing off with a clean dry cloth. The use of good quality carbon brushes obviates the necessity of lubricating the commutator, but occasionally the brushes cause an excessive noise or "hissing," and this is usually remedied by the application of paraffin wax or a slight trace of mineral oil. Paraffin wax has the disadvantage that it accumulates on the brushes along with the copper and carbon dust, and is troublesome to remove, and it also causes the machine to drop its load slightly when it is applied. The use of a slight amount of mineral oil is very beneficial in promoting a good running skin or surface on the commutator, and this treatment is applied regularly to the machines in the Royal Navy. With special brushes such as the "Morganite," a hard, smooth skin can easily be obtained on the commutator. A common trouble is the formation of flats on the commutator. These may arise from many causes, but are often due to neglected slight sparking. A frequent cause of sparking is the unequal wear of the copper commutator bars and the mica insulation. The trouble can usually be overcome by turning or grinding out the bad mica or in some cases by sawing out the mica until it is below the level of the segments. If a lathe or emery-grinder is not available, recourse must be had to hand work, and a somewhat temporary job can be made by using a file moistened with paraffin or a light lubricant. Should the flat not be very deep, it may be ground out with emery-cloth or glass-paper, using a wooden pad hollowed out to the curvature of the commutator and carefully bedded to it. The brushes can be quickly bedded down by increasing the pressure on the springs, and using emery-cloth. The correct pressure on the brushes is usually from 1½ to 3 lb. per sq. in. of bearing area, and this can be ascertained by using a spring balance. After trueing up a commutator, and rebedding the brushes, a good working surface can generally be secured by frequently cleaning the commutator, and treating it with slight applications of good mineral oil or vaseline.

German Export Trade in Electric Lamps.—According to an American consular report, the export of incandescent lamps from Germany has steadily increased since 1901, when it amounted in value to about £130,000. In 1907 it had reached some £400,000, and in 1909 it was £1,570,000. The value of the exported lamps in the first quarter of 1910 was put at £755,000, as against £347,000 for the corresponding three months of 1909. The increase is said to be due to greater shipments to this country, Austria-Hungary, Argentina, Russia, Denmark, and Italy.

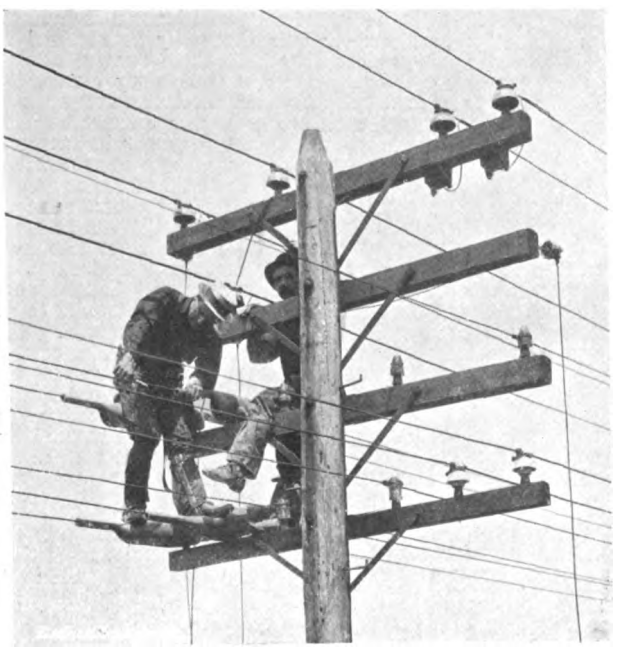
New Telephone Exchange at Melbourne.—It is expected that the new central telephone exchange, now being erected in Melbourne, Australia, will be out of the hands of the contractors, the Western Electric Co., in about eight months' time. The large common battery switchboard is capable of carrying 11,700 subscribers' lines, but at present it will be fitted with 9,000 only. Meters for automatically recording the number of calls are installed. Tunnels carrying heavy lead cables, each containing 260 pairs of wires, extend for a considerable distance underground.

High-Speed Telegraphy.—A system of high-speed telegraphy with some novel features has been devised by Mr. Hans Knudsen, and is being developed by a syndicate called the Knudsen Express Cable System. Instead of representing each letter by a group of long and short impulses as in the Morse system, only one short impulse is transmitted per letter, each letter being represented by the distance or time between two successive impulses. Three machines are employed. The first has a typewriter keyboard, and this punches holes in a tape, the distance between the holes representing the letters. This perforated tape is passed through a transmitter at a uniform speed so that the different letters are represented by different times between successive current impulses. A tape passes through the receiving instrument at the same uniform speed, and the distance between the marks made on it are then read off by means of a rule graduated in the letters of the alphabet. Mr. Knudsen claims a reduction in time of 75 per cent. over the Morse system for the actual transmission of the message, which means that the capacity of a cable working on this system would be four times its capacity on the Morse system.

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REPAIR WORK ON LIVE H.-T. OVERHEAD LINES

OUR attention has been drawn to a safety device of American origin which is shortly to be placed on the British market. This device has been designed for the purpose of enabling linemen to do repair and other work on overhead transmission lines working at high pressures up to 7,500 volts, and is stated to have been adopted by over two hundred power companies in the United States. As can be seen from the accompanying figure, the device, known as a "shield," consists of a thick rubber trough. This is laid over the wire and firmly clamped to it by means of two hard rubber split rings, which are passed over the tubular extensions of the trough at each end. The trough portion is large enough to fit over insulators, and when working on any set of wires, each wire which the man may come in contact with is covered by a shield, except that wire on which he is working. Thus, in the illustration, one of the men is shown cutting the insulation from one wire of a three-phase line, with an uninsulated knife held in his bare hand, and we are assured that the line was alive at 4,600 volts at the time. Though the man is thus charged to the full high pressure, he is insulated from earth and from the other wires, and is therefore protected from shock. The manufacturers recommend the use of these shields on circuits up to 7,500 volts only, as, although they are tested in water up to 30,000 volts, they consider that on damp days the man might get a shock on circuits of higher pressures. They also recommend the use of rubber gloves as an additional precaution against shock.



WORKING ON A LIVE 4,600-VOLT THREE-PHASE LINE.

Line superintendents in this country do not like, nor are they generally permitted, to allow their men to work on live H.-T. circuits, but in America it is very usual, even on extra high-pressure circuits. It is frequently highly inconvenient to both the power company and its customers to be obliged to shut down a heavy transmission line in order to carry out a trivial repair, but this is generally considered to be necessary in European countries. There have been a very large number of accidents due to linemen coming into contact with live wires, but it appears to be thought absolutely necessary that repair work should be carried out without shutting down the line; and much attention is being given to the subject of devices for rendering such work less dangerous.

We are informed that in the case of one company in America, who had used the above device for eighteen months, it had been found possible to carry out all repair work, tapping and connection, or removal of transformers, without shutting down any circuits and without any accidents. Previous to their use, two men had been killed while working on live wires. Readers desiring further information regarding this device should communicate with Mr. E. W. Stevenson, at 14 Union Court, Old Broad Street, London.

GAS COMPANIES AND STREET LIGHTING

IN view of the circumstances in connection with the street lighting contracts in Westminster, it is interesting to quote the remarks made by Mr. Corbet Woodall, who presided at the half-yearly meeting of the Gas Light & Coke Co., on Friday. An arrangement had been come to with the Corporation of the City of Westminster, he said, for the improved lighting of the district, and he felt sure that the result would surprise the inhabitants of London generally. A similar arrangement had been made with the Corporation of Finsbury, but he regretted "that the corporation of one of the North London boroughs had decided, in the interests of its own electrical department, to substitute electricity for gas." This Company's tender, he continued, would have given to that borough an amount of light 70 per cent. in excess of the light it would enjoy when the change was made, and at no more cost, "but these were considerations that would not weigh when the assumed interest of a municipal electrical department was concerned." It is a pity that Mr. Woodall did not quote actual figures, and it would have been interesting to know whether the Gas Light & Coke Co. are offering the same extravagantly low prices to the other London Boroughs as they did to the Westminster City Council.

The Birmingham Boundaries Extensions.—After a long hearing the House of Commons Committee have passed a Provisional Order made by the Local Government Board, extending the boundaries of the City of Birmingham. The Bill has some interest to electrical engineers, inasmuch as the districts of West Bromwich, Handsworth, and King's Norton are included in the scheme. Each of these Local Authorities have at present their own electricity works, and if the precedent of Stoke-on-Trent is followed, the local electricity works of these districts will be absorbed into the Birmingham undertaking, and probably station superintendents placed in charge.

Train Lighting.—According to the report issued by the Swiss State Railway authorities for the year 1909, there are 2 496 railway carriages (or 72·2 per cent. of the total number on the railways) already equipped with electric lighting. Gas lighting is used for only 15 per cent., and petroleum lighting for the remaining 12·8 per cent. All new cars for the main lines and most of the new cars for local lines are being fitted with electric lighting.

Electricity in Agriculture.—The British Consul for the province of Pomerania, Germany, states that a number of small power stations have been erected in various parts of the province for supplying current to neighbouring towns, villages, estates, and farms. The largest station is at Rosswitz, with 116 miles of overhead lines; the second in size is situated at Lottin with 83·2 miles of overhead lines. Two smaller stations are at Crüssow and Schmolsin. Additional stations are in course of erection. These works are principally controlled by associations formed by landed proprietors, and sums have been voted by the Provincial Representative Chamber to assist them.

Overhead v. Underground Telephone Lines.—The Croydon Corporation have been unsuccessful in an appeal to the Railway and Canal Commissioners against a decision by which the Post Office were permitted to erect certain overhead wires for telephones in Croydon. It had been urged that they would disfigure the roads, constitute a danger and a nuisance, and would depreciate the value of the house property; but, on the other hand, the difference in cost between overhead and underground wires in the particular case worked out to over £700. If in any particular streets the Corporation desire to have the wires placed underground and are willing to defray the difference in cost, this will be done.

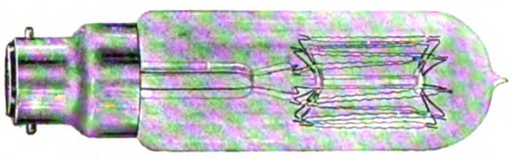
Electric Railways in Japan.—The following particulars are taken from a recent American Consular report:—The four miles of the Kobe Electric Co.'s line, opened in April, cost £300,000. The generators, rails, poles, and air brakes are American, the equipment of the cars English, and the cars and overhead equipment Japanese make. The Minomo-Arima Electric Railway Co.'s 18-mile line to mountain summer resorts, opened in March, cost £400 000. All the machinery is American, the cars and overhead equipment Japanese make. The Keihan Electric Railway, 28 miles long, was opened in April, and connects Osaka and Kyoto. The £700,000 capital was expended, and a debt of £250,000 contracted. The materials nearly all came from England, though the overhead wires came from the United States: the woodwork of the cars was made in Japan. The Keishin Electric Railway, from Kyoto to Otsu, and the Uji Electric Railway, from Fushimi to Uji, now building, will connect with this line. The Hyogo Electric Railway opened its first section—from Hyogo to Suma—on March 15th; it will extend 12 miles along the shore of the Inland Sea to Akashi. The material has chiefly come from the United States, the woodwork of the cars and the overhead wires being made in Japan.

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Incandescent Lamps.

The newest form of Tantalum lamp to be put on the market by Messrs. Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp Department, Tyssen Street, Dalston), is illustrated here. It has a tubular bulb 1½ in. diameter and

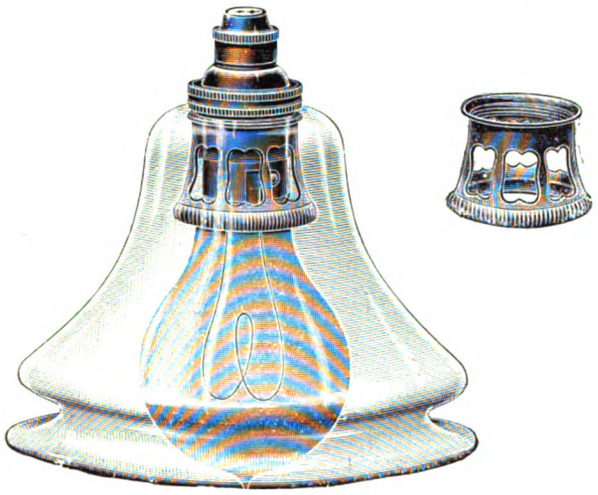


New Tubular Tantalum Lamp.

5¼ in. in length, and is made in the 25 c.p. size for 100 to 130 volts for single or series running on continuous or alternating circuits, with an efficiency of 1·7 watts per c.p. These lamps should prove of considerable use in connection with strip reflectors for shop windows and concealed decorative lighting.

Fittings, Switches, and Accessories.

The Sun Electrical Co., Ltd. (118 Charing Cross Road, London, W.C.) have introduced a new design of extended shade ring, which should be found useful in hotels, restaurants, shops, and other places where the lamp-shades are



Extended Shade Ring.

exposed to much dust and require frequent removal for cleaning. As shown in the accompanying figures, the shade ring can be readily removed without the aid of any special tool, even when the shades have narrow openings. The ring is threaded to screw on to all standard B.C. holders, and will carry all shades with 1⅛ in. hole.

Heating and Cooking Apparatus.

The Berry Construction Co., Ltd. (29A Charing Cross Road, W.C.) have issued a new list of their "Tricity"



Fig. 1.—Single Cooker with Extension Cooker.

cookers and cooking ranges. They have now a complete set of D.-C. apparatus, similar in external appearance and in wattage and output, and also in price, to their well-known A.-C. cookers. The apparatus in both cases can be supplied for any pressures from 100 to 120 and 200 to 240 volts. It is particularly the strong mechanical construction of these cookers that calls for admiration, and this is carried even to the flexible armoured conductor and plug. The two illustrations show the "single" and "duplex" cooker respectively, each fitted with an "extension cooker," which can be supplied with either if desired. The unit to the left of Fig. 1 measures 11 in. by 16 in. by 9 in., and consumes 800 or 200 watts, according to the position of the switches. The

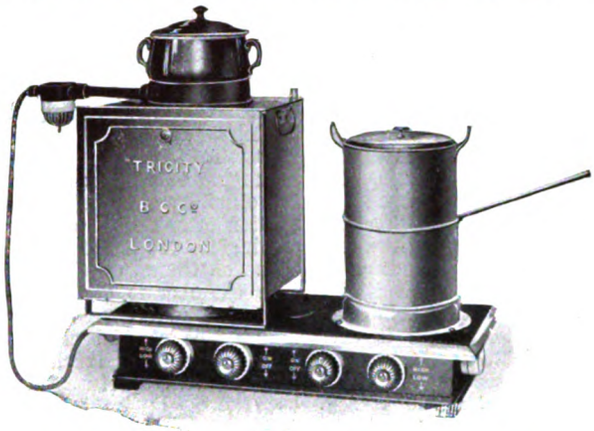
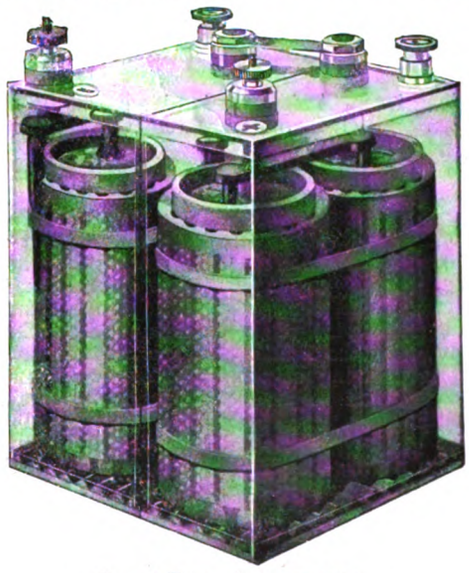


Fig. 2.—Duplex Cooker with Extension Cooker.

oven to the right of this can be removed from the hot plate and can be used as a stand for the "extension cooker," which is another hot plate controlled by a two-way switch, and consuming either 800 or 200 watts also. It can also be used for the top heat of the oven. The duplex cooker (Fig. 2) has two plates, each consuming either 800 or 200 watts, and controlled by its pair of switches, and two plug bases are attached to the cooker-case so that extension cookers or additional single cookers may be plugged up to increase the capacity of the outfit. In Fig. 2 the two plates are in use, and an extension cooker as well. The catalogue includes a full list of utensils for use with the apparatus.

Small Accumulators and Accessories.

A new series of portable accumulators for which a number of special advantages are claimed has been introduced by



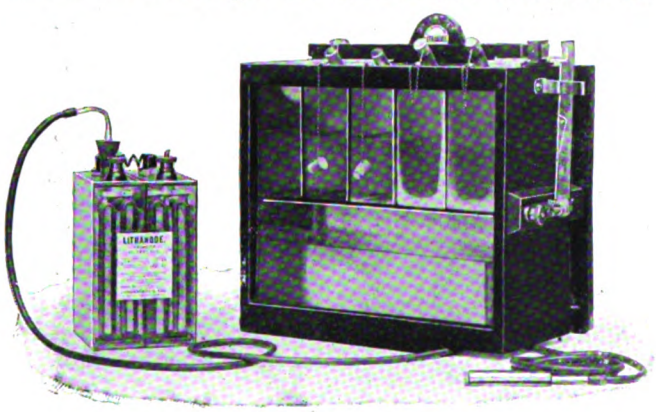
Cox 4-Volt Accumulator.

Messrs. Harry W. Cox & Co., Ltd. (47 Gray's Inn Road, London, W.C.). These accumulators are covered by the patents of Mr. H. Joel, the special features being the circular plates and a porous earthenware separating cylinder between the plates of opposite polarity. The illustration shows a 60 ampere-hour, two-cell battery, with four sets of

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electrodes. The dimensions of this battery in a stout oak case are 8¼ in. by 6 in. by 13¼ in., and the weight is 45 lbs. The discharge rate is 10 amperes for 6 hours, or 20 amperes for short periods. Although it would seem that the earthenware cylinders would materially increase the internal resistance, it is stated that they do not do so on account of their extremely high porosity. They afford the important advantages that internal short-circuiting and buckling of the plates are practically impossible. Among the other claims made are reduced weight and size for the same output, the possibility of charging and discharging at very high rates without injury, and retention of the charge for a long period when the cell is not in use. Another feature of these cells is the use of celluloid stuffing-boxes filled with vaseline for the terminals. These effectively prevent corrosion of the terminals. At present these batteries are listed in two sizes of 30 and 60 ampere-hours' capacity respectively.

A novel and ingenious device which may find favour amongst the many users of small portable accumulators has been introduced by Messrs. Longstreth's, Ltd. (190 Queen's Road, Battersea, London), the manufacturers of the well-known "Lithanode" accumulators. This device is an automatic switch for cutting off the charging current as soon as a battery is fully charged. It is worked by the gas given off by the cell, and requires no attention after having once been set. As shown in the accompanying figure, it consists of a celluloid chamber enclosed in a wooden frame, on the side of which is the switch itself. The chamber is divided horizontally into two halves. The bottom half contains water, and the upper half is divided into five vertical chambers, communicating with each other by means of small holes. Four of these chambers are provided with apertures at the top, which can be closed, as shown, by rubber corks. The end chamber on the left is in communication with the bottom of the lower chamber by means of a pipe, and contains a float consisting of two celluloid balls attached to the



Automatic Accumulator Charging Cut-out.

end of a long lever. This lever is pivotted at its other end, and holds in position the switch through which the charging current passes.

The gas given off by the cell is brought by means of a rubber tube into the lower chamber, and the water is slowly driven into the chamber containing the float. When the water reaches the top, the float is lifted and the switch released. Gas is given off, of course, during the whole period of charging, but the greater quantity is evolved when the cell is fully charged, and consequently, one size of chamber will be suitable for a wide range of cells. When charging at one ampere, only the float chamber is allowed to fill with water; when charging at two amperes, two chambers are allowed to fill, and so on—each chamber representing one ampere, until when charging at five amperes, all five are in use. To put any chamber into use, the rubber cork is removed from it; this allows the air to escape and the water to enter. Where a battery of several cells is being charged, the gas from one cell only is used to control the charging of the whole series. It is immaterial whether the battery has been completely or only partially discharged, and it is perfectly safe to leave cells charging over-night, provided the chambers have been tested for air-leakage before setting in operation by blowing down the gas tube until the water reaches the level of the float.

An ingenious appliance for facilitating the charging of small accumulators after lighting circuits has been brought out by the Accumulator Clip Co. (7 Cavendish Street, Keighley) in the form of a wooden spring clip, into which contacts connected to a flexible lead are embedded, so that connection can be made by simply springing the clip on to the terminals of the cell. The two jaws of the clip are clearly marked positive and negative.

REVIEWS OF BOOKS

Electrotechnics. By John Henderson. 165 pp. 7½ in. by 5 in. 38 illustrations. (London: Longmans, Green & Co.) 3s. 6d.

Although essentially a collection of instructions prepared by the author for the use of his students in the electrical department of the Borough Polytechnic Institute, London, this book is suitable for any students who wish to carry out a series of thoroughly practical experiments, and have the ordinary apparatus at their disposal. The book has been divided into three parts, corresponding roughly to a three years' course. The first part contains experiments corresponding to the elementary stage of the City and Guilds of London Institutes' syllabus in electrical engineering, whilst the second and third parts correspond to the D.-C. and A.-C. sections of the ordinary grade course of the same syllabus. The text is confined entirely to instructions for specific experiments, but in each case the instructions are preceded by a short explanatory statement, and a number of useful notes and hints are included. The book is illustrated with a few woodcuts of the more unusual pieces of apparatus, and diagrams of connections. The almost complete absence of curves is an advantage where college students are concerned, as it is best that they should not have a guide as to the curve their readings should follow, but in the case of private students there is perhaps a danger of their plotting the curves incorrectly and getting wrong impressions. The number of diagrams might also be increased with advantage. The experiments cover a large range, and are thoroughly practical. It is refreshing and also encouraging to the student to come across an experiment in the early pages dealing with the effects of the variation of resistance of carbon and metal filaments with the current. Other interesting and useful experiments dealing with the blowing currents of fuses, the efficiency of secondary cells and of incandescent lamps, &c., are met with early in the book, interspersed with the more usual laboratory work. Induction experiments, the measurement of permeability and hysteresis, the characteristic curves of D.-C. machines, and the testing of meters, are dealt with in the second part, while the third part is devoted to alternating-current experiments of a simple nature, including methods of measuring power and the taking of E.M.F. wave-forms. A useful collection of constants and tables is given at the end of the book.

Continuous-Current Dynamos and Motors and their Control. By W. R. Kelsey. Second edition. 346 pp. 7½ ins. by 4¾ ins. 192 illustrations. (London: The Technical Publishing Co., Ltd.) 7s. 6d.

After a concise exposition of the principles of electromagnetic induction, magnetisation, hysteresis, and other fundamental matters, the author describes ring armature windings which, though rarely employed in practice, are to some extent useful as a means of leading up to the consideration of drum windings. A large number of diagrams and tables are given in the chapter on drum windings, including the Arnold series-parallel winding and other unusual forms. The few notes on armature and commutator construction appear to be fairly representative of modern practice, but the inclusion in the section on field systems of a number of obsolete designs seems very unnecessary now that the circular frame radial pole construction is almost universal even for two-pole machines. In the calculations of the field windings, the losses and the commutation criteria, the approximate methods of Hobart are followed to a large degree. The objects of commutating poles and compensating windings are briefly explained, but in view of the extensive adoption of the former even in standard machines, one would expect further details as to their influence on the general design of D.C. machines. The calculations for a 12½-kw. 4-pole 800 r.p.m. generator are worked out in full on the usual lines in the chapter on design. The different types of motors are briefly described, and some notes on the design of motor starters are included. A separate chapter is devoted to traction motor design and control, and, in the section dealing with characteristic curves, an interesting diagram from which to obtain the behaviour of the motors of a car under any given running conditions is explained. The book concludes with some brief notes on the testing of D.C. machines.

Elementary Electrical Calculations. By T. O'Conor Sloane. 304 pp. 8 in. by 5½ in. Illustrated. (London: Crosby, Lockwood & Son.) 9s.

This book is a collection, with worked examples, of the elementary mathematical laws underlying the calculations which are met with in problems in electrical engineering, and should form a useful supplementary manual to the text-books dealing more with the physical side of the question. In the first forty pages the author briefly runs over the elements of algebra, mechanics, and physics with the idea of refreshing the reader's memory, and then deals in succession with Ohm's law, resistance

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the arrangement of cells, energy and power, absolute and practical units, heating effects of current, thermo-couples, and the principles of electro-chemistry. The second half commences with the elementary laws of magnetism, and deals with electro-magnetic induction, alternating-current circuits, hysteresis, and eddy currents. At the end of the book is a chapter on "Networks," in which analytical methods of arriving at the voltage drop on interconnected conductors are given. The book is of American origin, and, consequently, wire sections are expressed in circular mils. In a future edition some mention of the various wire gauges would be of use to American as well as English readers. Graphical methods are intentionally avoided by the author, and this we consider to be a mistake. Diagrams and curves are also only very sparingly employed; thus, in the section on magnetisation and hysteresis we look in vain for the familiar B.H. curve which would convey so much more to the student than the equivalent tables which are given.

First Stage Sound, Light, and Heat. By R. W. Stewart. Second Edition. 288 pp. 6¾ in. by 4¾ in. 57 illustrations. (London: University Tutorial Press.) 2s.

THE present edition has been thoroughly revised and much has been rewritten, while a large number of new experiments and diagrams have been added. Though specially prepared for those studying for the science examinations of the Board of Education, the book forms a lucid introduction to the subjects dealt with, suitable for the use of schools or private students.

THE ASSOCIATION OF CONSULTING ENGINEERS

WE have received a communication from the Secretary of the above Association, setting forth the aims and objects in view of some misunderstanding on the subject which appears to have existed.

One of the principal objects of the Association is to secure that municipal and other public works shall be supervised by duly qualified consulting engineers. The Association will include all branches of the profession—civil, mechanical, electrical, gas, and possibly others—and it is proposed that every member shall be a properly trained and qualified engineer, and that he shall be acting solely in a professional capacity—that is, as a consulting engineer. It is not intended to encroach in any way on the authority of the councils of the leading institutions which deal with the different branches of engineering.

The Association does not propose to deal with science and problems of engineering, but only with professional status and conduct.

Although the bye-laws governing professional conduct issued by the Institution of Civil Engineers, and adopted by the Institution of Electrical Engineers, require that the members of these institutions, when acting in a "professional capacity"—that is, as consulting engineers—shall conform to certain rules, no distinction is made between their members, and are therefore not able to say to which of their members the rules are applicable. As the rules stand, a member can act in one capacity one day, and in another the next. The new Association adopts the view that there should be as clear a distinction between the work of a consulting engineer and that of other members of the engineering profession as there is between the work of a barrister and that of a solicitor in the legal profession.

The register of the Association will, it is hoped, form a complete list of the qualified consulting engineers to whom the professional conduct rules above referred to will be applicable at all times. This register will be open to inspection by the authorities responsible for spending public money, as well as to anyone else requiring the advice of a consulting engineer.

The rules of the Association are now under consideration, and will be based on the professional conduct rules of the institutions of Civil and of Electrical Engineers. These rules will be submitted to a general meeting in the autumn. It is hoped that all the leading men in the profession will be willing to give their advice and help, so that nothing may be done that would be detrimental to the interests of the existing institutions or of the public.

At present the membership is confined to those who are corporate members of the Institution of Civil Engineers and also of the Institution representing the particular branch of the profession in which they practice. It is hoped that all consulting engineers in sympathy with the objects of the Association will send their names to the Honorary Secretary, Mr. A. H. Dykes (1 Victoria Street, Westminster, S.W.), so that notice may be sent them of the general meeting which will be called in the autumn to consider and decide on the rules and constitution of the Association.

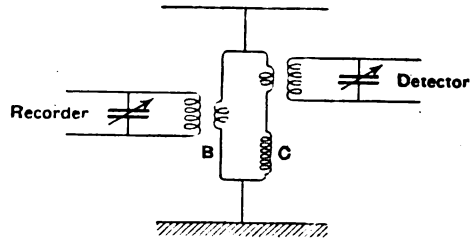
AN EXPERIMENT ON HARMONICS IN RADIOTELEGRAPHY

By C. C. F. Monckton

AT a station A, 60 miles from B and about 35 miles from C, an attempt was made to receive signals from both stations simultaneously on the same aerial. B was sending with 50 watts, C with from 1 to 3 kilowatts. The receiving circuits were in tune and arranged as in the accompanying figure.

The following points were noted:—(1) No signals could be received from station C if the B circuit were completed. (2) Closing the C circuit, no difference was made to the B signals. (3) Using a closer coupling, C signals could be received in B when C was open or closed. (4) The wave-length of C was double that of B within 10 per cent.

A further experiment was made. A single receiving circuit was used with three turns of inductance 22·7 cms. diameter as the primary, and 44 double turns of 19/0·005 mils. wire on a 15·4 cms. diameter bobbin as the secondary of a transformer. The



primary and secondary were both tuned to half the wave-length of C. Readable signals were obtained from C with the coils separated 8 cms. centre to centre, using the silicon detector; no signals were received if the capacity were increased or diminished by about 0·0001 mf. Then keeping the primary circuit the same, the capacity was increased fourfold to make the secondary in tune with C; readable signals were obtained with the coils 10 cms. apart centre to centre; the signals were lost if the capacity were increased or decreased 0·00006 mf.

Finally, altering the primary to tune C by adding inductance, and the secondary to tune B, the coils had to be brought as close together as possible for signals to be received from C. Increasing the capacity, the signals gradually became louder till the secondary was in tune with C.

Automatic Telephone Exchange.—According to a British Consular Report, the year's trial made in Lyons, France, of the Lorimer automatic telephone exchange, was completed in the autumn of 1909, and was very successful. It is stated, however, to be doubtful whether the French postal authorities will take up the invention, partly on account of its complicated, delicate, and costly nature, and partly also on account of the wholesale dismissal of telephone operators which the general adoption of the system would entail.

The Summer Meeting of the Institution of Mechanical Engineers.—On page 508 of ELECTRICAL ENGINEERING of last week, in our special report of the discussion on the electric traction Papers read at the combined meeting of the Institution of Mechanical Engineers and the American Society of Mechanical Engineers, Mr. J. G. Wilson was described by an error of our reporter as being connected with the Great Eastern Railway. This is not so, as the Mr. Wilson who spoke belongs to the firm of Merz & McLellan, consulting engineers, of Newcastle and London.

Electricity Supply in Austria.—The Elektrotechnischer Verein in Wien (Electrotechnical Society of Vienna) have issued a 32-page brochure giving full particulars of electricity supply in Austria. The list includes 675 stations supplying over 1,500 districts, and is corrected up to July 1st last. Among the details given are the number of inhabitants of the place in question, the owner of the supply system, date of commencement of supply, nature of supply, pressure, frequency, capacity of lamps and motors connected, charges, and output. Of the 675 stations, 241 are under municipal control, and the remaining 434 are owned by private concerns. Of the latter, 114 are works in connection with large factories, works, or mines. The continuous-current stations number 403; single-phase, 15; two-phase, 5; three-phase, 192; both continuous-current and three-phase, 37. Particulars are failing in the case of the remaining 23 stations. There are 10 stations of over 5,000-kw. capacity, and 89 of between 500 and 5,000 kw. Steam stations number only 127. There are 308 water-power stations, 52 gas and oil engine stations, 87 steam and water, 15 steam and gas engine, 42 water-power and gas engine.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Aug. 4th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

16,547/09. **Electric Heater for Liquids.** Dr. F. W. Forbes Ross (London). Nickel or other resistance wire is wound on a grooved core of porcelain, and enclosed in a closely fitting quartz tube. Before fitting on the tube, the grooves are filled up with plaster of Paris or a phosphate or silicate cement. The space between the core and the outer tube is thus filled up with paste, and this facilitates the transfer of heat from the wire to the liquid. The wire is heated before the paste sets, so that it makes a channel large enough for itself to expand in. One figure.

16,682/09. **Tramcar Trolley Head.** F. Jackson (Ashton-under-Lyne). A construction of ball race previously used for pulley blocks is applied to trolley heads. The trolley wheel is bored slightly taper, and is fitted with a bush, on each side of which is a ball race. The balls are retained in position by cones inserted in the bush and screwed on to the central bolt passing through the wheel. Two figures.

20,586/09. **Electrical Marine Propulsion.** J. N. Bailey (Stretford). In a system comprising a turbo-alternator and a motor driving the propeller shaft, speed variation is obtained by controlling the admission of steam to the turbine. A special form of controller is used, and on going from one step to a step of lower speed, steam is temporarily cut off and water is automatically admitted to a hydraulic friction brake on the turbine shaft. This slows down the turbine quickly. An alternative method of braking consists in temporarily admitting water to a water resistance permanently connected to the generator. Four figures.

20,786/09. **Switchgear.** C. B. Walker (Solihull, Warwick). This is a quick-break mechanism suitable for automatic battery regulators and slow-speed gear for heavy motor starters. The contact arm is attached to a worm wheel which gears with a worm. The wheel is held from rotating by a catch, and instead of moving the wheel, the worm, on being rotated, slides along its axis and compresses a spring. When a certain point is reached, the catch is released and the spring causes the worm to slide back and move the contact arm quickly one step on. The slow rotation of the worm ensures that the contact arm shall remain stationary a considerable time on each step. Two figures.

23,225/09. **Commutator Segment Insulation.** British Thomson-Houston Co. *(General Electric Co., U.S.A.)*. An insulating material which will wear down evenly with the segments is composed of 237 parts of dry Kaolin, 37 parts powdered glass, 88 parts green silko, 2 parts red silko, and 156 parts asbestos. The mixture is made into sheets, treated with silicate of soda, and finally fired at a high temperature under considerable pressure. The compound is stated to have high dielectric and mechanical strengths, and to withstand high temperatures

3,733/10. **Alkaline Accumulator.** L. Marseille and P. Gouin (Paris). When forming electrodes with hydroxides of nickel, considerable expansion occurs. To avoid distortion, the electrode consists of a cylindrical tube of nickel perforated and bound all over with wire. This tube is then oxidised, so as to fill the insterstices of the binding with sesquinoxide of nickel. Finally, it is filled with the active material and closed at both ends with ebonite plugs. Five figures.

4,697/10. **Motor Control.** H. E. White and E. R. Carichoff. (Schenectady.) In electromagnetic control systems as used with traction motors, auxiliary electromagnetic switches controlled by the motor current are mechanically interlocked with the successive resistance controlling contactor switches in the control circuit, so that if the master controller is moved to the next position, the corresponding contractor will not work until the motor current has fallen to a predetermined value. One figure.

6,658/10. **Supports for Metal Filaments.** Dr. F. Salzer (Ujpest, Hungary). In order to protect the metal supports or leading-in wires from the effects of the high temperature of the filament, the former are coated electrolytically with a thin film of chromium. The coated wires are heated to anneal the coating and render it flexible.

10,817/10. **Wireless Telegraphy.** R. A. Fessenden (Brant Rock, U.S.A.). On warships where the apparatus is placed below the protective deck, it has been found that the proximity of the steel plates to the aerial leads weakens the signals. To overcome this objection, the leads are surrounded by a cage of copper wires, where they pass through the protective deck. The cage is connected to the copper sheathing on the outside of the vessel. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Dalziel's Constant Voltage Patents, Ltd., and Dalziel [Distribution system] 16,645/09; Beaver and Claremont [Cable joints] 20,106/09.

Dynamos, Motors, and Transformers: Boult *(Deutsche Elektro Sparlicht Ges.)* [Transformers] 17,043/09; Siemens Bros. Dynamo Works, Ltd. *(Siemens Schuckertwerke Ges.)* [Frequency changers with commutators] 24,269/09; Schlick [Generator for bicycle lamps] 5,043/10; Siemens Bros. Dynamo Works, Ltd. *(Siemens Schuckertwerke Ges.)* [Frequency changers] 7,292/10.

Instruments and Meters: Berry, Russell and Jung [Speed recorder] 11,515/09; Rennie [Speed indicator] 16,621/09; Palmer [Prepayment meters] 10,802/10.

Storage Batteries: Garde and Adams [Plates] 9,066/09; Taylor [Charging methods] 14,212/09.

Switchgear, Fuses, and Fittings: British Thomson-Houston Co. and Wedmore [Protective devices] 17,031/09; Arnold [Lampshade holders] 20,666/09; Adams Manufacturing Co. *(Cutler Hammer Manufacturing Co., U.S.A.)* [Electromagnetically worked switches] 5,801/10.

Telephony and Telegraphy: Lake *(Electric Press Bulletin Co.)* [Telegraphic apparatus] 23,328/09.

Traction: Pink [Traction system] 18,499/09; Perraud [Automatic stopping of trains] 24,015/09; Heizer [Air brakes] 25,870/09; Wheless [Rails] 29,763/09; Roberts [Rail-joints] 4,762/10; Soc. in Accomandita per l'Utilizazione delle Invenzioni Ing. Beer [Signalling] 11,358/10; Walter's Electrical Manufacturing Co., and Moore [Signalling] 15,882/10.

Miscellaneous: Burks [Combined massaging and magneto machine] 16,405/09; Hirst [Coal-cutter] 17,235/09; Whipple [Tyre-pump] 17,414/09; Thompson *(Hamburger Elektricitats Ges.)* [Illuminated signs] 19,623/09; Knight [Fire-alarm] 22,378/09; Siemens Bros. Dynamo Works, Ltd. *(Siemens Schuckertwerke Ges.)* [Flexible couplings] 28,019/09; British Thomson-Houston Co., Ltd. *(General Electric Co., U.S.A.)* [Treatment of metals of chromium group] 3,981/10; Fairburn-Hart *(Electric Renovator Manufacturing Co.)* [Centrifugal fans] 5,376/10; Freise [Selenium cell fire-damp indicator] 9,545/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: A.-G. Brown, Boveri et Cie. [Voltage regulation of A.-C. machines] 15,415/10.

Electrochemistry: Billiter [Electrolysis] 11,693/10.

Miscellaneous: Maschinenfabrik Oerlikon [Driving of ring-spinning machines] 2,237/10; Maloney [Mono-rail cars] 17,075/10.

Opposition to Grant of Patents

9,110/09. **Boilers.** W. Wallis. This patent has been granted in spite of opposition. It covers the use of a series of short curved deflecting plates near the surface of the water to promote circulation.

15,496/09. **Metal Filaments.** R. Jahoda. Opposition has been entered to the grant of this patent, which covers the use of copper and silver oxides in the manufacture of metal filaments. (*See* Electrical Engineering, June 23rd, 1910, page 415.).

15,659/09. **Centrifugal Fan.** K. Maxaner. The grant of this patent has been allowed in spite of opposition. The specification was abstracted in Electrical Engineering, April 21st, 1910, p. 274.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: W. S. Weedon [Titanium oxide electrodes] 9,190/04.

Distribution Systems, &c.: E. Claremont and C. J. Beaver [Cable braiding] 8,810/03.

Dynamos, &c.: H. Chitty [Ventilation of field magnets] 9,397/02; H. Leitner [Train-lighting system] 8,812/05; British Thomson-Houston Co. and F. Holden [Train-lighting dynamo gear] 8,570/05.

Incandescent Lamps: British Thomson-Houston Co. *(General Electric Co., U.S.A.)* [Machine for capping bulbs] 8,568/05.

Switchgear, &c.: C. J. Klein [Push-button switch] 8,910/04; W. H. Lau [Lamp-holder] 8,253/05.

Telephony, &c.: S. G. Brown [Quadruplex telegraphy] 7,471/00.

Miscellaneous: A. F. Berry and R. J. Wallis-Jones [Electric welder with transformer] 8,340/99; G. C. Lilley [Mariners' compass] 9,178/02.

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THE WIRING CONTRACTORS' POINT OF VIEW

THERE are three topics of conversation among wiring contractors, and in all three cases they give rise to a certain amount of speculation. By the word speculation we do not mean "the laying out of money with a view to more than the usual success in trade," nor do we mean "a hazardous commercial or business transaction entered into in the hope of large profits," both of which are excellent dictionary definitions; we are using the term in what we believe to be its original meaning. Wiring contractors are speculating—or, let us say, wondering—what are the precise arrangements that have been come to by the tube makers who have formed a "ring," or, more than a ring, an "Electrical Conduit and Fittings Association." They are wondering what is precisely the position of the wiring contractor in the patent fight between the metal filament lamp makers and importers. Lastly, they are wondering whether Parliament will grant the general wiring powers to Local Authorities, which it has sometimes refused and sometimes granted in the special cases that have arisen hitherto.

The Incorporated Municipal Electrical Association has lost little time in circularising its members to enquire whether they would support a general Bill to give full powers to Local Authorities to carry on house-wiring. The proposition has already been considered by a few municipal councils, with varying results, as reported in our last issue. Among those who decided to support the Bill were the Dundee Council, but last week the Council received a deputation of Dundee wiring contractors, who placed before them their point of view, and after some discussion the matter was remitted for further consideration by 12 votes to 10.

The pending patent action by the Osram lamp people against Messrs. G. M. Boddy & Co., one of the importers of Philips lamps, will have one good effect in "clearing the air." Some surprise is expressed, however, that, with, we believe, only one exception, no other lamp makers or importers have replied to the public announcement made by the General Electric Co. and the B. T.-H. Co. with regard to this matter. The wiring contractor and his customer want to know what liability they incur by selling and purchasing lamps alleged to be infringements of the Osram group of patents, and the consulting engineer who has large consumers of lamps to advise, and the municipal electrical engineer who buys for street lighting, also desire similar information. If it is not forthcoming it is obvious that several customers of the smaller lamp makers and suppliers will be transferring their patronage to the Osram and Mazda.

The "Electrical Conduit and Fittings Association" is apparently a combination to level up prices of conduit for electrical purposes—we say advisedly level up and not level down. So far as we have been able to ascertain, practically all the interior electrical conduit firms have joined the Association, and prices have been agreed upon which represent a considerable advance in the case of the cheaper firms and those who have been cutting prices hitherto, but leave the list prices and discounts of the larger firms practically unchanged. It remains to be seen whether the new Association will endure, as has been the case of the Cable Makers' Association, or whether it is to be regarded merely as a temporary measure to prevent further price cutting. It is already causing some loss to contractors who have tendered for work on the basis of the lower prices of conduit and have now to buy at the top prices.

Parliamentary Intelligence.—Among the Bills to which Royal Assent was given last Wednesday were the following:—Eastbourne Corporation, London County Council (Tramways and Improvements), London United Tramways, Rhondda Urban District Council (Tramway Extensions, &c.), Electric Lighting Order Confirmation (Nos. 1, 2, and 4), Tramway Order Confirmation, Metropolitan District Railway.

Hysteresis in Iron and Steel.—A Paper on "Hysteresis Loops and Lissajous' Figures, and on the Energy Wasted in a Hysteresis Loop," was read by Prof. S. P. Thompson at a recent meeting of the Physical Society of London. Explanations of the forms of the looped curves which express the hysteresis exhibited by iron and steel have been given by Ewing and Hopkinson, and M. Pierre Weiss has put forward an electronic theory. Prof. Thompson shows that any hysteresis loop can be analysed into a harmonic series of closed curves corresponding to the various terms in the analysis of the current wave. A number of examples of hysteresis loops were chosen and subjected to analysis. These related to various kinds of iron and steel, hard and soft, solid and laminated. Details are given of the analysis of various loops, the effect of eddy currents on the size and form of the loops is discussed, and an account is given of the effect of the higher sine and cosine constituents of the current wave.

THE A.E.G. AND THE LAHMEYER CO.

Concentration of Interests

THE *Frankfurter Zeitung* aroused considerable interest on July 30th by predicting a combination of interests between the A.E.G. Co. and the Felten & Guilleaume-Lahmeyerwerke. That this prediction was based on good information is now proved by the announcement that an important agreement has been arrived at between the Elektricitäts-A.-G. (*vorm* W. Lahmeyer & Co.), Frankfort, and the Bank für elektrische Unternehmungen, Zürich, whereby shareholders in the Lahmeyer Co. are to receive new shares in the banking company to the face value of 3,000 francs in exchange for every 4,000 marks of shares of the Lahmeyer concern. The exchange has yet to receive the sanction of the shareholders of the Lahmeyer Co., and an extraordinary general meeting will be held on August 23rd, but it is considered certain that the arrangement will be agreed to. The importance of the agreement is due to the fact that the Bank für elektrische Unternehmungen is practically controlled by the Allgemeine Elektricitäts Gesellschaft, of Berlin, who own most of the shares, and that the Elektricitäts-A.-G., *vorm* W. Lahmeyer & Co., holds 16 million marks of the 55 million marks which is the total capital of the Felten & Guilleaume Lahmeyer Werke combination. The capital of the Bank is 40 million francs, and it has acted as a holding company for the various shares in the companies acquired by the A.E.G. in the course of their business. The capital of the W. Lahmeyer Co. is 25 million marks. Further, it is asserted that there has been for some time past a friendly understanding between the Allgemeine Elektricitäts Gesellschaft and the Siemens Schuckert group, so that a general concentration of interests is predicted with a view to eliminate wasteful competition. The competition of recent years is said to have been considerably increased by the rapid growth of the Bergmann Elektricitäts Gesellschaft of Berlin.

Telegraph Traffic.—On the 3rd inst., the cable between Bonny and Duala ceased working, while on the 8th inst. the line between Rome and Constantinople was down. The Western Union Telegraph Co. are now busily finishing their new Atlantic cable, the c.s. *Telconia* having laid the shore end at Bay Roberts, Newfoundland. The Direct United States Cable Co.'s deep-sea sections to connect their existing cable with Newfoundland (Harbour Grace) will also soon have been laid.

Wireless Telegraphy.—In connection with the manœuvres of the Territorial forces, a wireless company of the Northern Engineers is stationed near the Western Camp at Aldershot, and is provided with up-to-date portable apparatus, with a forty-foot aerial. At Bexhill, a wireless company of the Royal Engineers are using telegraph poles as masts from which to hang their aerials.

The City of Dublin Steam Packet Co. has made arrangements with the Marconi Co. for fitting the mail packets with wireless apparatus. The R.M.S. *Connaught* has already been fitted.

According to the *Times*, the Glasgow Chamber of Commerce on Monday agreed unanimously to oppose the Wireless Telegraphy Bill. Mr. Robert Henderson, of the Anchor Line, representing the Glasgow Steamship Owners' Association, stated that the Bill was uncalled for unless where vessels carried over 100 passengers, exclusive of crew. To compel vessels carrying only 50 passengers, inclusive of crew, to carry the apparatus would place a great hardship upon purely cargo ships. The Bill seemed in the interest merely of wireless telegraphy companies, who would make the utmost use of the monopoly thus afforded them.

Wireless Telegraph Detectors.—A Paper entitled "The Energy Relations of Certain Detectors used in Wireless Telegraphy" has been contributed to the Physical Society of London by Dr. W. H. Eccles. The paper gives the results of experiments on the electrolytic detector, the zincite rectifier, the carborundum rectifier, and a thermoelectric detector consisting of a light contact between graphite and galena. The quantities of energy given in the form of electrical oscillations were the same as in actual practice. Three ways of investigation were followed. The first way consists in applying to the detector an electromotive force which is gradually increased, and measuring the current at each step. The second way is to fix the electromotive force at some particular value, to send trains of oscillations of various energy values through the instrument, and to measure the intensity of the sound produced in the telephone on each occasion. The third way is to send trains of constant energy value through the instrument while the steady electromotive applied to it is varied, and to measure at each step the intensity of the sound produced in the telephone. The results suggest that all the detectors are fundamentally thermal in their action.

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LOCAL NOTES

Aberdeen: *Tramway Accounts.*—The result of the year's working is a balance of £14,634, which has been transferred to renewal account. The consumption of electrical energy has decreased since ampere-hour meters have been fitted to the cars, and is now 1·102 unit per car-mile, a reduction of 0·146 unit since 1906, although more top-covered cars are in use.

Auckland (New Zealand): *Tramway Brakes.*—According to the *Australian Mining Standard*, a Royal Commission which has inquired into the tramway undertaking recommends the adoption of compressed air brakes and sanding gear, and the reconstruction of the existing track brakes so that 45 per cent. of the weight of the car can be transferred to the blocks.

Belfast: *Tramway Extension.*—At the monthly meeting of the Corporation last week the proposed tramway extensions in various portions of the city which have been discussed by the Council in Committee were approved. The extension scheme consists of eight different extensions within the city, at a probable cost of £111,000, and also a new line of tramway to M'Art's Fort, on the top of the Cave Hill, which, it is estimated, will cost £130,000.

Chatham: *Lighting of Corporation Buildings.*—With reference to a proposed increased charge for current by the local company, the Town Council are to obtain an estimate for lighting the whole of the corporation buildings with gas, and also are to have a report prepared as to the advisability of the corporation generating their own electricity for lighting the Town Hall.

Chelmsford: *Street Lighting.*—The Council have received tenders from the Electric Supply Corporation for street lighting at the following prices:—Twenty-one flame arc lamps at £25 5s. each per annum, and twenty-three 200 c.p. and 280 100 c.p. and certain other incandescent lamps at £3 3s. per annum. The gas companies submitted several alternative tenders for lamps from 75 to 125 c.p. at prices from £3 to £3 4s. 6d. per annum.

Cleckheaton: *Tramways.*—The Board of Trade have decided to issue an order granting to the British Electric Traction Co. a cessor of powers with reference to the unconstructed portions of the Spen Valley lines, so that the projected line from Cleckheaton to Hartshead Moor will be abandoned.

Finchley: *Showroom.*—A small showroom at the electricity works is to be equipped with cooking, heating, and other apparatus for demonstrations.

Glasgow: *New Type of Tramcar.*—A new type of small single-deck car, in which one official will be able to act both as driver and conductor, is to be put into use between Finnieston and Stobcross.

Greenock: *Electricity Accounts.*—The profit on the year's working has amounted to £3,247, of which £1,000 has been carried to reserve, while the remainder is to be applied to relief of rates.

Halifax: *Tramway Accounts.*—The total revenue for the past year is given as £89,270, and the working expenses as £53,898. After meeting capital charges the net profit is £13,065, against a loss of about the same figure for the previous year.

Herne Bay: *Electrically-caused Fire.*—An outbreak of fire due to the fusing of a lighting cable took place at the new pier pavilion on Thursday evening, but very little damage was done.

Ilford: *Electricity Accounts.*—The electricity accounts for the year to March 31st show a net profit of £1,569 after meeting capital charges, compared with a profit of £1 in the previous year. The average price obtained per unit sold for private supply increased from 2·15d. to 2·55d., and for public lighting from 1·66d. to 1·98d.

Llanelly: *Tramways.*—The Board of Trade have confirmed the Llanelly & District Light Railway (Renewal and Extension of Time) Order, 1910, renewing the powers and extending the periods for the completion of light railways.

London: *Hornsey: Dispute with the North Metropolitan Electric Power Co.*—The Council have decided to take counsel's opinion regarding their complaint that the North Metropolitan Electric Power Co. have acted *ultra vires* in supplying a cinematograph theatre in Frobisher Road.

Nelson: *Lighting of Brierfield.*—A letter was read to Nelson Town Council from the Brierfield Authority on August 4th with regard to the supply of electricity in their district for lighting and motive power, and suggesting a limited term of 3¾ years. The suggestion was accepted, and an agreement was authorised for the supply of electricity in bulk until March 31st, 1914. Application is now to be made to the Board of Trade for an order authorising the supply.

Peterborough: *Electricity Accounts.*—The accounts for the year ended March 31st show a deficit on the year's working of £1,801. Included among the expenses of the year were £1,016, costs of an arbitration case with a traction company.

Plymouth: *Motor Hire.*—The Electrical Engineer having been instructed to report as to arranging for the letting of electric motors on hire, informed his Committee that at the present time the Corporation do not possess the requisite statutory powers.

Rochdale: *Electricity Accounts.*—The accounts of the Electricity Department for the year to March 31st show a net profit of £5,171 after meeting capital charges. The number of units sold was 3,545,339, and is a substantial increase over the figure for the previous year, due to the extra energy supplied for power purposes. In 1909 the Council passed a resolution that an amount equal to 1 per cent. of the capital charges should be charged to revenue account for depreciation, and this has been done. In view of the satisfactory condition of the undertaking, there is a possibility that the Committee will reduce the prices for energy, although there may be some doubt as to this in view of the fact that coal is likely to increase in price, and that all additional power units sold tend to reduce the average income per unit.

Sheffield: *New Tariff.*—The Electricity Committee has framed the following conditions with regard to discounts to lighting consumers:—(1) To any consumer who uses electricity for lighting purposes as much as possible throughout the year during daylight or long hours, mostly when the output is not at its maximum, and provided that the consumption, based on the estimated maximum demand, does not fall below 100 units per annum per 60-watt lamp or equivalent, a discount of 50 per cent. will be allowed from the usual price of 4d. per unit. (2) Accounts will be rendered weekly, monthly, or quarterly, at the option of the Committee, and the discounts will be adjusted according to the average daily rate of consumption as shown between successive readings. (3) No discount will be allowed unless the account is paid before the next account is due. (4) The Committee may, in special cases where they deem it an advantage so to do, make such terms as they think fit, provided that in any such case similar terms shall be allowed to other customers in similar circumstances as required by the provisions of "The Electric Lighting Act, 1882."

South Shields: *Electricity Accounts.*—The electricity undertaking, which, for nine years, had been producing a profit, has an adverse balance of £106 on the last year's working. It is stated that the introduction of the metal filament lamp has caused a serious diminution in revenue.

Stafford: *Electricity Accounts.*—The total expenditure for the year was £1,865, and the revenue was £4,344. After meeting capital charges, the net profit was £374, and £110 was brought forward from last year; £340 is to be transferred to depreciation, and the remainder carried forward.

Stockport: *Tramway Accounts.*—A balance of £5,000 has been contributed in aid of the rates.

Strood: *Order Revoked.*—The Board of Trade has revoked the Strood & Dartford Electric Lighting Order.

Wigan: *Extensions to Electricity Works.*—The foundation stone of the extensions to the Electricity Works was laid on Wednesday of last week. The cost of the extensions will be £36,000.

Wolverhampton: *Tramway Accounts.*—The past year's working of the tramways, which are upon the Lorain surface-contact system, has resulted in a net profit, after meeting capital charges, of £5,667.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Accrington.—The Electricity Committee have decided upon the purchase of a new battery, which is to be paid for out of revenue. It is the intention to use the old boxes and the present battery.

Australia: *Melbourne.*—Tenders are required for 4,840 yards of low-tension lead-covered cable, and 880 yards of

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high-tension concentric cable. Tenders by August 23rd. Particulars from Messrs. McIlwraith, McEacharn & Co. Ppty., Ltd., Billiter Square Buildings, London, E.C.

BOURNEMOUTH.—Tenders are invited for the reconstruction of 2½ miles of permanent way and the supply of 450 tons of rails. Tenders by August 31st, and particulars from the General Manager.

DUBLIN.—Considerable mains extensions are to be proceeded with at a cost of £2,350. The South Dublin Union have received sanction for a loan for an electric light installation.

ECCLES.—As an additional switch panel will be required in connection with a new H.T. feeder about to be laid from the electricity works to Monton Green, the Electrical Engineer has been authorised to inspect the Ferranti switchboard at the Hastings Electricity Works. The Local Government Board has sanctioned the borrowing of £1,927 for the extensions of the engine-room and additional generating plant, and £1,307 for main extensions.

FLEETWOOD.—A Local Government Board inquiry was held at Fleetwood on August 4th into an application by the Fleetwood Council to borrow £4,100 for the purpose of the electricity undertaking. The proposed extension comprises a 800 kw. steam dynamo (£1,700), switchboard (£560), an overhead crane (£135), extension of building (£1,120), and contingencies.

HEREFORD.—The Local Government Board have sanctioned loans of £2,000 for mains and £1,500 for services.

LEICESTER.—A Local Government Board enquiry was held last week concerning a loan of £19,190 for additional generating plant at the Tramways Power Station. The Corporation have two power stations. One will supply alternating current, and is used for lighting almost exclusively, and the tramway power station, which also distributes continuous current, for power purposes. It is now proposed to work the two stations in conjunction with each other, although the loan in question is not affected by any arrangement which may be come to between the Tramways and Lighting Committees.

ROCHDALE.—Tenders are invited for the supply and delivery of paper insulated cables during a period of twelve months. (See advertisement on another page.)

RUSSIA.—The Riga Telephone Co. plans the following long-distance telephone lines: 100 miles to Pernau, 160 miles to Riga-Dorpath, and 142 miles to Riga-Fellin. The Russian Government proposes to build wireless stations at the port of Libau, at Bolderaa (mouth of the Dvina), and on Runo Island (Gulf of Riga). New electric power stations are contemplated for Novgorod; Kupyank, in the Government of Kharkov; Roono, in the Government of Volhynia; and Karassubarar in the Government of Tabriz; Alexandroosk-Gruschersk; and Kharbin. The following undertakings are either decided upon or are projected: Hennitchesk, electric lighting; Kiev, extension of electric lighting; Tchernigoff, telephone system; Orgieff, electric lighting; Rostov-on-the-Don, power station; Simferopol, electric tramways; Abashukino (in the Caucasus), hydro-electric station: Vladivostok, central power station; Novo-Nikolaievsk, electric lighting; Minsk, electric traction for tramways; Tiflis, electric railway along Mount St. David, and several other works in the district; Piatigorsk, electric power station; Romaninsk (Caucasian oil fields), power station; Poltava, electric tramways. The St. Petersburg Central Telephone Administration has obtained permission from the municipal authorities to use £285,000 in extending the telephone system and enlarging the central exchange so as eventually to serve 34,000 subscribers. The administration desires to arrange for an eventual 45,000 subscribers, and has asked that the amount be increased to £485,000. If Moscow can secure a loan of £2,470,000, the town council will expend £1,050,000 on the tramway system.

STRETFORD.—The Resident Engineer is to prepare a specification for the switchboard connection to the battery.

WIMBLEDON.—The Local Government Board has sanctioned the borrowing by the Council of the following amounts:—£3,400 for mains; £1,600 for house services; and £1,600 for meters.

MISCELLANEOUS

AUSTRALIA: *Victoria.*—Tenders are required for telegraph and telephone material to various specifications by August 30th, September 13th and 20th, and October 4th; also for electric lamps. Particulars from office of Commonwealth High Commissioner in London.

New South Wales.—Tenders are required by October 5th for 5,000 insulators. Particulars from Departmental Stores, 170 Clarence Street, Sydney.

AUSTRIA-HUNGARY.—According to the *Board of Trade Journal*, tenders will be received up to October 1st by the Municipal Authorities of Mostar for plant for the supply of electricity to the town.

BARCELONA.—A concession has been granted to the "Sociedad Anónima Los Tranvías de Barcelona" for extensions.

EGYPT.—Tenders are invited for an electrical installation at an asylum at Khanka. Particulars from Mr. A. L. Webb, Queen Anne's Chambers, S.W.

KIRKCALDY.—Tenders are invited for tramway material by August 24th. Particulars from S. L. Lumsden, Burgh Surveyor, Tolbooth Street.

LONDON: *Poplar.*—The Board of Guardians invite tenders for general stores for twelve months, including electrical supplies. Particulars from the Clerk to the Guardians, 45 Upper North Street, Poplar, and tenders by August 13th.

RAINHILL.—Tenders are required for a complete telephone installation for the County Asylum by August 25th. Particulars from J. Gornall, Clerk's House, County Asylum.

SKIPTON.—Tenders are invited for a gas engine and dynamo, and for the wiring of the Town Hall. Tenders by August 17th, and particulars from R. Wilson, Clerk to the Council.

TORQUAY.—The Borough Surveyor has been asked to prepare a scheme for the illumination of the Princes Gardens by electricity.

WEYMOUTH.—A loan of £150 has been sanctioned for tools at the Electricity Works.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

N.—Church and Schools, Wightman Road, North Harringay. Architect, Edgar Harry Selby, 8 Buckingham Street, W.C.

S.W.—Electric Theatre, Balham. Surveyors, Williams & Williams, 151 Regent Street, W.

PROVINCES.

ASHTON-UNDER-LYNE.—Savings Bank (£3,160). Architects, W. H. George & Sons, 7 Warrington St., Ashton-under-Lyne. Builders, Saxon Bros., Stalybridge.

BESWICK.—School, Gibbon Street (£6,684). J. H. Reynolds and C. H. Wyatt, Joint Secretaries, Education Committee, Manchester Town Council.

BOGNOR (SUSSEX).—Congregational Sunday Schools (£1,660). Architect, E. J. Hamilton, Brighton. Builders, J. Lingfield & Sons, Littlehampton.

BOLTON.—Training College (£3,660). F. Wilkinson, Secretary, Education Committee, Town Council.

BURTON.—Electric Theatre. Architect, T. Jenkins, Arcade Buildings, Station Street, Burton-on-Trent.

CHESTER.—Fire station (£3,000). Architect, G. Strong, Liverpool. Builders, J. Meyers & Co., Canal Side, Chester.

CREWE.—School, Derby Street (£12,000). Architect, G. Eaton Shore, Council Offices, Crewe.

ECCLES.—Baths, Cromwell Road. Surveyor, Eccles Town Council.

EDINBURGH.—Additions, George Watson's Ladies' College (£12.000). Architect, G. Washington Browne, 8 Allyn Place, Edinburgh.

FENCE HOUSES.—School (£11,875). J. A. L. Robson and J. L. Dawson, Joint Secretaries, Durham County Council, Education Committee, Durham.

FOLKESTONE.—Additions, Corporation Offices (£234). Builder, Otto Marx, c/o Surveyor, Folkestone Town Council.

LINCOLN.—Proposed Carnegie library (£10.000). R. A. MacBrair, Surveyor, Town Council.

MANCHESTER.—Governesses' institution (£4,262), Upper Brook Street, High Street. The Governors.

PUDSEY.—Extensions Town Hall (£3,500). Architects, J. Kendall & Son, 26 Lowtown, Pudsey.

RENFREW.—Masonic hall (£3,000). Architects, J. Boyd & Co., 49 Bath Street, Glasgow.

RUGBY.—Palace Theatre (£4,344). Builder, C. Cockerill, Rugby.

RYHILL.—School (£4.500). W. V. Dixon, Secretary, Education Committee, West Riding of Yorks County Council, Wakefield.

SALFORD.—School (£14.000). O. Duthree, Secretary, Education Committee, Salford Town Council.

WIGAN.—School (£8.000). Architects, F. & W. Thornley, Library Street, Wigan.

British Association.—The Australian Government will invite the British Association to meet in Australia in 1913 or 1914. Meetings in all the State capitals are contemplated, and the Australian Parliament will be asked to vote £10.000 to defray expenses connected with the visit.

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TENDERS RECEIVED AND ACCEPTED

AUSTRALIA: *New South Wales.*—The tender of J. Paton (Sydney) for 6,000 wall telephones (£15,600) has been accepted.

Western Australia.—The tender of the Western Electric Co. for 1,200 telephone wall sets (£3,120) has been accepted.

BRIDLINGTON.—The tender of the British Westinghouse Co. for the supply of metal filament lamps has been accepted.

BURY.—The tender of Messrs. Siemens Bros. & Co., for extra high-tension trunk mains to be laid from the new power station to the present electricity works, has been accepted.

DELAGOA BAY.—The Chloride Electrical Storage Co., Ltd., are supplying a battery and Entz booster equipment.

ECCLES.—The Council have accepted the tender of E. M. Evans & Sons, Manchester, at £460 9s. 6d., for the electrical wiring and fittings for the proposed new secondary school.

FAREHAM.—The Asylums Committee of the Southampton County Council have accepted the tender of Shalders & Davis, Southampton, for electrical machinery at £1,715.

FOLKESTONE.—The tender of E. Morgan at £69 15s. for supplying and fixing electric fittings at the Corporation Offices has been accepted.

GRIMSBY.—The Council have accepted the tender of Accumulator Industries, Ltd., for the supply of metal filament lamps for street lighting; and the tender of E. A. Hall for fixing two 18-in. fans in the Council Chamber at £20 2s. 6d.

IRELAND (BALLYCLARE).—The tender of Messrs. Curran Bros. has been accepted for an electric lighting installation at Ballyclare. The contractors have promised the Council to have the plant in working order for the winter.

LEITH.—The tender of the British Westinghouse Co. for a mixed-pressure continuous-current turbo-generator and accessories (£4,775) has been accepted.

MANCHESTER.—The Council have accepted the tender of the Union Cable Co., Ltd., for service cables at £1,500. At the meeting on August 3rd objection was raised to the order going to a foreign firm. The Chairman of the Electricity Committee (Mr. Howarth) said the lowest British tender was £2,750. The undertaking had suffered in the past from the Cable Makers' Association. The Union Cable Co., it was said, are about to build a factory at Dagenham, in Essex. An amendment to refer the matter back to the Committee was negatived.

ROTHERHAM.—The tender of Hall & Matthews for electric wiring at the South Grove Higher Standard School at £117 has been accepted.

SHEFFIELD.—The Town Council has accepted the following tenders:—British Insulated & Helsby Cables, Ltd., two miles of figure 8 bronze trolley-wire, 8½d. per pound, less 2½ per cent.; W. T. Glover & Co., Ltd., ten tons of H.C. copper wire to be made up into cables during a period of two years.

STRETFORD.—The tender of the Tudor Accumulator Co. for alteration and extension of the existing battery at £784.

TORQUAY.—An order has been placed with Ferranti, Ltd., for the annual supply of meters at £1 6s. 6d. each, for the smaller sizes, this price to include all ordinary repairs and adjustments.

WALSALL.—The Town Council has accepted the following tenders:—H. G. Richardson & Co., providing low-tension switchboard and altering a switchboard, £88 10s.; Union Electric Co., Ltd., three high-tension isolation switches, £19 10s.

WARRINGTON.—The tenders of George Wallington for laying down concrete foundations for the turbo-alternator and condensing plant, and the erection of a building for switchboard extensions at £300 have been accepted.

The Synchronome Co. (32 Clerkenwell Road, London, E.C.) are now installing their system of electrical impulse dials in a number of buildings, including the Transvaal Government Offices, Pretoria; the Transvaal University, Johannesburg; the Royal Courts of Justice, Rangoon; the locomotive workshops of the Manchurian Railway at Shakako; several offices and the Eastleigh works of the London & South Western Railway. The company are also exhibiting at Brussels, and will instal the system in the Royal Palace at Laeken.

APPOINTMENTS AND PERSONAL NOTES

Mr. P. M. Hampshire, assistant in the physics and engineering department at Blackburn Municipal Technical School, has been appointed lecturer and practical instructor of engineering subjects at the Municipal Institute, Walsall, at a salary of £160 per annum.

Finchley District Council has increased the salary of Mr. E. Calvert, electrical engineer, from £500 to £525 per annum.

COMPANIES' MEETINGS AND REPORTS

LANARKSHIRE TRAMWAYS CO.—There was a net profit of £15,477 for the June half-year, and a dividend at the rate of 5½ per cent. per annum is declared, carrying forward £6,045. The traffic receipts increased by £4,058, and the expenses by £2,913.

BOMBAY ELECTRIC SUPPLY & TRAMWAYS CO.—The annual meeting was held last week under the chairmanship of Sir Edward Sassoon, Bart. The tramway revenue increased by £8,628, in spite of the depression in the mill industry. The proposal of the company for a small increase in a few of the long-distance fares has been met in a sympathetic spirit by the Corporation, and the new fares have now been instituted. It has been decided to construct ten new single-deck trailer cars in order to deal with the traffic at rush hours. The revenue from the electric supply undertaking increased by £9,800. During the year it has been decided to substitute a flat-rate system and to abandon the maximum-demand system of charging. The chairman regretted the inability to pay dividends upon the ordinary shares, but he thought their patience would be well rewarded in the near future.

NEW GENERAL TRACTION CO.—The amount received from the subsidiary companies for the year to March 31st was £780 in excess of that for the previous year.

LIVERPOOL OVERHEAD RAILWAY CO.—The report for the June half-year shows a balance of £5,916 after meeting the 5 per cent. preference dividend. At the half-yearly meeting on Tuesday, Sir Wm. Fulwood, who presided, announced a slight increase in traffic since the previous year. This had produced an increase in revenue of £824, while the expenditure had been reduced by £524. The report was adopted, and a dividend of 5 per cent. on the preference shares was declared.

MAIN COLLIERY CO.—Sir George White, Bart., presided at the annual meeting of this company last week, and mentioned that by the use of electrical pumping, twice the amount of work was now being performed, in the two pits where electrical working had been installed. It is proposed to extend the supply of electricity to other pits and utilise it for pumping, ventilation, &c.

GREAT WESTERN RAILWAY.—In the half-yearly report it is stated that the mileage run by electric trains during the six months under review was 130,400, an increase of 1,912 over the corresponding period of 1909. The expenses of electric train working are given as follows:—Wages of trainmen, £1,290; current, £3,952; oil and stores, £534; repairs and renewals, £2,751.

LONDON, TILBURY & SOUTHEND RAILWAY.—At the half-yearly meeting on Thursday last, Mr. A. L. Stride, who presided, said that with regard to the new electric service between Ealing and Southend, a certain amount of time was necessarily occupied in getting a new service known. It was found, however, that every week the traffic of the through trains increased.

CENTRAL LONDON RAILWAY.—At the meeting on Thursday last, the Chairman, Sir Henry Oakley, said that the company was in a comfortable position, but the progress was slow. The contracts for the construction of the extension to, and new station at Liverpool Street, were referred to, and it was mentioned that the cost of the subway to the City and South London Co.'s booking hall in King William Street was to be borne by the latter company. The report and accounts abstracted on page 514 of our last issue were adopted.

METROPOLITAN DISTRICT RAILWAY CO.—The report for the June half-year shows that after providing for interest and other charges and setting aside £10,000 to renewals, there is a credit balance of £62,277. As already announced, the full dividend is declared upon the 4 per cent. guaranteed stock, and a dividend at the rate of 3 per cent. per annum on the 4½ per cent. preference stock. The number of passengers carried increased by no less than 3,230,413.

GREAT NORTHERN & CITY RAILWAY CO.—Lord Lauderdale, who presided at the half-yearly meeting on Wednesday last week, said that by reducing the working expenses, they had a small credit balance for the past year, apart from the fixed charges. This deficiency has been balanced as in previous years from those of their friends who were interested in the welfare of, and had confidence in, the undertaking.

BAKER STREET & WATERLOO RAILWAY CO.—After providing for interest, rents, and preference dividend, and reserving £4,000 for contingencies and renewals, the accounts for the June half-year show a net balance of £21,974. A dividend at the rate of 3 per cent. is recommended on the "A" ordinary shares, and 2 per cent. on the "B" ordinary shares, carrying forward £2,869. The number of passengers carried increased from 14,325,065 to 14,807,736.

CHARING CROSS, EUSTON & HAMPSTEAD RAILWAY CO.—After providing for interest and rents, and reserving £3,000 for contingencies and renewals, the accounts for the June half-year show a balance of £16,783, and a dividend at the rate of ¾ per cent. per annum is recommended on the ordinary shares, carrying forward £569. The number of passengers carried during the half-year increased fom 14,862,882 to 15,264,355.

GREAT NORTHERN, PICCADILLY & BROMPTON RAILWAY CO.—After providing for interest, rents, and guaranteed preference dividend, and reserving £6,000 for contin-

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gencies and renewals, the accounts for the June half-year show a balance of £46,852. A dividend at the rate of 1½ per cent. per annum is recommended on the ordinary shares, and a balance of £8,972 is carried forward. The number of passengers carried during the half-year increased from 19,155,883 to 19,973,049. The report, in common with the reports of the two other affiliated companies, expresses appreciation of the services rendered to the companies by Sir George Gibb, and regrets that his retirement on accepting the chairmanship of the newly-constituted Road Board.

DUBLIN UNITED TRAMWAYS CO.—The half-yearly meeting was held in Dublin last week, under the chairmanship of Mr. William Murphy, who congratulated the shareholders upon an increase in receipts of over £5,000. On the question of renewals track, the chairman said he now looked upon this with more assured feelings than he had experienced in the past. They had been engaged for three or four years now in renewing their track, and had proof that they would be able to meet this additional demand upon their financial resources without inconvenience, owing to the increase in traffic and increase in gross profits.

NORTH METROPOLITAN TRAMWAYS.—The accounts for the half-year ended June 30th show a net profit of £385, so that, with the addition of £81 brought forward, £466 is to be carried forward.

A.-G. BROWN, BOVERI & CIE., BADEN, SWITZERLAND.—A dividend of 8 per cent. is proposed, as against 11 per cent. in the previous year. The dividends of the affiliated companies for the past year are as follows:—Gesellschaft Motor, 6 per cent.; Elektricitäts Ges., Baden, 5 per cent.; Brown, Boveri & Cie., A.-G., Mannheim, 4 per cent. (against 6 per cent. in 1908-9); Technomasio Italiano, Brown, Boveri, Milan, 6 per cent.; Electro-Mécanique le Bourget, Paris, 10 per cent.; Akt. Norsk Electrisk & Brown, Boveri, Christiania, 3 per cent.

NORTH MELBOURNE ELECTRIC TRAMWAYS & LIGHTING CO.—The report for the year to September 30th, 1909, states that the undertaking is still managed by Messrs. J. G. White & Co. Whilst the net revenue shows a slight increase in both departments, the directors are not satisfied with the results. The company, however, is gradually extending its electric supply business, and the directors believe the undertaking generally will show a steady increase in the future. The directors serve without fees, and Messrs. J. G. White & Co. merely charge out-of-pocket expenses in regard to management.

BLACKPOOL AND FLEETWOOD TRAMROAD.—The report for the half-year ended June 30th, gives the profit, after providing for debenture interest, as £5,277. A dividend at the rate of 4 per cent. per annum is recommended, with £750 transferred to depreciation, and £500 to reserve, and £1,027 carried forward.

MISCELLANEOUS CITY NOTES

MORTGAGES AND CHARGES.—Particulars of the following have been registered:—Institution of Electrical Engineers.—Mortgage and instrument of charge, both dated July 15th, 1910, to secure £11,500. Property charged, 15-18, Tothill Street, Westminster, and land in rear thereof. Holders—Economic Life Assurance Society, 6 New Bridge Street, Blackfriars, E.C.

DIVIDENDS, &c., ANNOUNCED.—Consolidated Electrical Co., 3½ per cent. for the year. Melbourne Tramway and Omnibus Co., bonus at the rate of 5 per cent.—Brompton & Kensington Electricity Supply Co., interim dividend of 9 per cent. per annum.—Waste Heat and Gas Electrical Generating Stations, Ltd., 5 per cent. per annum for the half-year ended July 31st.

Bank für Elektrische Unternehmungen, Zürich. A dividend of 10 per cent. is proposed for the past year as in the year 1908-9.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 5s. per ton (last week, £57 15s. to £58 5s.).

DISSOLUTIONS OF PARTNERSHIP.—W. J. Richardson Fox, Junior, and Arthur Brooke, electrical engineers, Victoria Garage, Bradford Road, Batley, have dissolved partnership.

E. Jennens, A. E. Summers, and G. F. Summers, electrical engineers, 6 Fisher Street, Gosta Green, Birmingham, have dissolved partnership.

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—The first and final dividend of 7s. 3d. in the £1 is to be paid in the bankruptcy of Messrs. Platt & Bleasdale, electrical engineers, Victoria Square, Bolton. The dividend is payable to-day at 10 Acresfield, Bolton.

NEW COMPANIES

THOMAS BRITTAN, 34 Risinghill Street, Pentonville, London. Capital, £500. To take over the telegraph, telephone, and electrical instrument business already carried on at the above address.

C. H. HARE & SON.—Capital, £12,000 in £1 shares (4,000 pref.), mechanical and electrical, general engineers, &c. To adopt an agreement with the Caribonum Co., Ltd. Private company. Registered by Radford & Frankland, 27 Chancery Lane, W.C.

SOUTH LONDON ELECTRIC THEATRES.—Capital of £1,500). To take over all or part of the business and assets of the Greenwich Electric Theatre, now carried on at St. Peter's Hall, Bridge Street, Greenwich, and to adopt an agreement with A .W. Grist. Office: 19 Laurence Pountney Lane, E.C.

HOLOPHANE.—(Capital, £200,000.) To acquire from O. A. Mygatt, of Paris, all his interests in the Holophane system of illumination in all parts of the world, except France and the French Colonies, including (*a*) the whole of the share capital (200,200 dollars) of the Holophane Glass Co., of New Jersey, U.S.A., which possesses the exclusive right, subject to certain contracts, of manufacturing and selling Holophane scientific glassware in North America; (*b*) the right to the use and goodwil of the word "Holophane," in all parts of the world, except North America, France, and French Colonies; (*c*) the business carried on by O. A. Mygatt at 12 Carteret Street, S.W., and elsewhere, as the Holophane Co.; and (*d*) all patents, secret processes, trade marks, and designs relating to glassware for artificial lighting purposes, belonging to the vendor, except so far as they may exclusively relate to such countries aforesaid. First director, O. A. Mygatt (President of Holophane Glass Co., of New Jersey), Lt.-Col. F. J. P. Butler, G. C. Glynn (manager, Holophane Co. of London), Lord Ernest William Hamilton, and R. Woodhouse, jun., Registered offices: 12 Carteret Street, S.W.

ENGINEERS' STANDARDISED PUBLICATIONS ASSOCIATION, Craven House, Kingsway, London. Capital, £2,000. To take over the business of agents for the classification and distribution of manufacturers' trade circulars carried on by F. Samuel and J. D. B. Innes at the above address.

DAC ACCUMULATOR SYNDICATE, 39 Red Cross Street, London, E.C. Capital, £25,000. Electrical engineers and contractors. To adopt agreement with G. Schauli, F. T. W. Price, and H. E. Hughes, for the acquisition of certain patents.

DARTMOOR ELECTRIC SUPPLY CO.—Capital of £4,000 in £1 shares, to carry on at Bovey Tracey and elsewhere the business of an electric light company in all its branches, and to adopt agreements with J. H. Lee for a lease of a mill and premises at Bovey Tracey, and with A. J. Wyatt, relating to the supply of any surplus power required by the company. Registered office, 12 Market Street, Newton Abbot, Devon.

LOCH LEVEN ELECTRICITY SUPPLY CO.—Registered by Messrs. Batten, Proffitt & Scott, 13 Victoria Street, London, S.W. Capital, £10,000 in £10 shares. To take over so much of the undertaking of the Loch Leven Water & Electric Power Co. as relates to the supply and distribution of electrical energy (other than the supply to the factories and works of the British Aluminium Co., Ltd.). To carry on at Kinlochleven and elsewhere in the counties of Inverness and Argyle, the business of an Electric Light & Power Co. The subscribers are W. B. Rommeh, engineer, 1 London Wall Buildings, London, E.C., and G. Fleet, contractor, Abchurch Yard, Cannon Street, London E.C.

M. & G. TRUCK & ENGINEERING CO.—Capital £5,500. To carry on the business formerly carried on by Mountain & Gibson, Ltd., Elton Fold Works, Bury, and to adopt an agreement with Hobdell, Way & Co., Ltd. Private company. Registered by Lawrence, Webster, Messer, and Nicholls, 14 Old Jewry Chambers, E.C.

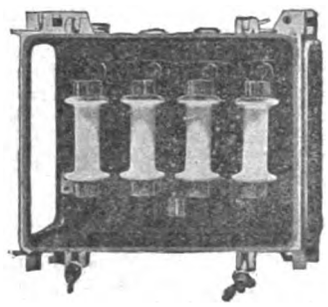
TITAN ELECTRIC CO., 792 Salisbury House, London Wall, E.C. Capital, £8,000. To adopt an agreement with S. de Szepczynski for the acquisition of a business of manufacturers of electric batteries and accessories.

CHAPMAN MOTOR STARTER SYNDICATE.—(Capital of £5,000 in £1 shares.)—To adopt an agreement with A. S. J. Chapman for the acquisition of the invention for an improved arrangement of a combined collector ring commutator and switches for use with a small battery to start petroleum engines fitted with magnetic-igniting apparatus. Registered office: 21 Great St. Helens, E.C.

DRILLS.—Registered by T. Hull & Son, 22 Chancery Lane, London. Capital, £2,000. To adopt an agreement between R. S. Crawford and J. Scott for the acquisition of patents relating to electric mining drills and other electrically driven percussive tools, &c.

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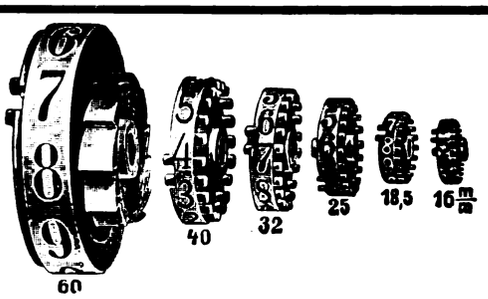
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No. 190 [Vol. VI., No. 33] THURSDAY, AUGUST 18, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203–206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

We have received letters from several consulting engineers complaining of the rule that only corporate members of the Institution of Civil Engineers shall be admitted to the newly formed Association of Consulting Engineers. (Page 530.)

The Post Office opened last Saturday the new central telephone exchange at Glasgow. It replaces an old flat-board exchange on the call-wire system, and is a 10,000 line C.B. exchange with many new features. The equipment was supplied and manufactured by the Peel-Conner Telephone Works, Ltd. In the operator's cord circuit the repeating coil is dispensed with, condensers are included in the speaking circuit, and a 40-volt battery is used instead of a 24-volt. Our article contains diagrams and explanations of the circuits and illustrations of some of the apparatus. (Page 531.)

The Grille water tube boiler, which is being introduced into this country, has several features of interest. One end of the tubes which are bent enters the steam drum above the water level, and means are provided for blowing the water out through a blow-off cock in the lower header to clean the tubes. Cartridges with ¼ in. openings are inserted in the lower ends of the tubes to restrict the flow of water into them, and this is claimed to increase the evaporative capacity and to prevent excessive discharge of water in the event of a tube bursting. (Page 533.)

Some progress was made at the unofficial meeting of the International Electrotechnical Commission held in Brussels last week. The alphabetical method of dealing with nomenclature is to be replaced by a more logical arrangement proposed by the German Committee. Symbols and the rating of electrical machinery were discussed. There is every probability of the official meeting of 1911 being held at Turin during the period of the International Exhibition. (Page 534.)

In accordance with our practice of last year we are publishing some particulars of the courses of instructions in electrical engineering which are given at the various universities, colleges, technical institutes, &c., about the country. Particulars are given in this issue of the Electrical Engineering courses at Cambridge and Oxford, and the leading universities, colleges, and technical schools in the provinces, giving an idea of the length and nature of the course, the fees, and the degrees or certificates that can be taken. The colleges, &c., in London will be dealt with next week. (Page 535.)

The Electricity Committees of fifty-one local authorities have already signified their intention of supporting the Bill to be promoted to confer upon all local authorities owning electricity works the right of wiring houses and selling and hiring lamps, fittings, motors, &c. (Page 538.)

Among the specifications published by the Patent Office on Thursday last was one by A. M. Taylor describing the use of a single battery booster on a three-

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wire system, the neutral point being obtained by means of tappings on the booster armature winding connected through slip-rings to a static balancer.—C. J. Beaver and E. A. Claremont have patented a joint box for protecting the junction of overhead copper and aluminium cables.—A simple lamp-shade ring is described by C. Arnold.—Opposition has been entered to the grant of a patent to the British Thomson-Houston Co. for a system of electrical propulsion for ships.—A patent by F. J. Chaplin for copper gauze dynamo brushes expires on Monday, after a life of fourteen years. (Page 540.)

The Birkenhead tramway system has shown a profit of £1,832 against the previous year's loss of £407.—The floods in Tokyo are causing failure of the electric light service.—A new system of fares has been inaugurated on the London United Tramways.—The "fair fare" system has been abandoned by the Potteries Electric Traction Co.—Trolley omnibuses are to be adopted in Stockholm. (Page 539.)

Tenders are invited for switchboard extension at Hackney, and cables at Ipswich. (Page 541.)

Over 36 million passengers have been carried during the last half-year on the Metropolitan District Railway, and the receipts have increased by £26,000.—The report of the Underground Electric Railway Co. of London states that the income from investments for the last six months shows an increase of 17 per cent.—The Mersey Railway has reduced its balance to debit of net revenue from £18,414 to £11,821. (Page 543.)

CORRESPONDENCE

THE ASSOCIATION OF CONSULTING ENGINEERS.

In two recent issues we published some information with regard to the newly-formed Association of Consulting Engineers. There is little doubt that there is room for such an association, and that it can do good and useful work; but the rules which have been formulated will, if unaltered, deter a large number of consulting electrical engineers of high standing and with good practices from becoming members. One of the rules mentioned in our previous articles is that to qualify for membership, gentlemen must be Corporate Members of the Institution of Civil Engineers; associate membership or even full membership of the Institution of Electrical Engineers is apparently not considered by the founders of the Association to be a sufficient qualification. There are upwards of thirty full members of the Institution of Electrical Engineers who practise as consulting electrical engineers, and who have ample qualifications to undertake consulting electrical engineering work, either of a special or a general nature, but are not Members or Associate Members of the Institution of Civil Engineers. Some of these gentlemen have already large practices, and no association of consulting engineers could be considered to be representative of the electrical engineering branch of the profession if they were excluded. In addition to these, there are many Associate Members of the Institution of Electrical Engineers who are amply qualified to practise. We publish below some letters on the subject which we have received from correspondents.

To the Editor of Electrical Engineering.

Sir,—In response to your invitation to state my views with regard to the proposed Association of Consulting Engineers, I have to say that I am entirely in sympathy with the movement, and consider that such an Association would, if properly conducted, be able to do a great deal of useful work. I consider, however, the proposal to enrol only those who are corporate members of the Inst. Civil Engineers a questionable one, as it means the exclusion of a number of well-known consulting electrical engineers, who will certainly object to being forced to apply for membership to an institution that has only an indirect connection with their work, in order to qualify for admission to the proposed Association. Membership of the Institution of Electrical Engineers should be a sufficient qualification. The proposed rule would, I venture to think, create a certain amount of dissatisfaction and opposition (already the technical press are adversely commenting on the point).

There are many consulting engineers of undoubted reputation, position and influence who are independent of any institution, and whose co-operation would be of considerable value, and it would be a pity to exclude them from membership of the Association solely because they are not members of the Inst. Civil Engineers.

If membership is to be confined to the Inst. Civil Engineers, then a similar association will become necessary to embrace members of the Inst. Electrical Engineers.

I should like to qualify my remarks by stating that I am not conversant with what has passed at the meetings held in connection with the proposed Association.—I am, dear Sir, yours very faithfully,

S. G. Castle Russell.

19 Lombard Street, E.C., Aug. 13th, 1910.

To the Editor of Electrical Engineering.

Sir,—Every engineer, whether a consultant or otherwise, will doubtless agree that the proposal to form an Association of Consulting Engineers is in the best interests of the profession generally, and of consulting engineers in particular. Such an association should be able, by weeding out unqualified men, to raise the status of consulting engineers, and put them on the same footing as solicitors and doctors. Membership of the Association should be a guarantee to the public that conscientious, impartial, and efficient technical advice will be given. Further, the Association should do a great deal to protect the interests of consulting engineers against the encroachments which are being made from many sides, but which it is not necessary to particularise here.

In order to exclude unqualified men, some sort of test must be applied, but the test proposed by the promoters, viz., corporate membership of the I.C.E., is quite unreasonable. Although at the time of its formation the I.C.E. could claim that it embraced all kinds of engineering other than the military branch, the conditions are now entirely altered: mechanical engineering has immensely developed since that time, and electrical engineering may be said to have come into existence during the last fifty years. The importance of these branches led to the foundation of the I.M.E. and the I.E.E., both of which are flourishing bodies with large membership, and it is, I think, generally recognised now that it is sufficient for an engineer to join the institution representing his particular branch. If the proposed rule comes into force, many electrical engineers perfectly well qualified to act as consultants will be debarred from joining the Association, and will consequently labour under a serious disadvantage in their professional career.

To take my own case: I am a full member of the I.E.E., and hold a degree of London University; further, I have had some twenty years' practical experience in the branch to which I have devoted myself, and the firm to which I belong has carried out responsible work with success. Since, however, I am not a corporate member of the I.C.E., I am not eligible for admission to the Association. It is surely unfair to expect that a busy consulting engineer who has left college many years should be compelled to take the examination for admission to the I.C.E. What an

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outcry would have been raised if, when the examination for admission to the I.C.E. was instituted, all existing members had been required to pass that examination or cease to belong to the institution! Whatever is decided in the case of subsequent applicants, I maintain that it is unjust that members of *bonâ fide* firms of consulting engineers already practising should be excluded from the Association on account of their not being members of the I.C.E. In my opinion a more reasonable method of procedure would be to require applicants for admission to submit their claims, which would be considered by a sub-committee for the branch to which they belonged.

I must apologise, Sir, for the length of this letter, but the subject is one which concerns many electrical engineers beside myself. I trust that you will take the question up, so that it may be well ventilated.

Yours truly,

Birmingham. FRANK J. MOFFETT.

August 15th, 1910.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Will the Association of Consulting Engineers be a truly representative body if its membership is to be confined to "those who are corporate members of the Institution of Civil Engineers?"

There must be a number of consulting engineers, thoroughly competent in their own specialty, who would be excluded by this restriction; and it is open to question whether they or the new Association would be the poorer for their exclusion.

Certainly in some special lines of work, as, for example, telephony, the man who has spent his life in the work is better qualified than the average corporate member of the Civils.

It is to be hoped that in justice to those who for a variety of reasons have not been able to join the Civils, the proposed restriction will not be maintained.

I am, &c.,

HERBERT LAWS WEBB.

35 Old Queen Street,
Westminster. *Aug. 15th*, 1910.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—By limiting the new Association to Members and Assoc. Members of the Institution of Civil Engineers an extremely easy method would be found of only admitting a good class of consulting engineer.

At the same time, there are a number of consulting electrical engineers of good standing who would wish to join the Association, and who would be excluded by the proposed regulation. In my opinion, this would be a mistaken policy.

Aug. 13th, 1910. C. C. F. MONCKTON.

NEW CENTRAL TELEPHONE EXCHANGE AT GLASGOW

EXCEPTIONAL interest attaches for several reasons to the new "Central" telephone exchange which was opened for public service in Glasgow on Saturday. It is the largest common battery exchange (10,000 line) exclusively of British manufacture that has been erected in this country; it marks the advent of a new competitor, the Peel-Conner Telephone Works, Ltd., in the business of large telephone exchange equipments; it embodies several new developments in the circuits and other technical details; and it is one of the first outward and visible signs of working arrangement between the Post Office and the National Telephone Company, preparatory to the acquisition of the company's system by the Post Office at the end of next year.

There is so much to describe in the new exchange from the point of view of the electrical engineer that any reference to historical matters must perforce be brief, but it may be noted that the new exchange replaces the old flat-board call-wire exchange built by the Glasgow Corporation to compete with the National Telephone Co. The existence of two independent and rival systems in one city without adequate intercommunication prevented the development of telephony in Glasgow to the same state of efficiency as in other towns of similar importance, and the terms of the agreement between the Post Office and the National Telephone Co. a few years ago to facilitate the new arrangements for working the telephone system of the country after the end of next year made the position of the Glasgow Corporation telephone department almost desperate. After a period of negotiation, the Corporation's system was acquired by the Post Office, who wisely decided to "scrap" the call-wire exchange and agreed with the National Company to transfer to the new central exchange a large portion of the company's subscribers.

The exchange is situated on the top floor of the new Post Office Building in Waterloo Street, a street in the very centre of the city, and it is all upon one floor. It is rare that it is possible for accommodation to be found on one floor, for the power plant, the main and intermediate distributing frames, the battery, and the switchboard itself, but it has been done in this case. The area covered is about 245 ft. by 107 ft., of which about 180 ft. by 65 ft. is occupied by the switchroom. The length parallel to the switchroom is taken up by the battery and power-rooms, the main and intermediate distributing frames with the meter and relay racks, and the linesmen's rooms, and beyond this are the operators' rooms, &c. The lead-covered cables enter the basement of the building from the street, and are brought right up to a cable run which supports them behind the main frame. This support accommodates the solid joints between the cables and the lead-covered, silk- and cotton-covered cables, which are used to lead to the main frame itself. The line side of the frame has a capacity of 16,560 circuits, made off on 69 verticals, and the exchange side 13,800 circuits arranged in 69 verticals. The fuses are upon the line side, and the heat coils and lightning protectors on the exchange side. The I.D.F. has a capacity of 12,400 circuits.

There are 28 equipped subscribers' sections to the switchboard, and 12 on the junction board, with one unequipped, one cable-turning section, and a one-third section on each. The sections have a multiple capacity of 14,400 lines, and equipment for 10,000 lines. On the subscribers' board there are 960 outgoing junctions, multipled every two positions. Space is provided at each position for 150 answering jacks and lamps, but the present equipment is for 120. Each keyboard has 17 cord circuits and 40 junction order-wires. Each position on the junction board accommodates 26 incoming junctions. The interconnecting cables, in chases under the floor, between the switchboards and the apparatus racks, &c., are lead-covered.

In the power-room two independent supplies are brought in from the Glasgow Corporation mains, and it has, therefore, not been considered necessary to duplicate the battery. On emergency, the battery could be temporarily replaced by a supply direct from the mains. One of the main new features of the exchange is evident in the battery-room, as the battery has twenty cells in place of the customary twelve, and extra cells are not employed for the meters. The battery consists of Chloride cells of 3,230 ampere-hours capacity at the nine-hour discharge rate, and with an initial equipment of plates corresponding to 2,720 ampere-hours. There are two ringing sets, one driven off the common battery, and the other direct off the Corporation mains, and two 30-kw. motor-generators have been installed for charging the battery. The motor generators, power switchboard, &c., were manufactured at the Witton works of the General Electric Co.

Apart from the 40-volt battery, the chief feature of the system employed is the absence of the repeating coil in the operator's cord circuit and the inclusion of condensers in the speaking circuit. This arrangement was also adopted in the

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new Cardiff exchange, equipped by another rival of the Western Electric Co., but the circuits are very different in other respects. Fig. 1 is an outline sketch of the transmission system. In an article reviewing generally the various C.B. transmission systems, published in the *Post Office Electrical Engineers' Journal* in April, 1908, Mr. M. Ramsay pointed out that this system was particularly adapted

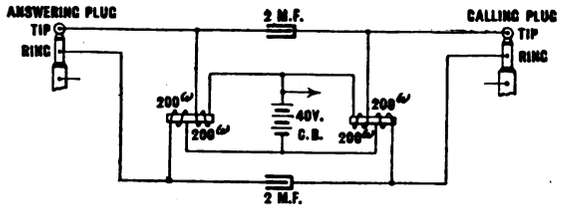


FIG. 1.—OUTLINE DIAGRAM OF THE TRANSMISSION SYSTEM.

for working on long and high resistance lines. Where there are small private branch exchanges to be supplied, in which current must be taken from the common battery, through the B-wire with an earth return, there would be objection to the 200-ohm relay coil between the battery and the B-wire, and also to a 200-ohm supervisory relay coil in a similar position in the cord circuit, but this class of service will not be catered for in Glasgow.

Fig. 2 is a more detailed diagram, showing the subscriber's line, the cord circuits, meter circuits, &c. Removal of the

If the wanted subscriber is not engaged, the insertion of the calling plug into his multiple jack energises his cut-off relay through the 400-ohm resistance, and disconnects his line relay and line lamp. While he is being rung, the supervisory lamp on the calling cord will glow, as the drop of voltage over the 400-ohm resistance is sufficient to energise it, but as soon as the subscriber has taken down his telephone the lamp will darken between the intervals of depressing the ringing key as the supervisory relay will be energised. When the subscribers hang up, the circuits of the supervisory relays are broken and the two lamps glow. The operator then depresses the meter key for effective calls, and clears.

The meter circuits should also be traced on Fig. 2; as already mentioned they are worked from the common battery without the usual extra meter cells. In addition to the subscribers' meters there are two meters connected to each position: a meter of 0·5-ohms resistance which records effective calls, and one of 500-ohms resistance for ineffective calls. When the answering plug is inserted in its jack, the 500-ohm winding of the subscriber's meter is connected to the battery, but is bridged by the cut-off relay, and the current passing through it is too small to actuate the meter. When, however, the meter key for effective calls is depressed at the conclusion of the conversation, the 400-ohm resistance between the battery and the sleeve of the plug is shunted by the 0·5-ohm position meter, and the subscriber's meter records. At the same time the armature of the meter places a 50-ohm coil in parallel with the 500-ohm coil, and the further increase in current is sufficient to actuate the 0·5-ohm

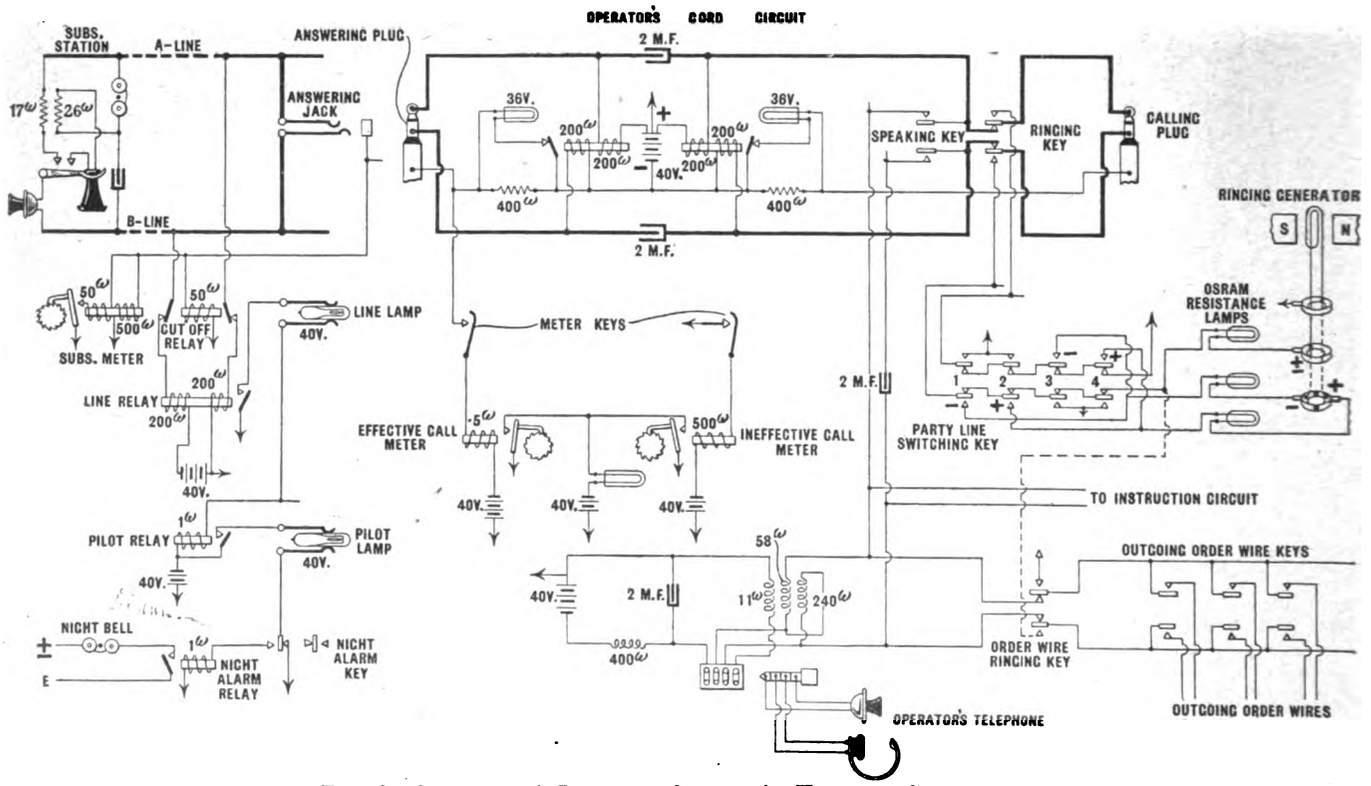


FIG. 2.—SUBSCRIBERS' LINE AND OPERATOR'S KEYBOARD CONNECTIONS.

subscriber's receiver from the switch-hook closes the circuit of the line relay and lights the 40-volt line lamp. Plugging-in the answering plug actuates the cut-off relay through a 400-ohm resistance and disconnects the line relay; at the same time the circuit of the supervisory relay on the answering cord is closed through the subscriber's instrument, and the 36-volt supervisory lamp is disconnected. On tracing out the circuit of the cut-off relay, it will be seen that, if a subscriber is engaged, the bush of his jack (and, therefore, all his multiple jacks) will be at negative potential, there being the resistance of the cut-off relay between it and the earthed side of the battery. The two-m.f. condenser connected through the tertiary of the operator's induction coil to the headgear receiver will be charged by the common battery when the speaking key is thrown over, but as the tip of the calling plug is at zero potential the condenser will be discharged to some extent when the bush of the multiple jack is touched by the tip of the plug, and a click will be heard by the operator.

"effective" position meter. The meter for ineffective calls is connected directly to the battery through its key.

In addition to the ringing keys on each cord, each position has one set of four party-line switching-keys on the Thompson and Robe system, enabling positive or negative pulsating currents to be sent between either the A or B line and earth.

On the incoming junction positions, there is a set of five ringing keys on each junction, four for party-line ringing and one for ordinary ringing, and the arrangement is such that the buttons of the party-line keys return to a half-way position after being depressed, and remain there even when the ringing circuit is automatically disconnected, until the next time a party-line key is depressed. This makes it simpler for the operator to ring up again if requested to do so. There is much that is interesting in the other details of the junction circuits, but space will not permit us to enter into them; there are seven different types of junction circuits, owing to the variety of exchanges that have to be connected to the Central.

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The design of some of the pieces of apparatus mentioned is novel. The lamp jacks (Fig. 3) are entirely of metal; Fig. 4 shows the constructon of the line and cut-off relays, the line relay being at the top, and Fig. 5 illustrates a combined ringing and speaking key and a meter key. Fig. 6 is a strip of twenty multiple jacks, and these, as well as the answering jacks, are made with the A and B springs one on each side, instead of on the same side of the plug.

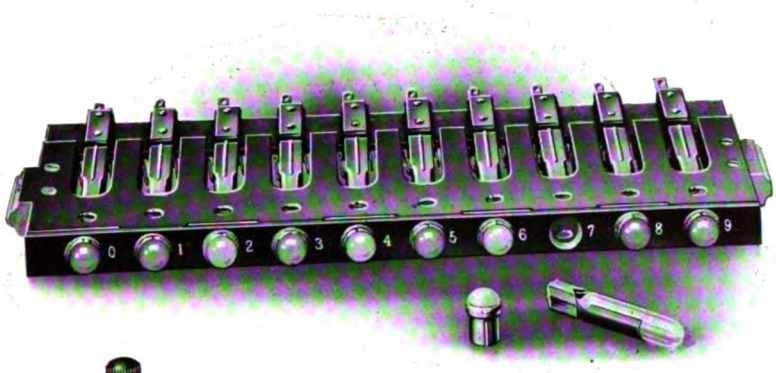


Fig. 3.—Lamp-Jack for Ten Line Lamps.

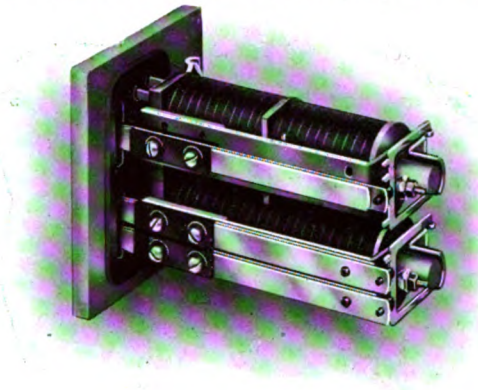


Fig. 4.—Line and Cut-off Relays.

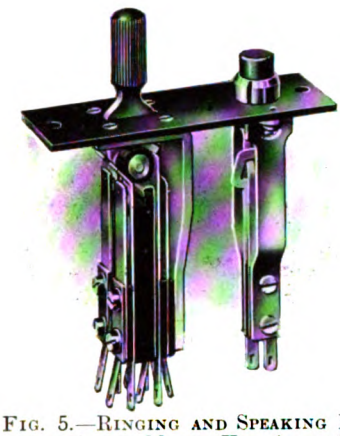


Fig. 5.—Ringing and Speaking Key (left) and Meter Key (right).

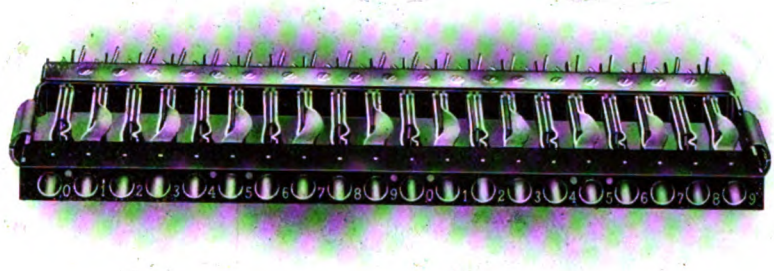


Fig. 6.—Twenty Multiple Jacks.

Those of our readers who desire to study the design of this exchange in greater detail should refer to an article by Mr. J. W. Turner, of the Engineer-in-Chief's Department of the Post Office, which appeared in the *Post Office Electrical Engineer's Journal* for last January. We are indebted to this article for the greater part of the technical particulars we have given above, and also to the Peel-Conner Telephone Works, Ltd. (Midland Bank Chambers, Queen Victoria Street, E.C.), for the loan of the blocks illustrating their apparatus. This company has taken over from the General Electric Co., Ltd., the telephone manufacturing branch of the latter company's business, and the whole of the Peel works in Salford. They manufacture, sell, and erect telephone exchange equipments, but the General Electric Co. remain sole selling agents for their house telephones, etc.

THE GRILLE WATER TUBE BOILER

DEMONSTRATIONS are being given at the engineering works of Messrs. Fraser & Fraser, Ltd., Bromley-by-Bow, London, by the British Grille Water Tube Boiler Co. (Craven House, Kingsway), of the special advantages of the Grille boiler. This boiler is already largely in use in France, and is now being introduced into this country by the above company. On Friday last we inspected the boiler erected at Messrs. Fraser & Fraser's works, and were enabled to witness a special test demonstrating that, should a tube burst, there is no danger of scalding accidents to stokers.

As shown in Fig. 1, which is a sectional elevation of the boiler, there is one steam drum with top and bottom headers *C* to which are attached the steam generating tubes. The top headers are above the water level, so that the steam, instead of entering the drum through the water, enters above the water level in a dry state. The tubes are arranged in sections of forty-seven tubes, each section having separate top and bottom headers. The steam separator pipe is shown at *T*. The tubes are bent U-shaped, and the necessity for mechanical cleaning of the tubes, usual with straight-tube boilers, but impracticable with bent tubes, is claimed to be avoided by the provision of a system of reverse circulation. This is effected by closing an internal valve *R* between the water drum and one of the lower headers. The supply of water is thus cut off from that particular section, and by opening the blow-off cock in the corresponding lower header, the water is blown out of the tubes by the steam, which scours the tubes and removes any deposit.

The principal feature of the Grille boiler, however, is the use of "Solignac" tuyeres or cartridges, with ¼ in. openings, which are placed in the ends of the one-inch tubes attached to the lower headers, as shown at *t* in Fig. 1. These restrict the amount of water admitted, and, it is claimed, enable a higher rate of evaporation to be secured than in boilers which have the tubes logged with water. Each section of tubes evaporates 1,100 lbs. of water (actual)

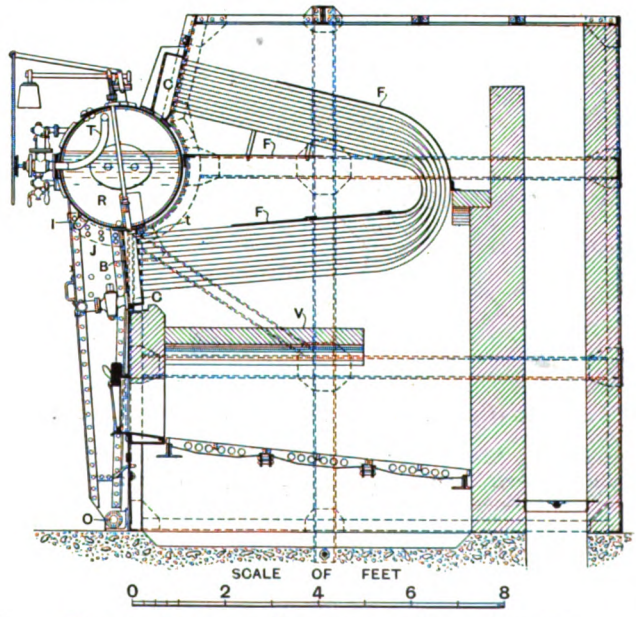


Fig. 1.—Sectional Elevation of Grille Boiler.

per hour from feed water supplied at 60° Fahr. Thus, a boiler with seven sections will evaporate 7,700 lbs. of water

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per hour. The maximum number of sections per drum is nine. An evaporation of 6 lbs. of water per hour per square foot of heating surface on normal duty is said to be obtained, and no trouble is said to be experienced when evaporating at the rate of 12 lbs. For special purposes, when burning 70 lbs. of coal per hour per square foot of grate area, 18 lbs. of water (actual) may, it is claimed, be evaporated per square foot of heating surface, the efficiency under these

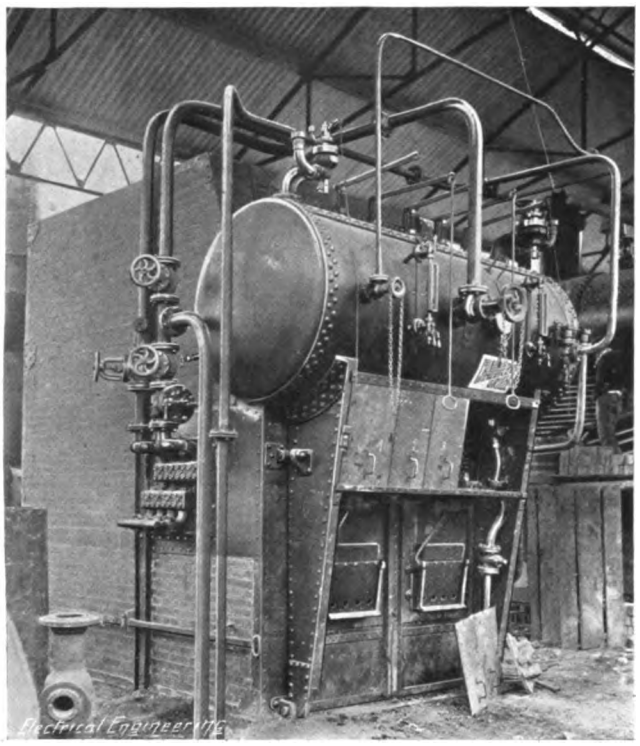


Fig. 2.—Grille Five-section Boiler with Superheater.

severe conditions being as high as 65 per cent. On normal duty and with natural draught of, say, half an inch, the boiler is claimed to give 76 per cent. efficiency. The temperature of the flue gases in the Grille boiler is about 650° Fahr. A reverberatory arch of firebricks *V* ensures smokeless combustion, and baffles *F* are provided to direct the course of the gases from furnace to flue.

The general appearance of the boiler is shown in Fig. 2, which illustrates a five-section boiler capable of raising 5,500 lbs. of steam per hour with natural draught, and fitted with a Grille nickel-steel superheater, the headers of which can be seen at the side of the boiler. This gives 100° of

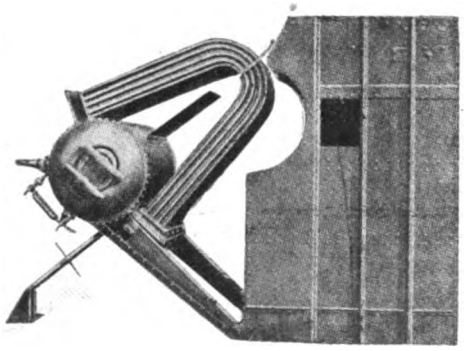


Fig. 3.—Drum and Tubes Swung clear of Casing.

superheat. Accessibility for examination of the pipes and drum is given by mounting the latter on steel standards *J*, which are hinged at the bottom to trunnions *O* fixed to the framework of the boiler. This enables both drum and tubes to be swung clear of the casing, as shown in Fig. 3.

The height of the boiler is 12·5 ft., and the depth 8·5 ft. The breadth is determined by the number of sections, each section being 13·6 in. wide. A boiler to evaporate 6,600 lbs. of water per hour would be 9 ft. 2 in. long, and the floor space (9·2 × 8·5), 78·2 sq. ft. From and at 212° Fahr. the evaporation of this boiler is 7,900 lbs. of water per hour, and allowing 20 lbs. of water per horse-power hour, the capacity is approximately 400 h.p., or 5·2 h.p. per sq. ft. of floor space. The weight is 7·4 tons, or 41 lbs. per h.p.

In order to demonstrate the effect of the "Solignac" tuyeres in lessening the danger due to explosion of a tube, an auxiliary tube of the full diameter has been fitted in the boiler at Messrs. Fraser & Fraser's works, with a rupture in it 6 in. by $\frac{3}{8}$ in., or double the cross-sectional area of the tube. This tube communicates with both the steam and water spaces of the drum, and by means of suitable valves steam or water, or both, can be discharged through the rupture. A "Solignac" tuyere is fitted in the water end of the tube. Whereas with an ordinary boiler the water would be rapidly discharged, and a great quantity of steam would be generated, the discharge from such a rupture in the Grille boiler, with 160 lbs. pressure, is said to be only $2\frac{1}{4}$ lbs. per second. The only effect produced was the damping of the fire, and no appreciable volume of steam was emitted. Further, when the blast was shut off after a few seconds, the fire burned brightly again. We understand that the inspector of the Boiler Insurance Co. reported so favourably on this demonstration that a considerable reduction was made in the insurance premium.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Unofficial Meeting in Brussels

An unofficial conference of members of the International Electrotechnical Commission was held, at the invitation of the Belgian Committee, in Brussels on August 8th, 9th, and 10th, and through the courtesy of Mr. C. Le Maistre, the General Secretary of the Commission, we are enabled to publish the following interesting report of the proceedings. The conference was quite representative, in spite of being unofficial, and it is generally felt to have relieved the tension with regard to the preparation for the full official meeting of 1911, by giving an urgently needed opportunity for the free ventilation of the ideas of the leading delegates. The meeting was convened by Col. R. E. Crompton, the Honorary Secretary, and Prof. Eric Gerard, Director of the Montefiore Electrotechnical Institute of Liège, presided. At the outset, Col. Crompton read a report on the general progress of the Commission, showing that sixteen committees had been officially formed; other committees were about to be formed in Holland and Switzerland, and a Russian committee was to be formed in October. Further, the Central Office in London was in close communication with Argentine, Chile, and Peru. The Commission has now been in existence for four years, and the immense amount of work expended in organising the various committees, and the mode of procedure is at last bearing fruit. The official languages of the Commission are English and French, the German section having courteously withdrawn their wish that German should be one of the official languages.

The first subject dealt with at the Conference was that of Nomenclature. Dr. E. Budde, a Director of Siemens & Halske, proposed, on behalf of the German Committee, that instead of dealing with terms in alphabetical order, some eighty words should be taken at a time all closely connected with some definite idea: this would avoid the necessity for dealing with so many out-of-the-way and rarely used words before the more important ones. This difficulty was admitted by several other delegates, and the proposal was adopted by the Conference to be put before the several Committees for consideration. The French, British, German, and Belgian Committees will prepare lists of definitions on this principle to be submitted to the Commission next year.

Symbols were next discussed, and it appears that some advance has been made along the lines so often advocated by Dr. Silvanus P. Thompson, namely, that principles have been dealt with instead of a huge list of symbols. The Conference agreed, provisionally, subject to the approval of the full Commission, that (1) instantaneous values of electrical quantities varying with time shall be represented by small letters: (2) effectual or constant values shall be represented by capital letters: (3) capital letters with the subscript "m" shall denote maximum values: (4) magnetic quantities shall be represented by Script capital letters. Further, the following symbols were provisionally agreed upon:—Electromotive Force E and e, Electrical quantity Q and q, Length L and l, Mass M and m, Time T and t, all in ordinary type, and the "Script" forms of **L, H,** and **B** for Inductance, Magnetic Force, and Flux Density respectively (instead of the more convenient block letters, which offer no difficulty to the printer in any country). The use of μ almost universally employed for perme-

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ability, was discussed, but it was not adopted finally as the French Committee propose that, as a matter of principle, Greek letters should not be used in this manner, and this proposal may possibly be adopted. Another question discussed was the signs to be given to the direction of rotation of vectors, which, it will be remembered, is different with different authors, clockwise rotation being positive with some and negative with others.

A discussion also took place on the rating of electrical machinery. Dealing first with continuous-current machinery, the Conference decided to place the following proposal before the Commission: That the output of a machine should be, for a generator, the electrical power measured at the terminals of the machine; and, for a motor, the mechanical power at the shaft; the power in each case to be expressed in watts or kilowatts. This would avoid the confusion due to the different values of the "horse-power" in different countries.

There is every probability that next year's plenary meeting of the Commission, under the presidency of Prof. Elihu Thomson, will be held at Turin. When the matter was brought up, Signor Semenza, the Italian delegate, mentioned that he had received correspondence from Paris with reference to an Electrical Congress to be held at Turin in connection with the 1911 International Exhibition, and it seemed a pity that the Commission should be meeting at Berlin, as was proposed, at the same time. Dr. Budde agreed, and said that if it was decided to hold an electrical congress at Turin, the German Section would willingly forego the pleasure of having the full meeting at Berlin.

ELECTRICAL ENGINEERING EDUCATION

IN response to frequent inquiries from prospective electrical engineers or their parents, we published last year an article giving the principal features of the courses of instruction at the various universities, technical colleges, &c., throughout the country. The success of this article has made us think that a similar collection of information relating to the courses about to commence this autumn may be of use. It is well known that an electrical engineer's education cannot be completed by college training alone; a period of pupilage or apprenticeship at an engineering works is essential, and this can either be taken before or after the college course, or "sandwiched" between two or three periods spent at the college, according to which method would be best suited to the physical and mental aptitude of the particular student. The choice of the works in which the practical part of the training is to be given is usually decided by the special circumstances of each case, but in the selection of a suitable college there is considerable choice. For further particulars, intending students should apply to the registrars of the various colleges.

I.—THE UNIVERSITIES OF CAMBRIDGE AND OXFORD

At both Cambridge and Oxford an engineering course has been established, and engineering subjects may be taken for degrees. Whether the student will proceed, as is usually done, straight to the University from school, or whether he will find it more convenient to work a short period in the shops of an engineering works, and perhaps also attend elementary technical classes before going up, will depend on each individual case. Both courses are possible, and in some cases the latter may be preferred in view of the age the student will have attained before taking his degree.

The University of Cambridge.

The laboratories of the engineering department of Cambridge University are open to, and the lectures may be attended by, any matriculated member of the University, whether he be a member of a particular college or not. In order, however, for him to take the mechanical sciences "tripos" examination, which qualifies for the honours B.A. degree, he must pass the "previous examination" in general subjects (including classics), either on entry or afterwards. He must also pass the qualifying examination in mathematics and mechanics at the end of his first year.

The most important feature is that the student has to reside at Cambridge for three years, and the value of this is now fully realised by many employers. The training is of such a character that it is of real educational value, even to one who is not going to take up engineering as his profession.

Prof. J. A. Ewing, F.R.S., was for some time Professor of Mechanism and Applied Sciences, and was succeeded by Prof. B. Hopkinson, who is assisted by a number of lecturers and demonstrators. The electrical work is mainly under the charge of Mr. C. G. Lamb.

The students, whatever branch of the profession they intend to enter, go through the same course as far as the elementary work is concerned; but a certain amount of specialisation is permitted to those who can take the advanced papers. The usual honours course covers three years. During the Long Vacation there are no formal lectures, but demonstrations are given in the laboratory, a drawing class is held, and the workshops are open. There is also a "special" examination of an easier character, which qualifies for the B.A. degree without honours, and is preceded by certain examinations in general subjects.

A student who has graduated in another university may obtain the B.A. degree at Cambridge by residing for two years and by getting a first class in the engineering tripos, or by submitting a dissertation of sufficient merit describing original research carried on at the engineering laboratories.

A few words should be added about the Engineer Company of the Officers' Training Corps, which is an important development of the Engineering School. The members of the Company do a good deal of military engineering work, such as bridge-building, and they also have a steam tractor on which some important trials are now being carried out. A good many of the members of the Company become officers in the Special Reserve Royal Engineers for a year after leaving Cambridge, and the training generally is of very considerable value.

The University of Oxford.

The Chair of Engineering Science at Oxford is occupied by Prof. C. F. Jenkin, and engineering subjects may now be taken in the Final Honours School of Natural Science for the honours B.A. degree.

The course of study recommended may be taken in three years, and is intended to be followed by an apprenticeship at some engineering works, or by a pupilage at an engineer's office; but it may be taken after part or the whole of the apprenticeship, if that is preferred. No attempt is made to teach any technical handiwork, but instruction in the engineering laboratory forms an important part of the course. Engineering drawing also takes a prominent position, and instruction in surveying is given during the Long Vacation. Physics, including electricity and magnetism, is taught in one of the university laboratories, where special courses, as far as they are required, are provided for the engineering students. Thus students who intend to take up electrical work may take advanced applied electricity and magnetism as a special subject.

All undergraduates are required to pass "Responsions" or an equivalent examination, which may be done before coming into residence, after which no further examination has to be passed till the "Final Honours School," which is usually taken at the end of the third year. Facilities will be given to advanced students and graduates to undertake research work in the engineering laboratories.

II.—UNIVERSITIES, COLLEGES, AND TECHNICAL SCHOOLS IN THE PROVINCES

The large modern universities in most of the principal towns have electrical engineering departments, at which the student can obtain a thorough theoretical groundwork in the principles of electrical engineering, while at the same time he has the opportunity to broaden his mind by other studies as well. At the larger technical colleges, a sound education in electrical engineering is also given, and there are a large number of technical schools and institutes, at most of which

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the evening classes are the all-important feature, and where the apprentice and workman may acquire a knowledge of the principles underlying their trade. Many of these schools also give instruction in day classes, by taking the full course of which an education of a similar character may be obtained to that at the technical colleges. We have not attempted to make any classification, but have arranged our descriptions alphabetically under the names of the towns.

Bangor.

University College of North Wales.

The department of Electrical Engineering is under the Professor of Physics, Dr. E. Taylor Jones. The course extends over two years. The laboratory equipment includes some electrical machinery, but the course is intended to be a preliminary training to be completed by practical work in an electrical engineering works. Fee, £14 14s. per annum. Students at the University are required to reside in registered lodgings.

Belfast.

Queen's University.

The subject of electrical engineering can be taken by candidates for the degree of B.E. (Bachelor in Engineering), and arrangements are in progress regarding the recognition of the courses at the Municipal Technical Institute, of which particulars are given below.

Municipal Technical Institute.

The object of this Institute is to provide instruction in the principles of those arts and sciences which bear directly or indirectly upon the various trades and industries. The classes are suitable for persons engaged during the day who wish to supplement and develop the knowledge and experience gained in the workshop, &c. The full course of electrical engineering is four years, and in the third and fourth year the more advanced branches of the subject are taught, including generator and converter design, &c. A course in electric wiring can be taken by second-year students. There is also a regular three-years' day course intended as a preparatory training for those who aim at filling positions of responsibility. Candidates for admission to this must be not less than fifteen years old, and must pass a simple entrance examination. The fees are low in all cases. Prof. R. Stanley is head of the electrical engineering department, and Prof. J. H. Smith of the mechanical engineering department.

Birmingham.

University of Birmingham.

The B.Sc. degree in engineering can be obtained after a four-years' course; the instruction in mechanical and electrical engineering embraces the same subjects throughout, only in the final year considerably more time is given to the designing and testing of electrical machinery in the latter case. Students are required to pass a matriculation or equivalent examination. Advanced students who have matriculated elsewhere are allowed to omit the first year of the course on passing the first intermediate examination. Students not wishing to take the degree are admitted to the courses on passing a shorter examination than the matriculation. In the fourth year the work includes the design of machines, apparatus, and complete installations to definite specifications. Prof. Gisbert Kapp is the Professor of Electrical Engineering, and Prof. F. W. Burstall of Mechanical Engineering. The fees are £34, £50, £50, and £55 respectively for each of the four years, in addition to which there is a membership fee of £1 1s. per annum, and a fee of £2 for each of the above examinations.

Birmingham Municipal Technical School.

Courses in electrical engineering are also held, and laboratory work is conducted at the Birmingham Municipal Technical School at low fees, and complete courses can be taken here by students desirous of obtaining a London University engineering or science degree. There are also afternoon classes, intended partly for apprentices and employees of local firms in electroplating and bronzing, electricity (intermediate), electrical engineering (advanced), and mechanical engineering, and complete evening courses, including special lectures in electrical engineering, electrical measurements, telegraphy, telephony, and instruction in jointing armature winding. Special drawing classes for electrical engineering students are also held. There is an entrance examination, which all students under eighteen years of age are expected to take. Certificates are awarded by the Board of Education, and also for technological examinations held by the City and Guilds of London Institute, and various prizes and scholarships are obtainable. Dr. W. E. Sumpner is the Principal and head of the Physics Department.

Bradford.

City of Bradford Technical College.

Students may enter at the age of fifteen, and have to pass a simple entrance examination. The ordinary electrical engineering diploma course is three years, but there is a fourth-year course for those who can stay for it. Occasionally students of exceptional attainments are excused the first year. The fourth year's course deals more in detail than that of the third year with the theory, design, and testing of machines, and with central station practice. The head of the department of engineering is Prof. G. F. Charnock, and Mr. W. G. Griffith is lecturer in electrical engineering. The fee is £13 13s. per annum for the full course. Evening classes at low fees are given for persons (over sixteen years of age) engaged in the various trades, and special courses covering the work necessary, and the intermediate and final B.Sc., London, examinations have also been arranged. A four-years' evening course in electrical engineering can be taken.

Bristol.

Merchant Venturers' Technical College.

The Faculty of Engineering of the University of Bristol is provided and maintained at the Merchant Venturers' Technical College. Courses are provided in electrical and other branches of engineering, and the B.Sc. degree may be awarded in any of these branches. The curriculum for the degree is spread over three years, of which the first is common to all departments of engineering, and prepares for the intermediate examination. The second and third years prepare for the final examination, which is special for each branch. Provision is also made for the award of a Certificate in each branch of engineering, open to students who do not matriculate. Prof. David Robertson is head of the electrical engineering department, and, besides the assistant lecturer and demonstrators, there are special lecturers on telegraphy and telephony, and an instructor in electric wiring. Prof. John Munro is the professor of mechanical and mining engineering. The tuition fees for the complete course amount to £26 5s. per annum, but a reduction of £10 10s. is made in the case of students the combined income of whose parents is less than £350. There are also evening classes, the fees for which are lower.

Cardiff.

University College of South Wales and Monmouthshire.

This is a constituent college of the University of Wales. The three-years' course in engineering, which qualifies for the college diploma, can also be taken for the degree of B.Sc. in engineering. Specialisation in electrical engineering is only allowed in the third year of the course. Prof. A. C. Elliott, with two assistant lecturers and demonstrators, carries on the engineering department. An Engineering Scholarship amounting to £70 per annum is given by the South Wales Institute of Engineers. The fees are about £6 6s. per annum, with substantial reduction to members of associated colleges. Students must reside in registered lodgings and conform to an elaborate code of discipline.

Dublin University.

The School of Engineering, Trinity College, Dublin University, gives a four-years' course in electrical engineering, the fourth year being optional. The student is required to be a member of Trinity College, and has at the same time the opportunity of obtaining the advantages of a general university education. He has first to pass an entrance examination. A student will be entitled to obtain a Certificate in engineering, a Licence in engineering, a degree of Bachelor of Engineering, and a diploma in electrical engineering, according to the courses gone through and the examinations passed. Prof. W. E. Thrift is professor of experimental physics; Prof. T. Alexander, professor of civil engineering, is head of the engineering department; Messrs. W. Tatlow and P. S. Sheardown (electrical engineer to the Dublin United Tramways) are lecturers in electrical engineering, and Mr. W. E. Lilly lecturer in mechanical engineering. The fees amount to about £30 per annum, and there is an entrance fee of £15.

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UNIVERSITY OF GLASGOW.

DEPARTMENTS OF ENGINEERING, MINING, AND NAVAL ARCHITECTURE.

Professor of Engineering ...	Archibald Barr, D.Sc., M.Inst. C.E., M.I.Mech.E.
Professor of Naval Architecture	J. Harvard Biles, LL.D., D.Sc., M.I.N.A., M.Inst.C.E.
Professor of Mining ...	Charles Latham, M.I.M.E.
Lecturer on Engineering Drawing and Design ...	Harry Bamford, M.Sc., A.M. Inst.C.E.
Lecturer on Electrical Engineering	John S. Nicholson, B.Sc., Whit. Sch., A.M.I.E.E.

The SESSION commences on October 17th, 1910, and ends on March 23rd, 1911. Students usually spend the summer months in practical work, thus receiving their training on the Sandwich system. Prospectus of the Courses for the degrees of B.Sc. and D.Sc. in Engineering and Syllabus of Classes will be forwarded on application to the Assistant Clerk, Matriculation Office, The University, Glasgow.

UNIVERSITY OF EDINBURGH.

ENGINEERING DEPARTMENT.

The next session opens on October 5th. The Preliminary or Entrance Examination is held in September. The University provides complete Courses in Civil, Mechanical, and Electrical Engineering, qualifying for the degree of B.Sc. in Engineering, and extending over a period of three years. Particulars of the Entrance Examination, Scholarships, Fees, and Courses of Instruction can be obtained from the Matriculation Office, The University, Edinburgh.

UNIVERSITY COLLEGE OF NORTH WALES.

ELECTRICAL ENGINEERING DEPARTMENT.

Professor of Physics :—E. TAYLOR JONES, D.Sc.
Drapers' Company's Assistant Lecturer and Demonstrator in Electrical Engineering :—W. E. WILLIAMS, B.Sc.

In October next a systematic COURSE OF INSTRUCTION IN ELECTRICAL MEASUREMENT and PRACTICAL ELECTRICITY for students proposing to enter the profession of ELECTRICAL ENGINEER will be commenced. The Physical Laboratory is equipped with a Compound Steam Engine, Continuous and Alternating Current (single and three phase) Dynamos and Motors, Transformers, Secondary Battery, and the most approved modern Measuring Instruments.

Fee for the Course, in ordinary cases, £14 14s. per Session. Average cost of living at Bangor for the Session (33 weeks), £20 to £30. The Course extends over two Sessions.

For Prospectus and further information apply to
J. E. LLOYD, M.A., *Secretary and Registrar.*

THE UNIVERSITY OF SHEFFIELD.

Session 1910–11.

Vice-Chancellor :—Sir CHARLES ELIOT, K.C.M.G., C.B., D.C.L., LL.D.

FACULTY OF APPLIED SCIENCE,
comprising
DEPARTMENTS OF ENGINEERING, METALLURGY, AND COAL MINING.

Dean :—W. RIPPER, D.Eng., M.Inst.C.E.

Professor of Engineering	W. Ripper D.Eng., M.Inst. C.E.
Professor of Metallurgy	J. O. Arnold, D.Met.
Assistant Professor of Metallurgy	A. McWilliam, M.Met.
Professor of Mining	F. W. Hardwick, M.A.
Professor of Applied Chemistry	L. T. O'Shea, M.Sc.
Professor of Mathematics	A. H. Leahy, M.A.
Professor of Physics	W. M. Hicks, Sc.D., F.R.S.
Professor of Chemistry	W. P. Wynne, D.Sc., F.R.S.

The Courses in Engineering, or in Metallurgy, extend over three years, and prepare respectively for the Degree of Bachelor of Engineering (B.Eng.), or the Degree of Bachelor of Metallurgy (B.Met.), of the University of Sheffield.

The LECTURE COURSES commence October 5th, 1910.

The TECHNICAL LABORATORY COURSES commence September 19th, 1910.

For Prospectus, giving further particulars and details of Courses, apply to
W. M. GIBBONS, *Registrar.*

THE UNIVERSITY OF LEEDS.

DEPARTMENTS OF ELECTRICAL, CIVIL, MECHANICAL AND MINING ENGINEERING, AND COAL GAS, FUEL AND METALLURGY.

The work of these Departments is carried on in separate blocks of buildings specially equipped for systematic instruction. Prospectus may be had free on application from the Registrar.

THE NEXT SESSION BEGINS ON OCTOBER 4th, 1910, on which day the ENTRANCE EXAMINATION will be held at 10 a.m. and 2 p.m.

EAST LONDON COLLEGE,

(University of London.)

Mile End Road, E.

NEW SESSION COMMENCES SEPTEMBER 26th.

The College is situated close to stations on the G.E.R., District Railway and L.T. and Southend Railway and is approached from The Royal Exchange in 15 minutes by motor omnibus. Electric tramcars from Wanstead, Leytonstone and Ilford pass the College.

CIVIL, MECHANICAL, AND ELECTRICAL ENGINEERING COURSES.

Fees : Ten Guineas per Session.

Courses in the evening are also held at moderate fees.

POST-GRADUATE AND RESEARCH WORK.

Calendar post free on application to the Registrar, or to
J. L. S. HATTON, M.A., *Principal.*

UNIVERSITY COLLEGE OF SOUTH WALES AND MONMOUTHSHIRE.

(A Constituent College of the University of Wales.)

DEPARTMENT OF ENGINEERING.

Drapers' Company Professor of Engineering :—
A. C. ELLIOTT, D.Sc., M.Inst.C.E., M.I.Mech.E.

THE NEXT SESSION will BEGIN on TUESDAY, OCTOBER 4th, 1910.

Particulars of the COURSES in ENGINEERING (Mechanical, Civil, and Electrical) may be obtained from the undersigned.

These Courses qualify for the B.Sc. Degree in Engineering of the University of Wales and for the College Diplomas in Engineering.

J. AUSTIN JENKINS, B.A.,
Registrar.

Cardiff,
July, 1910.

THE GLASGOW AND WEST OF SCOTLAND TECHNICAL COLLEGE.

Glasgow.

Session 1910–11.

Day Classes begin TUESDAY, SEPTEMBER 27th.
Evening Classes begin THURSDAY, SEPTEMBER 22nd.

The DIPLOMA of the College is granted in the following Departments :—Civil Engineering, Mechanical Engineering, Electrical Engineering, Mining, Naval Architecture, Chemistry, Metallurgy, Mathematics and Physics, Building, Textile Manufacture.

The courses of study for the Diploma usually extend over three sessions. The average fee per session is £12 12s. Holders of the Diploma are eligible for the Degree of B.Sc. in Engineering of the University of Glasgow after attendance for at least one session upon prescribed University classes. In conjunction with the Glasgow School of Art a Course for a Joint Diploma in Architecture has been arranged.

The preliminary examination for Candidates for the Diploma begins on September 19th. Names of Candidates must be lodged not later than September 1st.

New and well-equipped Laboratories have been provided in the Departments of Physics, Chemistry, Technical Chemistry, Dyeing, Metallurgy, Mechanics, Motive-Power Engineering, Electrical Engineering, Mining, Textile Manufacture, Biology, Bacteriology and Navigation, and facilities for research are afforded.

Calendar (price by post, 1s. 4d.) and Prospectus (gratis) will be sent on application to the Secretary.

SOUTH-WESTERN POLYTECHNIC INSTITUTE.

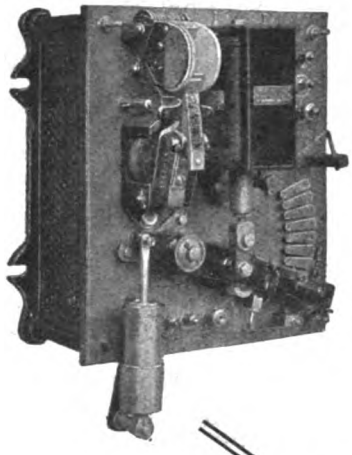
Manresa Road, Chelsea, London, S.W.

COMPLETE THREE YEARS' COURSE IN ELECTRICAL ENGINEERING is held during the day and a FOUR YEARS' COURSE in the evening. COURSES OF LECTURES and PRACTICAL WORK are given in the following subjects, which may be taken separately or as part of a Course :—

Elementary, Intermediate, and Advanced Electrical Engineering, Electrical Design, Instruments and Lamps, Alternating and Polyphase Currents, Electrical Wiring and Fitting (Lectures and Practical Work), Calculus for Engineers.

For particulars apply to the SECRETARY.

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Edinburgh.

University of Edinburgh.

Students must pass an entrance examination, but "leaving certificates," issued by the Scottish Examination Department, may exempt candidates for the whole or part of the examinations. The degree of B.Sc. in engineering is obtainable after a course of two and a half years, but a considerable number of students take three and a half years. Eleven courses of study must be taken, six of which may be taken outside the University. Stress is laid upon laboratory work. Facilities for post graduate work are afforded, and graduates of five years standing may offer themselves for the degree of D.Sc. in Engineering. Prof. T. Hudson Beare is head of the engineering department.

Heriot Watt College.

The classes are in connection with the University. Arrangements with engineering firms permit students to work as apprentices from March to October in their second year, and to complete their apprenticeship after completion of the college course. Students must pass an elementary entrance examination or its equivalent. The course is from three to four years. Prof. F. G. Baily is professor of electrical engineering, and is assisted by six demonstrators. The laboratories have recently been extended. Fees from 15 to 20 guineas per year, or for complete training in five or six years, including apprenticeship premium, from £120 to £200. Evening classes are also held at the college.

Exeter.

University College.

Instruction in electrical engineering of a more or less elementary nature is given in the Engineering and Manual Training School of this college, in evening classes, by Mr. W. T. Dicker, of the City Electricity Department. The work of the class covers the syllabus for the certificate of the City and Guilds of London Institute. The fee for a course or group of subjects is 10s. per session.

Glasgow.

University of Glasgow.

In most cases the students work at the University during the winter session from October to March, and spend the remaining six months of the year in works. A candidate for the B.Sc. degree in engineering must attend at the University for not less than three years, taking certain courses of instruction, and passing certain prescribed examinations. Certificates of "Proficiency in Engineering Science" are also granted to students after a three years' course with examinations. Students who have obtained the diploma of the Glasgow and West of Scotland Technical College (see below) can obtain the B.Sc. degree in engineering after one year's attendance at the University, taking the necessary courses of study and passing prescribed examinations. Prof. Barr is professor of engineering, and Mr. J. S. Nicholson is lecturer in electrical engineering. The fees, including examinations, amount to from £20 to £25 per annum.

The Glasgow and West of Scotland Technical College.

A complete three years' course in electrical engineering is held at the Glasgow and West of Scotland Technical College, which qualifies for a college diploma and associateship in electrical engineering; the fees per session average £12 12s. Evening classes are also held. The professor of electrical engineering is Dr. Magnus Maclean, with whom are several assistants and lecturers. Candidates for the degree of B.Sc. in engineering of Glasgow University who hold the college diploma are admitted to the examinations for the degree after attendance for at least one academical year on prescribed University courses. Entering students must pass a preliminary examination. Considerable additions are about to be made to the already extensive laboratory equipment.

Leeds.

The University of Leeds.

The University of Leeds, which as the Yorkshire College was at one time a part of the Victoria University, with those of Liverpool and Manchester, but is now an independent organisation, contains an electrical engineering department, presided over by Prof. G. D. Aspinall Parr, assisted by several demonstrators. It is considered desirable that students should have some practical experience before taking the University course. The course qualifying for the degree of B.Sc. in electrical engineering covers three years, and can only be entered upon after passing the matriculation examination. The electrical engineering department students not entering for a degree can also take the regular three years' course, and in special cases a two years' course. The fee for the full course is about £30 per annum. Research students are admitted to the laboratories. An advanced evening course with laboratory work is also given.

Liverpool.

The University of Liverpool.

The course for the B.Eng. degree occupies three years. The M.Eng. degree is conferred on Bachelors of three years' standing, either on the passing of a further examination or the presentation of a dissertation upon an engineering subject. The degree of D.Eng. is conferred upon Masters of Engineering of a certain standing who are adjudged to have distinguished themselves by their original contributions to the science of engineering. A certificate in engineering and a diploma in engineering are also granted. Candidates up to the final ordinary degree have a general engineering training. Specialisation in the higher branches of electrical engineering can be done remaining a fourth year to attend the Honours School or to qualify for the M.Eng. degree. The fees for the ordinary course amount to about £26 per annum. The professor of electrical engineering is Dr. E. W. Marchant, and Mr. J. K. Catterson-Smith lectures in electrical engineering.

Municipal Technical School, Liverpool.

The electrical engineering department of the Central Technical School, Byrom Street, Liverpool, provides a course of work at low fees (in evening classes only), including laboratory work, extending over three years. The special instruction in electrical engineering is based chiefly on the syllabus of the City and Guilds Institute. There is a special systematic course of instruction for wiremen. Mr. J. Lloyd Barnes is lecturer in electrical engineering, and Messrs. J. M. Robertson and E. S. Francis, lecturers on telegraphy and telephony respectively.

Manchester.

The University of Manchester.

Engineering subjects may be taken to qualify for the ordinary B.Sc., or honours B.Sc. degrees of the University of Manchester. In the case of the honours degree, there is a regular three years' course, in which electrical engineering can be included. The matriculation examination is similar to that of other universities, and for the ordinary degree an intermediate examination must be passed as well. A further degree of M.Sc. is conferred on graduates of certain standing, who are required to present a thesis. Students who are not candidates for a degree may also take a three-years' engineering course similar to that for the honour B.Sc. in engineering, and qualify for a certificate in engineering. The professor of engineering is Dr. J. E. Petavel, F.R.S., but a part of the electrical engineering course comes under Dr. R. Beattie, who is attached to the Department of Physics. There is a well equipped electro-technical laboratory, and recent additions to the plant include a 100-h.p. Zoelly steam turbine and three-phase alternator. Opportunities for post graduate study and research are given, including special lectures on electrical power station management. The fee for the engineering course is about £30 per session, not including degree and examination fees. Students can reside at certain licensed halls of residence or in registered lodgings. The subject of electrochemistry is dealt with by Dr. R. S. Hutton and Dr. J. N. Pring, and there is a special electrochemical laboratory.

The Municipal School of Technology.

The Manchester Municipal School of Technology in Sackville Street is connected with the University of Manchester in that day students who have been through the courses there can qualify for Manchester degrees of Bachelor and Master of Technical Science (B.Sc. Tech. and M.Sc. Tech.). The School is under control of a joint Board, and virtually forms the Faculty of Technology of the University. There is a very complete special three years' course in electrical engineering, one feature of which is that it includes instruction in German. For those not taking the University degree an entrance examination is required instead of the University matriculation, and a Certificate of the University in technical science is given. The fees amount to twenty guineas for each complete session. The electrical engineering laboratories are very fully equipped. Mr. J. H. Reynolds is Principal. Students desirous of admission must be not less than sixteen

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years of age, and must produce a satisfactory reference in respect of conduct and progress from the school previously attended.

Newcastle-on-Tyne: Armstrong College.

The Armstrong College, Newcastle, forms a part of the University of Durham, and students passing a matriculation examination, and taking a three or four years' course in electrical engineering can qualify for the Durham degree of B.Sc. A similar three years' course qualifies for a college diploma, or a second-class diploma can be obtained after a two years' course. The fees for either degree or diploma course are: First year, £21; second year, £26; and third year, £26. Laboratory fees are charged extra. The head of the electrical engineering department is Prof. W. M. Thornton, who is assisted by Mr. W. Firth. A feature of the college is the series of special Saturday classes, which include courses of electrical engineering, and other subjects for miners and colliery engineers. Evening classes are also held.

University College, Nottingham.

Special facilities for the study of electrical engineering are afforded at University College, Nottingham. The day courses are intended for boys who have just left school, but more advanced students can join the senior classes. The courses are arranged with regard to the requirements of the London University examinations. Students can combine the first year engineering course with the London matriculation course; the second-year course is suitable for the intermediate examination in science (engineering), and the third-year course is intended to prepare students for the B.Sc. degrees in engineering of the London University. No entrance examination is required, but intending students must satisfy the Professor of a general knowledge of English and elementary mathematics. The fees are £6 for each of the first three terms, and £3 3s. for the summer term, including all laboratory and workshop charges. Prof. W. Robinson is the head of the engineering department, and Mr. R. A. Sheldon and Mr. W. Inchley give instruction in electrical engineering.

The University of Sheffield.

The full three years' course in electrical engineering at Sheffield qualifies for the degree of Bachelor of Engineering (B.Eng.), but non-degree students are allowed to take the whole or any portion of the course. Those reading for the degree are required to pass a matriculation examination. The fees are about £25 per annum. A similar course qualifies for the Associateship in Engineering, which can also be obtained by evening students. A special course on electricity in mining is given, and the equipment of the metallurgical department includes two Kjellin electric furnaces. Prof. W. Ripper is professor of engineering, and Mr. E. H. Crapper lectures on electrical engineering.

The Technical College, Sunderland.

An important feature of the Technical College, Sunderland, is the arrangements which have been made for the granting every year of a certain number of "Apprenticeship Studentships," which entitle their holders to pass free of class fees through the three or four years' courses of study in the day classes of the College prescribed for the diploma of Associate of the college in electrical engineering. These students spend the summer months in the works, and attend classes, &c., during the winter. There are also evening courses, which include telegraphy and telephony. Mr. V. H. Mundella is the Principal, and Mr. W. T. Maccall is head of the electrical engineering department.

Some notes on the electrical engineering courses at the leading colleges and institutions of technical instruction in London will be given in our next issue.

L.C.C. Free Studentships.—In return for the grant of £8,000 made last year to the Imperial College of Science and Technology, South Kensington, the London County Council secures the privilege of nominating twenty-five students for one year's free instruction at the College. Only advanced students qualified to enter on the fourth year of the course should apply. There is no restriction as to income, but candidates must be resident in London, and must be students at an institution aided, maintained, or approved by the Council. There is no examination, and the studentships will be awarded on consideration of the past records of the candidates. In special cases, the studentships may be extended to two or more years. Entries for the studentships will be received until October 1st, 1910, and application forms (T.2/263) can be obtained from the Education Officer, London County Council, Victoria Embankment, London, W.C.

MUNICIPAL HOUSE WIRING

WE are now in a position to give some further particulars of the progress that has been made by the Incorporated Municipal Electrical Association in connection with the Bill to be promoted next session to give all local authorities power to carry on house wiring. On July 9th a preliminary inquiry was sent out to all local authorities who are members of the I.M.E.A., asking whether they would support a Bill to give all local authorities with electricity supply undertakings powers to wire houses, and also to sell or hire lamps and fittings, motors, &c., without tying their hands as to the employment of contractors for carrying out the work. It is also proposed that the Bill should deal with stand-by supply; as the Act of 1909 (Clause 15) now stands, public electricity supply works are relieved of the obligation to give a stand-by supply to premises with their own electricity works, but it is now proposed that this protection should be extended to those premises which are gas lighted. A provision in the Bill for further protection against unauthorised undertakers is also suggested.

The Electricity Committees of the following local authorities have agreed to support the Bill, and in many cases the matter has already been before the Councils themselves, who have endorsed the action of the Committee. In the list one or two local authorities are included who, although agreeing to support the Bill generally, are not desirous of supporting the wiring clause, chiefly because they already have powers; one or two others, we believe (Middlesbrough, for instance, as already reported in our columns), have so far only consented to give their moral but not their financial support.

Barnes, Barrow-in-Furness, Birkenhead, Bolton, Brighton, Bury, Blackpool, Bradford, Cardiff, Coventry, Croydon, Colne, Canterbury, Carlisle, Dartford, Devonport, Darlington, Dewsbury, Eastbourne, Eccles, Exeter, Fulham, Falkirk, Gillingham, Hackney, Hastings, Hull, Ilkeston, Ilford, Keighley, Loughborough, Londonderry, Lincoln, Maidstone, Middlesbrough, Peterborough, Portsmouth, Rochdale, Sheffield, St. Marylebone, St. Helens, Swindon, Southend-on-Sea, Shipley, Taunton, Walsall, West Bromwich, West Ham, Wigan, Wimbledon, Warrington.

It is seen that the above list already includes a number of large towns, and when the Electricity Committee meetings resume their normal frequency and activity after the holiday season there is no doubt that the number of supporters of the Bill will be greatly increased. There are signs of corresponding activity among the wiring contractors in certain districts, and it may be anticipated that the fight will be a severe one. Among those local authorities who have decided not to support the Bill are Oldham, Stoke-on-Trent, and Tunbridge Wells. At Dundee there is already a keen fight between the contractors and the electricity department, and the consideration of the matter in the Council has been postponed until next month.

Gun Explosion at Portsmouth.—On Thursday last a Sergeant of the Royal Garrison Artillery was killed by a gun explosion at the Spitbank Fort, Portsmouth, and a gunner was severely injured. At the inquiry on Friday, it was elicited that a misfire with the 4·7 in. gun in question was reported early in the morning, and that the acting bombardier had tested the cells, the ignition circuit and the primer in the cartridge that had misfired, and had found the bridge of the primer to be broken. A new primer was obtained and the gun reloaded, and the Sergeant proceeded to test the circuit with the breech of the gun open, which appears to be one of the recognised tests. It seems that while doing this the Sergeant accidentally touched the primer with a wire with which he was testing the circuit, with the result that the cartridge was exploded. The coroner suggested that steps should be taken by the military authorities to prevent similar accidents, and a verdict of accidental death was returned.

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CATALOGUES AND PAMPHLETS RECEIVED

ADVERTISING LITERATURE.—The electricity supply department of the Borough of St. Marylebone have issued a pamphlet entitled, "Gas *v.* Electricity for Health and Pure Air." This consists of a number of extracts from the 1909 reports of H.M. Inspectors of Factories, commenting on the better atmosphere resulting from the substitution of electricity for gas lighting, and referring to the dangers of flueless gas stoves.

STORAGE BATTERY ACCESSORIES.—A leaflet from S. Heilpern (82 Hamilton Road, Longsight, Manchester), gives particulars and prices of the "Unica" sediment pump for lifting lead sediment and foreign matter from the bottom of storage battery cells while the cells are in use. This firm also supplies water distilling apparatus and electrical instruments.

CABLES, WIRE, AND TAPE.—A card with humorous drawings illustrating the use of St. Helens cables in a mine in prehistoric days, and calling attention to various other manufactures of the firm, is to hand from the St. Helens Cable & Rubber Co., Ltd. (Warrington).

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

INSULATING VARNISHES.—A list is to hand from Chas. H. Blume (White Building, Fitzalan Square, Sheffield), covering insulating varnishes, japans, and enamels, manufactured at the Mitcham works of this firm in Surrey. Among the specialities listed are various grades of stoving and air-drying varnishes, mica sticking varnishes for building up micanite, core-plate varnish, acid-resisting enamel for wood and metal-work in battery rooms, machine fillings and enamels, slate enamels, and lacquers of all descriptions. A very low moisture absorption is claimed for the insulating varnishes; after 200 hours' exposure of a test cloth impregnated with a stoving varnish, the absorption of moisture was only 1·2 per cent.

ELECTRIC CAPSTANS.—A booklet is to hand from Messrs. Bruce Peebles & Co., Ltd. (Edinburgh), describing the "Clyde" electric capstans constructed under the patents of Dixon and Baxter. These capstans have been in successful use for many years, and embody a number of special features, the chief being that the head is not fixed to the spindle, but is driven through a clutch. This enables a fixed rope to be used, practically eliminating the wear on the head and increasing the life of the ropes, and is claimed to effect some 25 per cent. saving in energy consumption, as well as a 50 per cent. reduction of the maximum demand of the motor. Some sectional drawings and a photograph of the device are given in the booklet, together with some test figures.

CARBON BRUSHES.—A booklet is to hand from Messrs. Krupka & Jacoby (11 Queen Victoria Street, London) giving particulars and prices of carbon brushes manufactured at Dr. A. C. Lessing's works in Germany. A very large variety of shapes and compositions is listed, suitable for current-densities of from 40 to 250 amperes per square inch. Brushes for the higher densities contain a very high percentage of copper, and are suitable for slip-rings.

METERS.—Messrs. Siemens Bros.' Dynamo Works, Ltd. (Supplies Dept., 39 Upper Thames Street, London), have sent us a booklet giving instructions for the use of the Siemens "G 4" type meters. These are intended for use on two- or three-wire D.C. or A.C. systems, and for currents up to 200 amperes, and pressures up to 650 volts. The cyclometer dials register B.O.T. units. All the working parts of this meter can be replaced without special tools, and it is stated that the replacement of any worn or damaged part does not necessitate recalibration. The booklet contains diagrams of connections, photographs illustrating the renewal of parts, and full instructions for using, overhauling, and testing these meters.

SWITCHGEAR.—A leaflet is to hand from the A.E.G. Electric Co., Ltd. (121 Charing Cross Road, London, W.C.), with an illustration of a large wagon-type high-tension switch-panel. When the switch is in the "off" position, the wagon can be withdrawn from its chamber, completely isolating the gear from the 'bus-bars.

D.C. MOTORS AND GENERATORS.—The British Thomson-Houston Co., Ltd. (Rugby), have issued a new price list of Type D.G. continuous-current motors and generators. A design of pipe-ventilated dust-proof motor is included. This has a flange fitted to the motor case for connection to an air-duct, through which a supply of clean, dust-free air can be drawn. Motors of this pattern are particularly suitable for driving machine-tools, paint-mixing machines, pumps, wood-working machines, and coal-hoists, where the motor would be subject to dust or water.

SEWING-MACHINE MOTORS.—Another list from the B.T.-H. Co. gives particulars and prices of small sewing-machine motors for continuous and alternating current. These are of 1-30 to 1-40 h.p., and have speeds of from 1,500 to 2,400 r.p.m.

LOCAL NOTES

ARGENTINE.—The *Review of the River Plate* states, in a statistical note upon the imports during 1908, that of dynamos and motors, 48 per cent. came from Great Britain, 30 per cent. from Germany, and 11 per cent. from the United States. Of "electrical goods," 45 per cent. were British and 34 per cent. German.

BACUP: *Tramways.*—The Town Clerk of Bacup has received an intimation from the Board of Trade confirming the order for a new electric tramway from Bacup to Shawforth, which will link up the system to Rochdale.

BIRKENHEAD: *Tramway Accounts.*—The receipts for the past year amounted to £55,754, an increase of £602 over the previous year, and the working expenses were £33,756, a decrease of £1,675. The net profit is £1,832, against the previous year's loss of £407.

BRIERFIELD: *Tramways.*—At the Brierfield Council meeting on August 11th, Councillor Walmsley mentioned that the tramways agreement with Burnley was now settled, and only required signing.

BUENOS AIRES: *Proposed Tube Railway.*—According to the *Review of the River Plate*, the Buenos Aires Western Railway has approached Congress in connection with its concession for a tube between the Once and the Port. It is now proposed that this tube should be for freight only and that the passenger traffic should be diverted to the tube to be constructed by the Anglo-Argentine Tramway Co.

CHILE.—A concession has been granted to Mr. O. L. McDermott for the construction of an electric railway from Antosagasta to Mejillones.

DENMARK: *Jutland.*—According to a Consular report, large electric works are projected in the district between Aarhus and Randers.

HASLINGDEN: *Tramway Supply.*—An agreement has been sanctioned under which the Haslingden Electricity and Tramways Committee will be supplied by the Accrington Corporation, from August of next year, with electricity in bulk. Accrington are petitioning the Board of Trade for their sanction of the scheme, Haslingden to obtain borrowing powers to place themselves in a position to receive the current and to resell to consumers in their own borough.

JAPAN: *The Floods.*—A Reuter's telegram states that the floods in the Tokyo district are causing the failure of the gas and electric light services.

KILMARNOCK: *Electricity Accounts.*—The annual report records a net profit on the electricity undertaking of £401.

LEEDS: *Tramways.*—The Leeds tramway system is to be extended to Morley by an agreement between the two Corporations.

LONDON: "*Big Ben.*"—During the present vacation the opportunity is to be taken to put in an electric motor to drive the winding gear, which is at present worked by hand.

London United Tramways.—A new system of fares has been inaugurated during the week. The routes have been divided up into sections, any consecutive three of which may be traversed for a penny, six for twopence, and so on. If a traveller goes beyond the third section and does not pass the fourth, only an extra halfpenny will be demanded, whereas before a penny was charged.

PENZANCE: *Electric Lighting Scheme.*—It is reported that the Board of Trade are to be asked not to take any steps to revoke the electric lighting order, provided the undertakers are able to show by Christmas next that they are in a position to carry it out.

PERTH: *Electricity Accounts.*—The total revenue for the past year amounted to £7,935, and after meeting capital charges a balance of £67 has been carried forward. After considerable discussion it has been decided to reduce the price charged for current to the tramway department, which will now be at the rate of 1·12d. per unit instead of 1·29d.

RAWTENSTALL: *Tramways.*—The Town Council have received sanction to lay a new line from Waterfoot to Water. Last year there was a loss on the Rawtenstall tramways of £2,196, including £1,146 paid for a tram accident which occurred in December, 1908.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Aug. 11th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

14,212/09. **Battery Boosters for Three-wire Battery Installations.** A. M. Taylor. Instead of having two separate booster armatures, connected to the two sides of the system, a single booster of double the voltage is employed. This has slip-rings connected to two tappings on its armature winding, and these are connected to a choking coil or balancer to give the neutral point and to compensate automatically for fluctuations in the out-of-balance current. Further, where two boosters are arranged for series-parallel grouping, the neutral point is obtained by similar static balancers. The balancers also protect the boosters from undue rushes of current due to external short circuit. Three figures.

16,621/09. **Current Indicator for Electric Speed Indicating Apparatus.** J. Rennie. This instrument consists of a compound strip of brass and iron loosely coiled up and fixed at the outer end, the inner end having a pointer attached to it. When heated up by the current, the strip uncoils and moves the pointer. The scale is attached to a second strip, which, by moving the scale, compensates for atmospheric temperature variations. A contact placed on the scale causes a bell to ring when the pointer reaches it. For use with a speed indicator, the current generated by a small dynamo is passed through the strip. Four figures.

17,031/09. **Balanced Protective Arrangement for Three-phase Distribution Systems.** British Thomson-Houston Co., Ltd., and E. B. Wedmore. This specification covers the system of balanced protection described with the results of tests in Electrical Engineering, June 2nd, 1910, p. 356. Three figures.

19,623/09. **Illuminated Signs.** W. P. Thompson (*Hamburger Elektricitäts Ges.*) Letters or designs cut out in rough gold leaf are pasted on to a dark concave opaque surface, and an electric lamp is fixed at the optical centre of the surface. The lamp is shaded from the observer, and the letters have the appearance of being self-luminous. A sign may be made up of a large number of such concave surfaces, each having a lamp at its optical centre, and containing one letter or design. Four figures.

20,106/09. **Joint Boxes for Aluminium and Copper Cables.** C. J. Beaver and E. A. Claremont (Manchester). This is a box for enclosing and protecting a mechanical joint between overhead cables of copper and aluminium respectively, to prevent electrolytic action. The mechanical connector is of copper or aluminium, and over the end engaging with the cable of unlike metal is fixed a metal shell. A bush of a non-metallic material is inserted between the neck of the shell and the cable, and the shell is filled with a bitumen or wax compound. All joints between dissimilar metals are thus protected from the atmosphere. Two figures.

20,666/09. **Lamp-shade Ring.** C. Arnold. A readily fixed and simple ring for fixing shades on lamp-holders consists of a ring with two or more springs converging inwardly upwards so as to grip the threaded part of the holder. The springs are bent out again so as to form a support for the shade. Ring and springs may be in one piece, or the springs can be riveted to the ring. There is no screwing motion, the holder being merely gripped by the springs. Two figures.

24,269/09. **Control of Induction Motors.** Siemens Bros. Dynamo Works, Ltd. (*Siemens Schuckertwerke Ges.*). For the speed control of a large polyphase induction motor, a frequency-transformer is employed to supply a current of variable frequency to the rotor. This transformer consists of an induction motor coupled to a polyphase commutator machine with slip-rings. The slip-rings of the induction motor are connected to the three brushes of the commutator machine which supply the variable frequency current, and the speed of the set depends on the frequency of the currents generated. Two figures.

3,981/10. **Drawn Tungsten Filaments.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). In order to pass a tungsten rod or wire into the die for drawing, it must be pointed at the end. The metal is exceedingly hard, and so, to effect this, the wire is dipped into a bath of a fused oxidising salt such as potassium or sodium nitrite. The chemical action points the wire and leaves a clean surface free from pits.

5,801/10. **Electrically Operated Switch.** Adams Manufacturing Co., Ltd. (*Cutler Hammer Manufacturing Co., U.S.A.*). This is a circuit-breaker of the "contactor remote control" type described in Electrical Engineering, April 14th, 1910, p. 247. In order to permit access to the contacts of the switch, the pole-pieces of the blow-out magnet are swung aside. Thus the pole-pieces may be constructed in one piece with the core of the blow-out magnet, and the core may be arranged to turn in its bobbin. Eight figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Summaries of some of the more important of these patents will appear in our next issue.

Dynamos, Motors, Transformers: Holmes [Induction motor] 17,520/09; Leitner [Train-lighting dynamos] 17,847/09 and 8,219/10; Siemens Bros. Dynamo Works, Ltd. (*Siemens Schuckertwerke Ges.*) [Starting of polyphase motors] 7,822/10 and [Compensated polyphase series motor] 9,046/10.

Electric Ignition: Dier and Whitcher [Electric gas lighter] 25,574/09; Smith [Sparking-plugs] 9,618/10.

Electrometallurgy and Electrochemistry: Cowper Coles [Reflectors] 20,017/09; Helfenstein [Electric reduction furnaces] 24,498/09; New Ignition Syndicate and Sandy [Battery electrolyte] 26,649/09.

Incandescent Lamps: Redfern (*Compagnie Générale d'Electricité*) [Apparatus for jointing filaments] 25,383/09; Krause [Supports for metal filaments] 349/10.

Instruments and Meters: Berardi [Prevention of fraud with meters] 17,488/09; Hamilton and Ferranti, Ltd. [Counting trains for meters] 18,691/09.

Storage Batteries: Lewis, 18,098/09; De Laminière and Soc. Anon. des Accumulateurs de Laminière [Plates] 27,976/09.

Switchgear, Fuses, and Fittings: Fisher [Plugs] 12,452/09; Wardle Engineering Co. and Wardle [Lamp fittings] 17,230/09; Schultz [Switches] 17,274/09; Tucker [Switches] 18,471/09; Kohler [A.-C. motor controllers] 21,249/09; Rockstroh [Control gear for electrically-driven printing and stamping machinery] 4,678/10; Midgley and Vandervell [Switches] 5,571/10; Lundberg [Switches] 10,423/10.

Telephony and Telegraphy: Eisenstein [Wireless aerial] 17,215/09; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Signalling apparatus] 7,154/10.

Traction: Heenan & Froude, Ltd. [Radial trucks] 18,390/09; La Barre [Stopping trains independently of drivers] 21,666/09.

Miscellaneous: Pealing [Portable electric drill] 11,858/09; Brougham (*A.-G. Maschinenfabriken Escher, Wyss*) [Exhaust-steam plants] 17,475/09; Steinert and Stein [Electromagnetic separator] 17,490/09; Heurtley [Electrical magnification of mechanical effects] 17,555/09; Brown and Scott [Reversible turbine] 28,931/09; Wooton and Howett [Fire alarms] 7,820/10; Verhoeven [Burglar alarm] 11,254/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: Siemens Schuckertwerke Ges. [Electric speed regulation of machines] 16,997/10.

Electric Ignition: R. Bosch, 14,575/10.

Switchgear, &c.: R. Bosch [Terminals] 11,600/10; Siemens Schuckertwerke Ges. [Fuses] 17,047/10; Allgemeine Elektricitäts-Ges. [Signalling apparatus] 17,156/10; Bonhomme [Signalling apparatus] 17,172/10.

Traction: Jellinek and De Továros [Suspension of trolley wires] 8,831/10.

Miscellaneous: A.-G. Brown, Boveri, et Cie. [Turbine blades] 28,140/09.

Opposition to Grant of Patent

19,872/09. **Electrical Propulsion of Ships.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). Opposition has been entered to the grant of this patent. The specification, abstracted in Electrical Engineering, June 23rd, p. 415, describes a system combining electrical drive with motors supplied by high-speed turbo-alternators and direct drive with low-speed, low-pressure turbines.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

18,617 of August 22nd, 1896. **Copper Brushes.** F. J. Chaplin. This covers dynamo brushes formed by folding two sheets of copper-wire gauze, the outer sheet being cut diagonally to the wires, while the inner sheet is cut on the straight.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: A. Blondel [Ventilation of flame lamps] 9,316/03.

Distribution Systems, &c.: L. Randolph [Insulating composition] 9,511/02; E. R. Hill [Balanced protection system for H.-T. feeders] 8,906/05.

Instruments, &c.: W. D. Watson and Rochdale Electric Co. [Prepayment meter] 9,657/03.

Switchgear, &c.: C. L. Menges [Lamp-holders and wall-plugs] 9,728/03; J. H. Dale [Lamp cluster fitting] 9,397/04.

Telephony: E. N. Baird [Prepayment apparatus] 2,238/01.

Miscellaneous: J. B. Bessey [Electrical treatment of peat fuel] 17,497/04.

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STAFFORDSHIRE: *Abandonment of the "Fair Fare" System.*—In consequence of local opposition, the Potteries Electric Traction Co. has decided to abandon the "fair fare" system, with its farthing fares, from September 1st.

STALYBRIDGE: *Electricity Costs.*—It is announced that the Works costs have averaged 0·33d. per unit, which is considerably below the average of undertakings in this country. The average selling price has been 0·59d., including a large supply for power purposes. The units consumed per head of population worked out at 102·7, which is said to be a record for this country.

STOCKHOLM: *Trolley Omnibuses.*—It is stated that the municipal authorities have granted a concession to a private syndicate for a service of accumulator and trolley electric omnibuses.

TAUNTON: *The Borough Electrical Engineer.*—Eighty-two applications have been received for the vacant post of Borough Electrical Engineer at a salary of £200 a year.

WEYMOUTH: *Tramway Propositions.*—The Council have had under consideration a report of the Electric Lighting Committee on several alternative traction schemes, embracing propositions for services of petrol, petrol-electric accumulator, and trolley omnibuses, and electric tramways. The Committee favour the tramways scheme, which they think could be made to pay if the capital costs are kept to a minimum. It would also provide a valuable day load to the electricity works. It is recommended that a Provisional Order be applied for at once.

WIGAN: *The Tramway Undertaking.*—An extensive report on the tramway system has been prepared by Mr. C. W. Mallins (General Manager, Liverpool Corporation Tramways), who recommends: (1) The appointment of a general manager, responsible to the Tramways Committee for the whole undertaking, with the possible exception of the permanent way; (2) that the maintenance charge on overhead equipment, rolling stock, car sheds, and workshops should be reduced to the average; (3) that the cost of electric current be reduced to the average of tramway undertakings; (4) the cost of maintenance of permanent way reduced to the average; (5) an improved service; (6) a system of through running; (7) the contract for advertising on the cars to be looked into, as to whether better terms could be arranged; (8) a rearrangement of the present stages and fares; (9) a more up-to-date type of rolling stock; (10) that standard gauge be substituted for the narrow gauge portions.

WOLVERHAMPTON: *Tramway Accident.*—On Monday some excitement was caused by one of the feeder cables breaking down to earth at the base of a feeder pillar and producing dense volumes of smoke, which poured out of the ventilating holes at the top of the pillar. A tramcar happened to be standing by, and a panic appears to have been started, in which one man jumped from the top of the car into the road and sprained his ankle, and another man was pushed off the top and somewhat shaken. The traffic was delayed about half an hour while temporary connections were being made.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

CANADA: *Winnipeg.*—Tenders are required by September 1st for 46,000 ft. of 13,000-volt three-core cable. Particulars can be obtained from the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

CREWE.—Mains extensions amounting to £1,300 are to be made.

IPSWICH.—Tenders are invited for the annual contract for underground cables. Tenders by August 22nd. Particulars from Chief Engineer; deposit, one guinea.

ITALY.—It is reported that owing to the increase of traffic on the Milan-Varese Electric Railway, a number of new electric locomotives are to be purchased.

LONDON: *Hackney.*—Tenders are invited for extensions to the main switchboard. Tenders by August 22nd. Particulars from Town Clerk, Town Hall, Mare Street.

MISCELLANEOUS

LONDON.—Tenders for a year's supply of electrical accessories are invited by the Commissioners of H.M. Works and Public Buildings. Tenders by August 24th. Particulars from the Storekeeper, H.M. Office of Works, Engineer's Stores, 20 Newington Butts, S.E.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.

S.W.—Houses and shops, Foulser Road, Upper Tooting, S.W. Swain & Selley, builders, 31 Grayswood Street, Streatham.

PROVINCES.

ABERDARE.—School (£13,154). Architect, J. H. Phillips, 7 Pembroke Terrace, Cardiff. T. F. Howells, builder, Cardiff.

ABERDEEN.—Extension tramway depôt (£1,625). Borough Surveyor, Aberdeen T.C.

BARROW.—Fire station, Abbey Road, and Clifford Street (£2,380). J. W. Smith, surveyor, Barrow T.C.

BOLTON.—Additions Spinners Hall (£5,000). Architects, Potts & Sons, 79 George Street, Bolton. Builders, Townson & Sons, Bolton.

COLWYN BAY.—The electrical lighting of the Eisteddfod Pavilion has been decided upon, and cable, &c., is to be ordered forthwith.

DAILSTONE.—Additions hospital (£16,000). J. Jepson, Guardian Chambers, Tiviot Dale, Stockport.

DANTHILL.—Textile works, Caroline Street (£12,000). S. Stott, architect, York Chambers, Oldham.

GLASGOW.—Masonic temple, Cochrane Street. Architects, Lennox & MacMath, 103 Bath Street, Glasgow.

GOOLE.—Extensions workhouse (£3,700). Thorpe & Turner, architects, Carlisle Street, Goole.

HYDE.—A proposal to install electric light in the borough infectious hospital has been approved by the Council, subject to the Joint Electricity Board supplying electricity upon satisfactory terms.

NEWBURN-ON-TYNE.—Council chamber (£2,700). C. Cratne, architect, Station Road, Wallsend. Builder, T. Clemens, Grosvenor Road, Newcastle.

PORTSMOUTH.—Parish hall and Sunday school, St. Mark's Church (£3,197). Rake & Cogswell, architects, Portsmouth. Messrs. Salter, builders, Portsmouth.

POWERSCOURT.—Carnegie library. Surveyor, Rathdown (Dublin), No. 2, R.D. Council.

RENFREW.—Council offices, Yoker Road (£2,000). Surveyor, Renfrew P.C.

ROMFORD.—School (£5,567). Builders, Dowsing & Davies, Mawney's Road, Romford.

ROTHERHAM.—Smallpox hospital, Kimberworth (£6,000). Surveyor, Rotherham Town Council.

SHILDON (Durham).—School (£16,000). M. Turnball, surveyor, Shildon U.D.C.

YARMOUTH.—Pavilion, Britannia Pier for the Britannia Pier Co., Ltd.

TENDERS RECEIVED AND ACCEPTED

BELFAST.—The Harbour Commissioners have accepted the tenders of J. Howden & Co. for a steam engine (£224), and Siemens Brothers Dynamo Works, Ltd., for a dynamo (£331).

EDINBURGH.—The tender of Messrs. A. W. Penrose & Co. for electric lifts in the new General Post Office at Edinburgh has been accepted.

MIDDLESBROUGH.—A contract has been placed by Messrs. Dorman, Long & Co. with the A. E. G. Co. for a complete generating plant, including three mixed-pressure turbo-alternators, and one live steam turbine each of 1,280 kw. The exhaust steam turbines will be driven by steam from three large steam rolling mills.

MOTHERWELL.—The following tenders have been accepted:—Chamberlain & Hookham, meters; Balcke & Co., cooling tower (£818); Callendar's Cable & Construction Co., cables (£530); Siemens Brothers Dynamo Works, switchboard extensions (£305).

SWANSEA.—Messrs. C. H. Musker & Co. have received an order for three electric transporters for the new King's Dock (£4,100).

WHITEHAVEN.—The tender of Messrs. Browett, Lindley & Co. for a 250-kw. generating set with Phœnix dynamo has been accepted.

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APPOINTMENTS AND PERSONAL NOTES

Mr. W. Perren Maycock, who has recently completed an eighteen-months' engagement with the International Correspondence Schools, Kingsway, London, is now engaged upon a new edition of his "Electric Wiring, Fittings, Switches, and Lamps," which, as well as another on a kindred subject, will be published before Christmas.

The Governors of Faraday House have appointed Mr. E. A. Nash as Secretary and Business Manager of the Electrical Standardising, Testing & Training Institution in the place of Mr. Howard Foulds, who has recently secured an appointment in Birmingham.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire-bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 5s. to £58 10s. per ton (last week, £58 to £58 5s.).

BRANCH OFFICES.—Messrs. Arthur Jopling & Co., 10 Westmorland Buildings, Aldersgate Street, London, E.C., inform us that they have opened a branch office at 16 Park Place, Leeds, where a complete stock will be kept. Mr. A. A. Pyman has been appointed manager for the district.

THE WITTON-JAMES SYSTEM OF PRINTING-PRESS CONTROL.—We are informed that this business has been purchased by Witton-James, Ltd., with a view to further development and extension. The new business will be under the management of Mr. H. V. James, as before, and the new address is Witton-James, Ltd., Midland Bank Chambers, Queen Victoria Street, E.C.

CHANGE OF ADDRESS.—Messrs. Grindlay, Ross & Co. (278 St. Vincent Street, Glasgow) have removed their works and offices to more commodious premises at 47 Waterloo Street. (Telephone No. Central 4593, and Argyle (Nat.) 2173.)

PARTNERSHIP DISSOLVED.—The partnership between Henry W. Davis and Harry W. Hosier, trading as H. & W. Davis, surgical and electrical instrument makers, of 43 Grafton Street, Tottenham Court Road, has been dissolved as from July 16th. Debts by H. W. Davis, who will continue the business.

The partnership between K. W. Bacher, H. C. Taylor, and S. R. F. Smith, electrical engineers, trading as Middlesex Electric Works, Hounslow, has been dissolved.

BANKRUPTCIES.—The discharge of Albert Clapham, of the Yorkshire Motor Car & Electrical Engineering Co., 101 Kirkstall Road, Leeds, has been suspended for two years.

METAL FILAMENT LAMP PATENTS.—We have been requested by the London Commercial Electrical Stores, 65 and 67 Knightrider Street, E.C., to state that the metal filament lamps which they sell are made under the colloid patents, and that they indemnify customers against any legal proceedings.

BRUSSELS EXHIBITION FIRE.—Among the many exhibitors who have suffered in the disastrous fire is the Synchronome Company, of Clerkenwell, who had equipped the whole of the British Section with their system of electric clocks. We are informed that their loss is not covered by insurance.

THE FIRE AT THE BRUSSELS EXHIBITION.—In the first reports of the disastrous fire at the Brussels Exhibition the outbreak was attributed to a short-circuit in an illuminated device over the Attic portico at the entrance to the Belgian section, burning portions of which were said to have fallen into the Salon of Belgian Needlework. In later reports, however, it is stated that an attendant certifies to having seen a curtain flare up in the needlework hall. A *Times* correspondent learns "from an authoritative source" that a night watchman has admitted that he involuntarily caused the fire when lighting his pipe. M. Beernaert, Minister of State, in an interview with the *Journal de Bruxelles*, stated that the fire was not due to a short-circuit. The whole of the British Section has been destroyed, but those of the engineering and electrical exhibits that were in the Machinery Hall have not been damaged.

Street Lighting at Finsbury.—With reference to an announcement in a contemporary that the Finsbury Borough Council has granted a contract for the lighting of all its streets by gas, and that this decision was taken after the latest examples of gas and electric lighting had been carefully inspected, and relative costs considered, Mr. H. B. Renwick (General Manager and Secretary, County of London Electric Supply Co., Ltd.) calls our attention to a letter which he has written to the journal in question, pointing out that his company offered to submit examples of electric lighting free of expense to the Council, but this offer was declined. With regard to the question of relative running costs, the company submitted a tender for lighting which gave an illuminating power three times as great as the existing gas lighting, and, moreover, showed a saving in running costs as compared with gas of over 14 per cent. In spite of this, however, he writes, the offer was declined.

NEW COMPANIES

G. W. CLARKE & CO. (LIVERPOOL).—Capital, £1,000 (250 deferred shares). To take over the Liverpool branch of the Walsall Electrical Co., Ltd.

ELECTRIC FURNACES AND SMELTERS, 110 Cannon Street, London. Capital, £5,000. Manufacturers of electrical furnaces for smelting.

HIGH-SPEED PRINTING TELEGRAPH CO., 10 Walbrook, London, E.C. Capital, £2,000. Objects as title.

PICKFORD, TROWN & CO., 264 Ecclesall Road, Sheffield. Capital, £3,000. To acquire the business of electrical and mechanical engineers now carried on at the above address.

BRACUHY FALLS & METALLURGICAL SYNDICATE. Registered by Slaughter & May, 68 Austin Friars, London, E.C. Capital, £48,000. Promoters, constructors, and makers of tramways, railways, telegraph and telephone lines, electrical works, &c.

JOHNSON BILLINGTON ELECTRICITY METERS.—Registered by Beddle & Co., 22 Aldermanbury, London. Capital, £8,000. To manufacture and supply meters of all kinds, and to adopt an agreement with A. M. Billington, and H. S. Johnson.

GREENHILL & CRAIG, 29-37 King Street, Belfast. Capital £6,000. Electrical engineers and machinists.

HORSE-POWER & SMELTING SYNDICATE.—This company was registered on July 29th with a capital of £12,000, to carry on the business of manufacturers of dealers in machinery for the treatment of ores and the generating of electricity, &c. Private company. Registered by Ingle Holmes, Sons & Pott, Capel House, E.C.

T. F. SYNDICATE, LTD., 341-5 Birkbeck Bank Buildings, High Holborn, W. Capital £2,000. Manufacturers of and dealers in metallic filaments, &c. To adopt an agreement with the Deutsche Gluhfahden Fabrik, of Berlin, R. Kurtz, and Dr. F. Eimer, and the Co-operative Commercial Concessions, Ltd., of 341-5 Birkbeck Bank Buildings, W.C. Private company.

LUMINATOR WATER CO. (FOREIGN PATENTS), LTD. (111,214.) Capital £5,000. Engineers, electricians, &c. Private company. Registered by Mayo, Elder & Co., 10 Drapers Gardens, E.C.

BRYANT & SONS, 42 Queen Anne Road, St. Philips, Bristol. Capital of £3,000. Electrical mechanical engineers. To take over the business of E. T. Bryant at same address. Private company.

GEM ELECTRICAL PICTURE CO., LTD., Public Hall, Burnley Road, Bacup. Capital of £500. Proprietors and managers of electric or cinematograph halls, &c.

SALERNO SYNDICATE, LTD., Cross Keys House, Moorgate Street, E.C.—Capital £8,300, shares of 1s. each, to obtain concessions, and to work railways, tramways, &c., in the province of Salerno, Italy. Private company.

ORIZABA TRAMWAYS SYND.—Capital of £3,150. Private company. Registered by J. J. Edwards & Co., 28 Sackville Street, W.

Association of Mining Electrical Engineers.—The annual meeting of this Association has been arranged to be held at Newcastle-on-Tyne on October 7th and 8th next.

New Power Station in South Africa.—According to the *African World and Cape-Cairo Express*, the Rosherville Lake power station of the Rand Mines Power Supply Co. (formed and financed by the Victoria Falls & Transvaal Power Co.) will probably be in operation in December next. When completed, this station will be the largest steam-turbine station in the world, the capacity of the plant being 106,000 h.p. The steel constructional work, comprising 1,800 tons of steel, supplied from Berlin, has been carried out by Messrs. Baerecke & Klendgen, of Johannesburg. A Johannesburg firm secured the contract for the foundations and brickwork, and the machinery is being supplied by the Allgemeine Elektricitäts Gesellschaft, of Berlin, who are the main contractors for the whole station. There are three boiler houses with eight boilers in each, each rated at 3,000 h.p. There will be sixteen chimney stacks, each 80 ft. high, when the plant is complete. Messrs. Babcock & Wilcox have secured the contract for the whole of the boiler plant. In the engine house are five 12,500 k.v.a. turbo-alternators, generating at 5,700 volts, and four turbine-driven air-compressors, each delivering about 600 cubic metres of air at a pressure of 140 lbs. per sq. in. Pipe mains for the transmission of the compressed air and cables for the electric power are now being laid to the mines of the Eckstein and Rand Mines group.



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COMPANIES' MEETINGS AND REPORTS

TYNESIDE TRAMWAYS CO.—The surplus of receipts over expenses for the half-year ended June 30th was £3,656, making, after deduction of debenture interest, &c., and with inclusion of £521 brought forward, an available balance of £3,144. It is proposed to pay a dividend of 1 per cent. on the ordinary shares after the provision of the 5 per cent. dividend on the preference shares, to transfer £900 to reserve, and to write off £330 from registration and formation expenses, carrying forward £643. Dr. T. Merz said, at the meeting last week, that the expenses had remained about the same, but there had been a slight increase in receipts.

NORTH METROPOLITAN TRAMWAYS.—The report and accounts mentioned in our last issue were adopted at the meeting last Thursday. Mr. James Devonshire, who presided, said that very little progress had been made in disposing of the assets of the company.

BARBADOES ELECTRIC SUPPLY CORPORATION.—At the statutory meeting on Thursday, Mr. L. W. Hawkins said that reports as to the demand for electrical energy were encouraging; a site had been secured for the works, and the greater part of the plant had been ordered.

LONDON STREET TRAMWAYS.—At an extraordinary meeting on Wednesday of last week, a resolution was passed in favour of returning a final 8s. per share to the shareholders. The company now comes to an end with the cessation of the lease of their lines to the North Metropolitan Tramways Co.

METROPOLITAN DISTRICT RAILWAY.—At the half-yearly meeting on Wednesday of last week, Sir George Gibb, who presided for the last time, owing to his appointment as chairman of the Road Board, announced that 36 million passengers had been carried, an increase of over three million over the previous half-year. The passenger receipts had shown an increase of £26,000, and the working expenses had been reduced by 3¼ per cent. The service of trains now reached 36 per hour during the busy time. The passenger receipts average 1·36d. per passenger. The chairman spoke enthusiastically of the progress made by the line and its future prospects. The report and accounts were adopted.

LONDON ELECTRIC RAILWAY.—The half-yearly meetings of the Great Northern, Piccadilly & Brompton; Charing Cross, Euston & Hampstead; and Baker Street & Waterloo Railway Companies, which are now to be amalgamated under the above title, were held contemporaneously last Thursday, when the reports summarised in our last issue were adopted. Sir George Gibb stated that the increase of receipts of the three lines aggregated £10,940 during the half-year under review. The dividends were announced in our last issue. The first meeting of the new company was held on the following day.

UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON.—The report states that the net revenue from investments and properties (including general interest), after deducting general expenses, amounted to £96,767, the net income from the operation of the power house was £45,416. The interest on £1,000,000 4 per cent. First Power House Debentures, and a proportion of commission, discount, and expenses incurred in connection with the issue, required £20,870, leaving a surplus from the power house of £24,546. The service of the £1,000,000 5 per cent. Prior Lien Bonds required £26,458. The service of the £2,818,700 4½ per cent. Bonds of 1933 required £67,120. The payment under the guarantee on Metropolitan District Railway Assented Extension Preference Stock amounted to £1,343, leaving a surplus over half-yearly charges of £26,392, which amount will be applied as follows:—Interest at the rate of 1 per cent. per annum on £4,928,050 6 per cent. Income Bonds of 1948, £24,640; income tax thereon, £1,437; balance to reserve applied in reduction of the accumulated revenue deficiencies, £315. The income from investments for the six months shows an increase of about 17 per cent. over that for the corresponding half-year of 1909. The amount paid under guarantee on Metropolitan District Railway Assented Extension Preference Stock only amounted to £1,343, as compared with £9,403 paid in previous half-years. The difference of £8,060 represents a dividend for six months ending June 30th last at the rate of 3 per cent. per annum payable by the Metropolitan District Railway Company on the 15th inst. in respect of the Preference Stock to which the guarantee of the Company refers. The traffic of the railway companies in which the company is interested is increasing satisfactorily. The gross earnings of the London United Tramways, Ltd., show an increase of £10,923, the operating expenses an increase of £10,566, and the net earnings an increase of £357 over the corresponding period of last year. The net output of electric energy from the Lots Road power house during the half-year was 63,627,200 kilowatt hours. Sir George S. Gibb has retired from the board of the company in consequence of his having accepted the chairmanship of the Road Board. The Right Hon. Lord George Hamilton has consented to act as deputy chairman of the company.

MERSEY RAILWAY.—The receipts for the last year have amounted to £21,457, as against £18,758 for the previous corresponding half-year. The balance to debit to net revenue is reduced to £11,821, against £18,414 a year ago.

MISCELLANEOUS CITY NOTES

SPRINGFIELD & JACKSONVILLE ELECTRIC RAILWAY CO.—An issue of $800,000 first mortgage 6 per cent. gold bonds is being made.

DIVIDENDS ANNOUNCED.—Mather & Platt, interim dividend at the rate of 10 per cent.—Crossley Brothers & Co., interim dividend at the rate of 4 per cent.—Silvertown Tramway, 1s. per share, and a bonus of 1s. per share.—W. T. Henley's Telegraph Works Co., Ltd., interim dividend on the preference shares at 4½ per cent., and on the ordinary shares at 10 per cent. for the half-year ended June 30th (payable September 1st).—Northampton Electric Light and Power Co., Ltd., 5 per cent. on preference shares and interim dividend at the same rate on ordinary shares.—Vickers, Son & Maxim, interim dividend 1s. per share.

HARPER ELECTRIC PIANO CO.—This company is to be wound up voluntarily. Mr. H. Wilson, of 23 Devereux Court, is appointed liquidator.

South African Institute of Electrical Engineers.—A gold medal has been offered for the best Paper read by a member of this Institute during the year ending December 31st, 1910, and a silver medal for the best Paper by a student member.

Wireless Telegraphy.—It is reported that the Marconi Wireless Telegraph Co. have made an offer to the Portuguese Government to establish wireless stations in all the colonies of Portugal on very favourable terms, and that the Portuguese Government is favourably disposed towards the proposal.

Porous Pot Accumulator.—Messrs. Richard Pape, Ltd. (Albion House, 59 New Oxford Street), write to inform us that although the porous pot accumulator described on page 519 of our issue of August 11th is manufactured under Mr. H. F. Joel's patents, Mr. Joel has parted with his rights to Messrs. Richard Pape, who hold the sole licence, both for manufacturing and selling these accumulators in the United Kingdom.

Railway Nationalisation.—According to the *Times*, at a meeting of the National Association for the Extension of Workmen's Trains and Trams, held on Friday in London, a resolution was carried protesting against "the slow progress made by the County Council in the construction and electrification of the London Tramways." Further, it was decided to make the nationalisation of the railways one of the objects of the Association.

Competition in Practical Telegraphy.—An international competition in practical telegraphy will be held in connection with the International Exhibition at Turin next year, which will include trials with Morse, Hughes, and Baudot instruments, which have to be deposited at the exhibition by August 22nd, 1911. Prizes will be awarded on the results of these trials. A code of regulations has been drawn up by the Italian Ministry of Posts and Telegraphs.

The Engineering and Machinery Exhibition.—The Marquis of Graham, C.V.O., will formally open the Naval, Mercantile Marine, and General Engineering and Machinery Exhibition at Olympia, London, on Sept. 1st. Special meetings of engineering societies will be held at Olympia as follows:—Sept. 6th, Junior Institution of Engineers; Sept. 14, Institute of Metals; Sept. 17th, Institute of Marine Engineers; Sept. 21st, Society of Engineers; Sept. 24th, Association of Engineers-in-Charge. Provision has been made for the admission of workshop parties, engineering and technical students, at reduced rates. The Exhibition will run from Sept. 1st to Sept. 26th, inclusive.

Telegraphic Traffic and Movements of Cable Ships.—The cable between Bonny and Duala, which was interrupted on the 3rd inst., was repaired on the 9th inst., but on the following day it again broke down. On the 15th inst., the cable between Hong Kong and Macao ceased working. The line between Rome and Constantinople has been repaired.—The c.s. *Faraday* has successfully completed two deep-sea repairs in over 2,000 fathoms, and is now returning to London. The c.s. *Mackay-Bennett*, of the Commercial Cable Co., has been occupied in recovering the abandoned portion of the Southern Cable of the company, which was diverted to Newfoundland. The recovered portion will, it is understood, be sent to England. The French c.s. *Amiral Caubet* did not leave port during July.

Rumoured Railway Electrification Scheme for the Manchester District.—There was a persistent rumour in Manchester that the Lancashire & Yorkshire and London & North-Western Railway Companies contemplated the electrical working of about 200 miles of line. It was stated that a joint committee of the London & North-Western, Lancashire & Yorkshire, and Great Central Railways had been formed to consider various schemes. It was said that the Lancashire & Yorkshire Railway had a scheme for converting their system in the Bury direction, the London & North-Western line from Manchester to Stockport was also mentioned, as well as the joint line of the Great Central and L. & N.W.R. to Altrincham. Later reports say that official denial has been given to the rumours, which may have arisen from some remarks of Sir Alexander Henderson at the Great Central meeting, when he stated that the conversion of the Manchester, South Junction, and Altrincham railway had been considered, although no decision had been arrived at.

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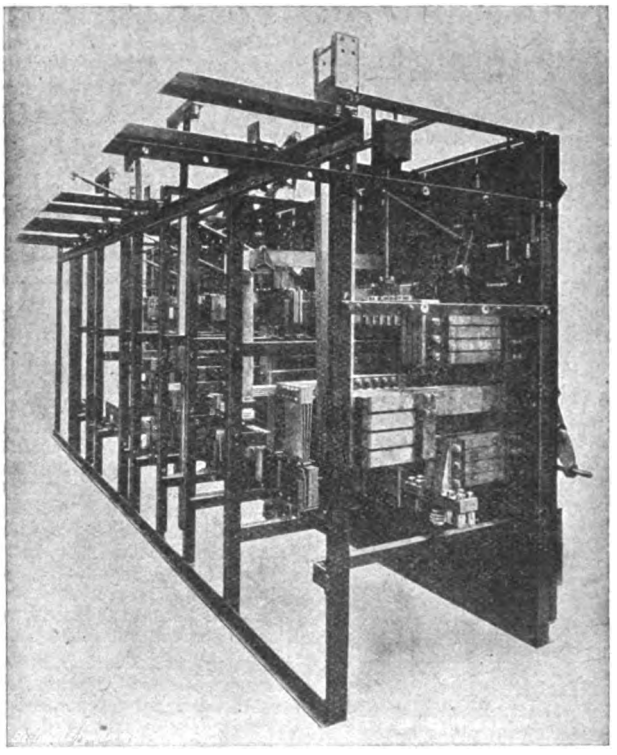
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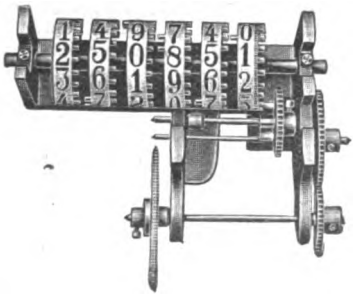
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ELECTRICAL ENGINEERING

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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

The fire at the Brussels Exhibition was not due to electrical causes, as was at first reported. The British exhibit is being reconstructed. (Page 546.)

At Marylebone, Hampstead, and Shoreditch, gas is to be entirely displaced by electricity for street lighting. The complete electric lighting of the Borough of St. Marylebone is expected to be complete by next month. In all cases the existing gas lanterns are made use of, and at Marylebone the cost of conversion, where mains existed, comes out to the low figure of £3 per post. The figure at Hampstead is £6 10s. per post, but more elaborate switching arrangements are in use there. (Page 547.)

We publish this week particulars of the courses in electrical engineering which are given in the leading University and other Colleges in London, in the same way as the provincial Colleges were dealt with in our last issue. (Page 549.)

An article by Mr. W. S. Burge discusses some of the disadvantages of the usual design of high-tension cellular switchboards, and proposes a system employing lead-covered cables and a special form of carriage-type selector switches. (Page 551.)

A new flame arc lamp of simple construction has been introduced. It is of the type in which one carbon rests at its tip on a refractory support, and feeds down by gravity as it is consumed. A double-carbon pattern burning 32 to 38 hours on one trim can be obtained. (Page 552.)

We have received two further letters from consulting electrical engineers expressing their disapproval of the rule that only corporate members of the Institution of Civil Engineers shall be admitted to the newly-formed Association of Consulting Engineers. (Page 553.)

Among the specifications published by the Patent Office on Thursday last was one by J. H. Holmes & Co., for a short-circuiting device for induction motors, in which the switch is held in the open position against the action of a spring during starting.—A train-lighting dynamo, in which the short-circuit currents caused by using broad brushes are utilised to reduce the main field on increased speed, is covered by H. Leitner.—E. von Lepel and the Gesellschaft für Drahtlose Telegraphie have both been granted British patents for oscillation generators of very similar construction in spite of opposition.—A patent by R. Scherl for gyroscopic apparatus suitable for mono-rail cars is opposed.—Three important patents relating to the Curtis steam turbine expire on Thursday next after the full life of fourteen years. (Page 554.)

Owing to a short-circuit in the standard of a tram-car at Blackburn, the framework became "alive," and two men were injured.—The East Ham School Medical Officer recommends electricity for school lighting.—A bonus system has been introduced on the Dundee

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tramways, but this system has been condemned by the men at Accrington.—Manchester Ratepayers' Association has entered a protest against the Local Government Board granting a loan without an inquiry.—A new tramcar depôt, which has cost £22,700, has been opened at Oldham.—Ipswich electricity accounts show a profit of £1,080 for last year, but the tramway accounts show a deficit of £1,732. (Page 555.)

Switchboard extensions are required at Rawtenstall; mains at Hoylake and Ipswich; meters at Littleborough; condensing plant at Darlington; and coal storage and conveying plant at Carlisle.—Loans are to be taken up as follows:—Aldershot, £1,500; Bury St. Edmunds, £1,460; Heywood, £4,000; Stalybridge, £22,268.—Electrical stores are required by the Powell Duffryn Steam Coal Co., and telephone material by the Australian Government. (Page 556.)

Domestic Irons.—There are some interesting notes on electric flat-irons in the August issue of *Installation News*, published by Simplex Conduits, Ltd. The writer deprecates the practice of keeping irons light for the sake of economy in the power required to heat them. A six-pound iron, he says, should be loaded up from 450 to 500 watts. It is a fallacy to believe that a heavy iron makes the operator tired; the requisite pressure for the work in the case of a light iron (3 to 4 lbs.) has to be compensated for by muscular exertion.

Patent Office Vacancies.—An open competitive examination to fill vacancies in the staff of assistant examiners in the Patent Office will be held in London, commencing on September 26th next. The present number of vacancies is seven. Limits of age, 20 and 25. Particulars of the examination and forms of application, which must be sent in on or before September 1st, can be obtained from the Secretary, Civil Service Commission, Burlington Gardens, London, W.

Faraday House.—The August issue of the *Faraday House Journal* contains an article on the electrochemistry of the commercial production of aluminium and an illustrated description of some electrically-driven winding engines for mines. The list of students attending the courses at Faraday House and the movements and successes of old students will be of interest to many. A photograph of Mr. H. Foulds, who has resigned the position of Secretary to take up the post of Secretary to the Birmingham Electricity Supply Department, is also included.

Turin International Exhibition.—At the International Industrial Exhibition to be held in Turin, Italy, from April to October, 1911, there will be sections devoted to electrical, mechanical, and civil engineering, while electrochemistry, telegraphy, telephony, and other branches of electrical science will also be represented. Among the prizes offered is one for new applications of electric power. The interests of British exhibitors are being looked after by the same special committees who were nominated by the Royal Commission for the Brussels Exhibition. A prominent site of about 220,000 sq. ft. in extent has been secured for the British section, and special rates have been arranged for the carriage of exhibits. A memorandum of information relating to the exhibition has been published, and this and any further information required can be obtained from the Director of the Exhibitions Branch, Board of Trade, Queen Anne's Chambers, Broadway, Westminster, S.W.

Electric Power in Sweden.—According to a British Consular report, the Trollhhättan Works, which commenced operation in 1908, has extended its lines to Gothenburg, Alingsas, and Skövde. The Hemsjö Company started up its new power station at Torsebro during the year. In Norrland, the Ungers Industriaktiebolags power station at Arbra was opened, while the Stora Kopparbergs Bergslags station at Bullerforsen is still under construction. The power station of the Uddeholm Company at Forshult and the Västerdalälfvens Kraftaktiebolags power station at Mockfjärd have started operation, and the Hellefors Bruks Aktiebolag has begun the harnessing of four of its waterfalls in Svartälfven. The town of Umea has begun the construction of a power station at Klabböle on the Umea River. A large steam turbine station at Gellivare started work at the close of the year. The most important event in the iron trade during 1909 was the completion of the experiments in iron ore reduction in electric furnaces of different types at the Domnarfvet iron works, in which the furnace of the Aktiebolaget Elektrometall was most successful. The Swedish Iron and Steel Institute has granted a large sum towards experimental works at Trollhättan.

THE FIRE AT THE BRUSSELS EXHIBITION

Lord Lytton, Chairman of the Royal Commission and of the Executive Committee of the British Section of the Brussels Exhibition, has stated that the fire broke out at the corner of the Grande Terrasse nearest the Brussels Kermesse. The main entrance was brilliantly lighted by electric lamps, and it had been suggested that the cause of the fire was a short-circuit at this point outside the Exhibition walls. This view was not, however, upheld by the Belgian authorities, who were of the opinion that the fire broke out inside the Exhibition near this point, and was probably due to the carelessness of some individual. *The Times* states, further, that the theory of a short-circuit has been unanimously discarded, and quotes a statement made by the President of the Exhibition Committee to the effect that the electricity supply had already been cut off for two hours when the outbreak occurred. The Board of Trade has decided to reconstruct a British exhibit, and a grant for this purpose has been made by the Treasury. The Salle des Fêtes has been offered by the Belgian authorities. An appeal to the British exhibitors by the British Commissioner-General has met with a hearty response, and offers of help have been received from various firms, including two shipping companies, who offer to carry goods for the reconstructed British exhibit free of charge from London to Ostend. By Tuesday morning no less than 110 firms had applied for space in the new British Section, and it is expected that a satisfactory exhibit will be arranged in the course of a week or two.

Wireless Telegraphy.—The construction of a wireless telegraph station at Scarborough will shortly be commenced. The decision to erect a station here was the outcome of complaints that no wireless station existed on the East Coast between Caister and Newcastle.

In an article in the *Times* it is stated that the area embraced by the daily weather service of the Meteorological Office has been materially extended by the receipt of wireless telegrams from Atlantic liners. The messages record the state of the weather over the ocean at fixed hours corresponding with those at which observations are made at the land stations. For purposes of weather forecasting, however, the scheme has not as yet been of great value, owing to the unavoidable delay which occurs. As the range of the apparatus on most of the liners does not exceed 300 miles, the messages must be first passed from an outward-bound vessel to a homeward-bound one when the distance is greater, and as a result very few of the reports made by ships when westward of the 20th meridian arrive until at least 12 hours after the observations have been made.

The *Morning Leader* Berlin correspondent states that an interesting experiment with wireless telegraphy will be carried out in connection with the forthcoming German Army manœuvres. A series of towns, including Berlin, Frankfort, and Cologne, will be supposed to be besieged, and efforts are to be made to discover the best means of establishing communication with them. Transportable wireless stations will be made use of to a large extent.

Telegraph Traffic.—The submarine cable between Hongkong and Macao was restored to working order on the 22nd of August. On the following day the Chio-Teredos cable failed, but a quick repair was effected. On the same day the cable between St. Jacques and Doson was interrupted, and, in consequence, telegrams from Tonkin are being sent by land-lines.

National Telephone Co.'s Staff.—In the course of a speech at Saltburn on Monday, Mr. Herbert Samuel, the Postmaster-General, stated that the assertion that only half of the present staff of the National Telephone Co. would be taken over by the Post Office was entirely incorrect. With a few exceptions, the whole staff will, he said, be transferred to the service of the Post Office. The transfer, it will be remembered, will take place on January 1st, 1912, and the Postmaster-General has agreed to take over all the staff who have been not less than two years continuously in the service of the company on December 31st, 1911. This, however, does not apply to officers of the company receiving salaries of £700 a year and upwards. Moreover, employees will be allowed to count for purposes of pension their continuous service with the company subsequent to December 31st, 1909, as service under the Crown.

Underground Telegraph Cables.—It is now some years since the underground telegraph cable between London and Manchester *via* Birmingham was completed, and two or three years ago the line was extended from Manchester to Leeds. Last year an underground cable connecting Newcastle and Stockton was completed, and now Leeds is being connected in the same manner with Stockton. This will complete the chain between London and Newcastle. According to the *Yorkshire Post*, work on an underground line connecting Leeds with Hull will be commenced in a few months.

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ELECTRICITY v. GAS FOR STREET LIGHTING

Gas to be Entirely Displaced in Marylebone, Hampstead, and Shoreditch

The Truth about Westminster

IN view of certain inspired paragraphs which have recently been appearing in the daily Press, and which are liable to give the impression that practically the whole of London is lighted by gas, it is interesting to note what is being done in Marylebone, Shoreditch, and Hampstead towards displacing gas entirely for street lighting.

It is anticipated that every street in Marylebone will be lighted by electricity by the end of September. This work has been undertaken in two portions, the first, which is now completed, comprising 1,964 posts, consisting of 1,114 single-burner, 827 double-burner, and 23 triple-burner lamps. The 4¼ cubic feet Kern incandescent gas burners have been replaced by two 35 watt Osram lamps in series; the 8½ cubic feet Kern burners by two 55 watt Osram lamps in series, and in important thoroughfares by two 88 watt lamps in parallel; finally three 88 watt Osram lamps have been put in those lanterns which contained 12¾ cubic feet burners. The first scheme embraced all streets in which distributing mains were

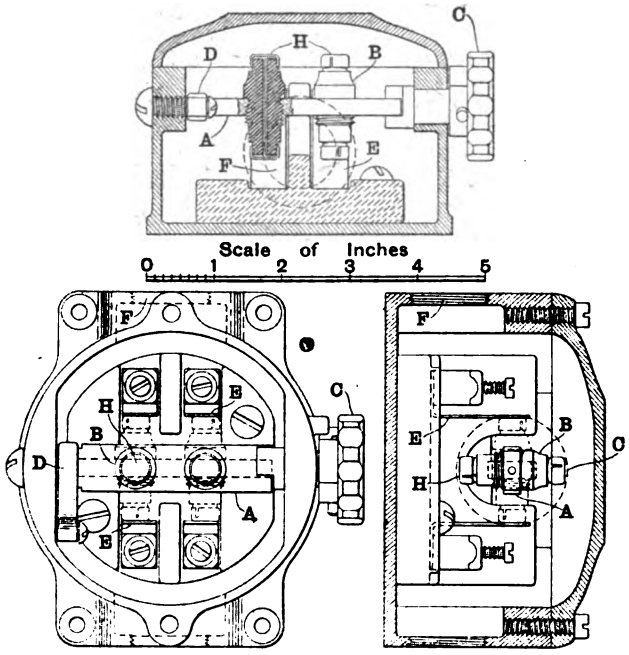


FIG. 1.—COMBINED SWITCH AND FUSE FOR MARYLEBONE STREET LIGHTING.

A.—Turn-bar. B.—Fuse-Carrier. C.—Switch-handle. D.—Spring. E.—Contacts. F.—Inlet and Outlet. H.—Fuse-caps.

laid, the existing gas lamp posts being utilised, and the comparative prices per post per annum are as follows, for all night supply, including maintenance:—

(*a*) 4¼ c. ft. gas lamps, £3 7s. 6d., replaced by electricity for £3 2s. 9d.

(*b*) 8½ c. ft. gas lamps, £5 19s. 5d., replaced by electricity for £4 9s. 6d.

(*c*) 12¾ c. ft. gas lamps, £8 16s. 11d., replaced by electricity for £6 14s. 6d.

In the important thoroughfares where double-burner gas lamps had been used, the effect of the conversion was not quite satisfactory with two 55 watt metal filament lamps, although the candle-power measured by a photometer was the same, and it was decided to replace these lamps by two 88 watt lamps in parallel, and this was done without increasing the cost for supply. On the first scheme the Council's lighting bill was reduced by £1,500 per annum; nevertheless, the Electricity Department, as will be seen later, is making a profit out of the transaction.

The Council was so satisfied, not only from the monetary point of view, but also by the improvement in general lighting, that it was decided last year to displace all the remaining gas lamps in the borough, making 3,500 in all, and to lay new distributing mains where necessary, with the double object of fostering the light and power load in districts hitherto not tapped, and of obtaining an efficient street lighting system. In some cases short services have been laid at the same time as the new distributors, and in others ducts have been laid, a policy which has been justified by the enquiries which are now coming in for lighting and power on the routes of the new street lighting. Indeed, there are anticipations that a good power load will be developed off the side streets.

All the street lamps are run off the ordinary distributors, which are 0·15 sq. in., 0·1 sq. in., and 0·25 sq. in. triple cables, the lamp services being 3/20 twin cable. Each post is fitted with a combined switch and fuse designed and supplied by Mr. Haydn Harrison, who also supplied the fitting in the lantern. The switch fuse box (illustrated in Fig. 1, which is self-explanatory) contains two ebonite fuse carriers, the heads of which form the moving contacts of the switch. Fig. 2 shows the fitting employed. The vibration in the lanterns is taken up by tensile springs arranged so that the whole lamp-holder is in a state of suspension. This will, of course, contribute further in the direction of low maintenance figures, as it will diminish the number of lamp renewals.

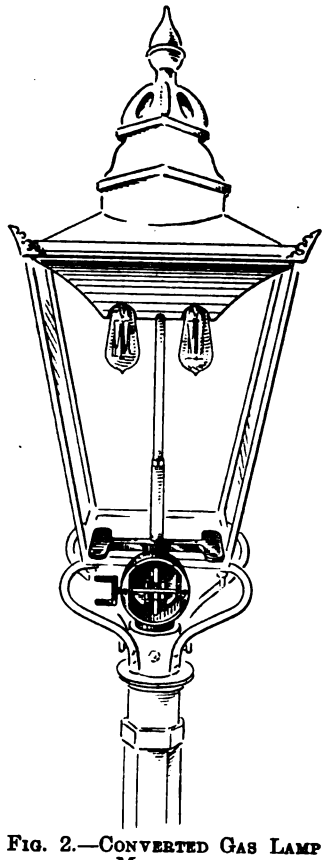


FIG. 2.—CONVERTED GAS LAMP AT MARYLEBONE.

One man is able to turn on or off 130 to 140 switches in the three-quarters of an hour which is the lighting-up time allowed. In this connection it may be mentioned that Mr. C. H. Smyth, the mains superintendent at Marylebone, is at work upon an automatic lighting device operated by an impulse current over the d.c. mains.

Originally the reflectors were made of enamelled zinc, but an Austrian enamelled iron is now used, which, it is found, requires less frequent painting.

The estimates of cost are being well kept to in practice. For the 55-watt lamps in the double and triple lanterns, the price allowed for current was 1·42d. per unit, which is at the ordinary schedule rate. The introduction of the larger wattage lamps reduces this figure slightly. The maintenance figures are made up of 12s. 6d. per annum for lighting, cleaning, extinguishing, and odd repairs; 2s. 6d. per annum for painting, and replacement of lanterns or posts damaged by passing vehicles; and for lamp replacements for 70 and 110-watt posts, 12s. per post per annum, slightly more for 176-watt posts, and approximately 20s. for

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triple posts. The cost of conversion where distributors are already laid amounts to £3 per post complete. Under the second scheme, which involves trench work and new mains, the cost is estimated to average £12 to £15 per post. This latter scheme has involved the laying of 15 miles of distributors, and 20½ miles of ducts. The total length of streets in the borough is 64 miles. Assuming a *pro rata* saving with the second scheme as with the first, the borough will, when the whole of the streets are lighted by electricity next month, make a saving of £2,600 per annum on its lighting bill compared with the old gas lighting.

In Hampstead, electric street lighting is replacing gas lighting in the whole district of the Borough Council, with the exception of a few of the smaller streets, in which there are no mains. Over 800 street gas lanterns have been converted, and the remaining ones are being proceeded with rapidly. When the work is completed, over 2,000 street lanterns will have been changed over from gas to electric light. In practically all cases a 4¼ c. ft. upright incandescent gas burner is being replaced by two 32-watt 100-volt Osram lamps, and the cost of conversion averages about £6 10s. per post, including all the work and the laying of a switch wire. The Electricity Committee have entered into a contract with the Lighting Committee at the rate of £2 10s. per annum per post for eight years, and £1 10s. per annum per post after this period. By the end of eight years the capital cost of the conversion will have been cleared off; hence the reduction in price. The price includes the supply of current, cleaning, renewals, and everything that is necessary. The comparatively high capital cost of £6 10s. per post is largely due to the switching arrangements, as the lights are switched on and off at the sub-station in groups of about 30 lamps by means of Venner time switches, which are set once a week.

The ordinary distributing mains are used for the supply, but the arrangement adopted has, of course, necessitated the laying of a switch wire. It is estimated, however, that the extra cost of this is quite counterbalanced by the saving in lighting and extinguishing.

Another borough in which electric lighting will shortly displace gas altogether is Shoreditch. Here the Electricity Department have nearly completed replacing 300 gas burners, using the same posts, by 50 and 100 c.p. metal filament lamps, and it is the intention of the Lighting Committee to extend street electric lighting throughout the whole of the Shoreditch area. The main streets are already lighted by arc lamps. The lamps replaced consist of 50 nominal c.p. incandescent gas lamps, either singly or in pairs, the 100 c.p. metal filament lamps replacing two gas lamps in the latter case. The existing lanterns have been adapted in a very simple manner. The hole at the top of the existing reflector has been covered by a plate, and the lamp holder has been suspended from this. Watertight switches are used in each lantern, with the usual knock-over lever arrangement which the lamplighters switch on and off.

Mr. E. Wilmot Seale, Secretary to the Charing Cross, West End & City Electricity Supply Co., has sent a letter to the press with regard to the misleading reports published that the City of Westminster have displaced electricity by gas for street lighting throughout. He first of all points out that the Westminster City Council have only transferred to the Gas Company the lighting of that part of the City of Westminster which has been hitherto lighted efficiently and economically by the St. James's & Pall Mall Electric Light Co. This lighting comprised the supply to 66 arc lamps. The Westminster Electric Lighting Co., under contract, are still supplying, and will continue to supply until 1931, 970 arc lamps, and the Charing Cross Co., under contracts which do not expire for some years, 165 arc lamps in the City of Westminster. With regard to the question of cost, of which so much has been made, Mr. Seale repeats what we stated at the time the matter was discussed by the Westminster City Council (ELECTRICAL ENGINEERING, April 28th and May 5th, 1910), that the conditions of the specification for the new contract were of a nature to handicap the electric supply companies. The electricity supply companies, whose mains are only laid in certain positions whilst the Gas Company's mains cover the entire area, were compelled to quote for the whole of such specific district or districts as might be within their particular area of supply. The City of Westminster Council on their part reserved the right to select any part or parts of those districts for lighting by electricity, to the exclusion of other parts of the district, at the contract price per lamp quoted for the whole district. It is obvious, therefore, that the electricity companies, in the event of the exclusion of parts of the district, might suffer serious loss.

The concessions of the electricity supply companies expire in 21 years, and all capital charges have to be provided for within that period. On the other hand, the Gas Company is not purchasable by the Local Authority, and has, therefore, a practically unlimited period in which it would be possible to deal with capital charges.

The question whether or no the contract will pay the gas company other than as an advertisement is, of course, continues Mr. Seale, one for themselves and their shareholders, but an analysis of their published accounts would appear to show that their costs are 1s. 10d. per 1,000 ft., while the contract price, which includes capital charges for street work, would appear to yield certainly not more than 10½d. per 1,000 ft., as against 2s. 8d. per 1,000 ft. charged to the general public. Would it be very unfair, he says, to deduce that considerations of advertisement and preference had an undue bearing upon the composition of the prices tendered by the Gas Company?

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION: *Change of Address.*—Mr. C. McArthur Butler, Secretary of this association, informs us that in future communications should be addressed to him at 28 Bedford Square, London, W.C.

THE LATE MR. H. W. COX.—A petition is being prepared by the Hackney Borough Council, and will be submitted to the Prime Minister, urging that an adequate pension be granted to the widow of the late Mr. H. W. Cox, whose death was due to X-ray dermatitis, brought about by his experimental work with X rays.

RUMOURED EXTENSION OF THE LIVERPOOL-SOUTHPORT RAILWAY.—According to the *Liverpool Courier*, the Lancashire & Yorkshire Railway Co. will shortly commence the extension of their electric system to Ormskirk. The company intend, it is said, to inaugurate a circular electric route between Liverpool, Ormskirk, and Southport *via* Beerscough Bridge. An overhead power-line is to be constructed between the power station at Formby and a new sub-station near Ormskirk.

A NEW C.B. TELEPHONE EXCHANGE.—On August 13th the National Telephone Company transferred the subscribers connected to its Trafford Park Exchange to a new central battery equipment installed in new premises at Trafford Park Road, which have been specially designed. The equipment is of the No. 1 C.B. (W.E. Co.'s) type, and consists of eight subscribers' positions giving accommodation for 780 lines, four incoming junction positions, and one exchange testing position. The equipment is of similar design to those previously described in ELECTRICAL ENGINEERING.

Lighting of the O'Connell Bridge, Dublin.—The General Electric Co. have sent us a photograph showing the lighting, by means of Osram lamps, of the O'Connell Bridge, Dublin, which was previously lighted by gas. In all, 39 100-volt, 55-watt lamps are used, these being fitted in the old lanterns put up originally by the gas company. The lamps are in a very exposed position, but, we understand, are giving every satisfaction both as regards life and general illumination.

The Pacific Cable.—The report of the Pacific Cable Board for the year to March 31st, 1910, states that the net receipts amounted to £111,723, which represents an excess of £17,956 over the expenditure. Interest on and repayment of capital, however, amounted to £77,544, which leaves £59,588 to be contributed by the Governments interested. The traffic receipts for the year show an increase of only £403, but a sum of £2,211 should have been credited, but was kept out of the accounts owing to accidental delay in transfers to the Board's account by the Governments of Australia and New Zealand. The expenditure decreased by £2,668. In order to minimise the difficulties with land-lines in Canada, an agreement has been entered into with the Canadian Pacific Railway for the exclusive use of a wire between Montreal and Bamfield. [This line was completed and taken over on Tuesday.] Similar difficulties are being experienced in Australia, and the Government there is being urged to place the control of the land-lines in the hands of the Board.

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ELECTRICAL ENGINEERING EDUCATION

III.—COLLEGES, &c., IN LONDON *

As is the case in the provinces, there are colleges and institutions in London of very varying character at which courses in electrical engineering are given. Some of these are incorporated in the scheme of the University of London, such as University College, King's College, and the East London College. The Central Technical College of the City and Guilds of London Institute at South Kensington, which forms the engineering section of the new Imperial College of Science and Technology, ranks also as a school of the University of London. The Finsbury Technical College was also founded by the City and Guilds of London Institute. In addition to these more or less interconnected organisations, and some others of an independent nature, there are a number of institutions or polytechnics in various parts of London, where evening and day classes of various grades are held, and most of these also have well-equipped educational laboratories.

University College.

University College (Gower Street, W.C.) is incorporated with the University of London. The electrical engineering department is under the direction of Prof. J. A. Fleming, F.R.S., who is assisted by Mr. W. C. Clinton and a staff of demonstrators. Mr. H. M. Hobart lectures on dynamo design. Students who go through the complete electrical engineering course of three years can obtain the University of London degree of B.Sc. in engineering, and the college diploma. Degree students are required to pass the matriculation examination of the London University. The composition fee for the three-year course is 120 guineas, which is paid in three instalments—namely, first year, 45 guineas; second year, 40 guineas; third year, 35 guineas. For students who have already completed part of their training elsewhere, special courses are arranged, extending over one or two years, as the case may be. There are also facilities for post-graduate and research work. The accommodation provided for the electrical engineering department, and that of all the engineering departments, was doubled three years ago, and the extensions were opened in 1908. The electrical engineering department has a complete wireless telegraph plant and antenna, which is used to communicate with King's College. Scholarships are awarded to electrical engineering students.

King's College.

King's College (Strand, W.C.) is a college of the University of London. Complete courses of study are arranged in the departments of electrical and mechanical engineering for the engineering degrees of the University of London and for the diploma and certificate of the college. The London matriculation examination should be passed before commencing the course. Either a four-years' course, the winter sessions being passed in the college, and three summer sessions in an engineering works may be taken, or a three-years' continuous college course. The electrical engineering department is equipped with up-to-date appliances for dealing with the heavier branches of the subject, and special attention is given to that of electrical traction. A wireless telegraph installation is in operation between University and King's Colleges. The entrance day for new students is Tuesday, October 4th. Prof. E. Wilson has charge of the electrical engineering department, and Profs. D. S. Capper, H. M. Waynforth, and M. Curry conduct the department of mechanical engineering. An entrance fee of £5 5s. has to be paid, and the tuition fees for the regular course amount to £50 per annum, and £1 5s. per annum laboratory fees.

The City and Guilds of London Institute.

The Central Technical College.

The Central Technical College of the City and Guilds of London Institute in Exhibition Road, South Kensington, is a "school" of the University of London in the Faculty of Engineering, and also forms the engineering section of the Imperial College of Science and Technology. For many years before its affiliation with either of these bodies, it was famed as a centre for electrical engineering education, and the pioneering work in this direction of the late Prof. W. E. Ayrton, F.R.S., will always be a landmark in the history of the subject. The electrical engineering course entirely at the college consists of three years' work, with an optional fourth year, and contains a large proportion of laboratory work. The programme is arranged so that students can take the examinations for the London B.Sc. degree in engineering, but is not absolutely confined to these requirements. The professor of electrical engineering is Prof. T. Mather, F.R.S., who is assisted by a number of demonstrators. Attention should also be drawn to the special post-graduate course in railway engineering, under the superintendence of Prof. W. E. Dalby (head of the mechanical engineering department), which includes lectures on electric traction by Mr. Philip Dawson.

Entering students must be over sixteen, and those not taking the London University matriculation examination must pass a college matriculation examination of about the same standard. A diploma of associate of the City and Guilds of London Institute is awarded to students who have gone through a complete course of instruction as laid down in the programme, and have passed certain college examinations thereon. An honours diploma can be obtained by students who present a thesis embodying the result of original work during a fourth year of study. The title of Fellow of the Institute (F.C.G.I.) is conferred upon associates who have spent at least five years in actual practice and specially distinguished themselves. A number of scholarships are obtainable for engineering students. The fee for the complete course to matriculated students is £36 per session. Special or partial courses can be taken by non-matriculated students at special fees.

The City and Guilds Technical College, Finsbury.

Both day and evening courses are given at the Finsbury Technical College (Leonard Street, City Road, E.C.) of the City and Guilds of London Institute. The day courses cover a period varying from two to three years. The college is provided with laboratories and workshops, and occupies the position of a finishing technical school for those entering industrial life at a comparatively early age, and of a supplementary technical college, for those who, having had some industrial experience, desire to qualify themselves to become foremen or managers. A certificate is awarded by the Institute to students who have passed through one of the complete day courses of instruction with sufficient merit. The age of admission to the day department is over fourteen years. There is an entrance examination once a year in September, and the fee for the session is £20. The principal is Prof. Silvanus P. Thompson, F.R.S., who is himself professor of electrical engineering, and is assisted by several demonstrators. The professor of mechanical engineering is Dr. E. G. Coker. There are several scholarships open to engineering students.

East London College.

The East London College (Mile End Road) is now a school of the University of London, and full day and evening electrical courses, under Prof. J. T. Morris, are arranged for students who take electrical engineering subjects for the B.Sc. examination in engineering, pass, and honours. Students joining the college must be not less than sixteen years of age. The work of the department consists of a three years' course—the first year's work being general electrical engineering; the second year's, two courses, one on instruments and testing, the other on dynamos, motors, transformers, and electric traction; the third year being devoted to a more advanced study of these subjects. In conjunction with the lecture courses, laboratory courses and work in the drawing office have been arranged. The fee for the full-day course is ten guineas per annum. Evening courses of instruction are also given in preparation for the same degree, and facilities are offered in the laboratories for research and experimental investigation. There are also complete courses in the evening for non-university students, and these have been entirely rearranged for the coming session. Special arrangements are made whereby it is possible for shift engineers to attend during the day-time those lectures which they are unable to attend in the evening on account of their night shifts.

* Part I. "The Universities of Cambridge and Oxford," and Part II, "Universities, Colleges, and Technical Schools in the Provinces," appeared in our last issue.

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The Electrical Standardising, Testing, and Training Institution.

The course of training at the Electrical Standardising, Testing, and Training Institution (Faraday House, Southampton Row, W.C.) is specialised to prepare for mechanical or electrical engineering appointments, and comprises lectures, instruction in mechanical drawing, as well as laboratory and workshop practice. The full course occupies four years, and two of these (the second and fourth years) are spent in engineering works, the remainder being spent at Faraday House. During the third year, in addition to the lectures by the staff of the institution, a series of lectures by engineers engaged in actual practice are delivered to the students upon special branches of electrical engineering work. Students are also taken to the various engineering works in easy reach of London, under the guidance of Mr. Buchanan, who was formerly works manager and designer to the Electric Construction Company, Ltd. Thus the feature of the training is its practical character and the combination of college and workmanship training upon the "Sandwich" system. There is an employment bureau connected with the college which is very successful in finding students openings. The Principal is Dr. Alexander Russell, Mr. J. Thomas also lectures on mathematics and physics, and Mr. H. M. Hobart and Mr. W. Buchanan lecture on electrical machine design. The visiting lecturers include Mr. W. R. Cooper, Dr. W. H. Eccles, Mr. J. Rennie, M.I.E.E., and Mr R. T. Wallis-Jones. The fees are inclusive of everything, and no extra payments have to be made to the works to which the student is sent. The amounts are as follows: First year, thirty-five pounds a term; second year, seventy-five guineas the year; third year, twenty-five guineas a term; fourth year, fifty guineas the year.

The Northampton Institute.

The principal feature of the electrical engineering course at the Northampton Polytechnic Institute (St. John Street, Clerkenwell, London, E.C.) is the way in which the commercial experience and work at the institute are interlaced. The course occupies four years. In the first year the student works at the institute, and at the end of that period, if he be an undergraduate of London University, he can take the intermediate examination for the degree of B.Sc. in engineering. The second and third year's work consists of six months' training at the institute during the winter, and two periods of approximately six months each passed in commercial workshops during the summer. The fourth year's work is entirely at the institute. The works to which the students are sent include some on the Continent, as well as in this country. The principal, Dr. R. Mullineux Walmsley, is also head of the electrical engineering department, Dr. C. V. Drysdale is the associate head, and is assisted by a number of permanent lecturers and demonstrators. Mr. H. M. Hobart also gives lectures. Special courses are given in electric traction and electro-chemistry. The advanced students, especially in their fourth year, can specialise in these subjects. Since last session the class for electrical engineers' quantities and estimates has been permanent and embodied in one of the special courses. The telegraphy and telephony classes, which hitherto have been separate, are now to be amalgamated, and it may also be mentioned that the aeronautical engineering classes have been further developed, and for the coming session the services of Mr. F. Handley Page have been secured as a lecturer. Before being admitted to the courses, students should be not less than fifteen years of age, and will be required to pass an entrance examination. The fee for the electrical engineering course is £15 per session for the first and fourth years, and £11 for the second and third years. Evening classes are also given.

The South-Western Polytechnic.

Electrical engineering courses are given at the South-Western Polytechnic (Manresa Road, Chelsea) for both day and evening students. The regular three-years' day course includes preparation for the engineering degree of the University of London, and it is also possible for evening students to take the same degree. Special courses are also arranged for the examinations of the Institution of Civil Engineers for Studentship and Associate Membership. Some of the courses form suitable preparation for some of the honours examinations of the City and Guilds of London and the Board of Education. A number of special courses are arranged for students engaged in or preparing for engineering work of various kinds. Students must be over sixteen, and must pass an elementary entrance examination. The fees vary from £7 10s. to £15 per session, according to the number of hours per week. Mr. A. J. Makower is head of the electrical engineering department. Evening courses in electrical engineering extending over four years are also given, and special arrangements may be made for students engaged in central stations, whereby they may attend in the day during those weeks in which they are on night duty. Arrangements have been made with several leading engineering firms whereby students are allowed, without payment of a premium, to enter upon apprenticeship in their works. Students completing their studies in the first-year college courses may proceed at once and continue their work with one of these firms, whilst those who continue their college courses through the second and third years and obtain the diploma of the institute, will, in addition, have their period of apprenticeship substantially reduced.

Battersea Polytechnic.

The Battersea Polytechnic provides in the day technical college a three-years' course in electrical engineering, admission being restricted to students of sixteen years and upwards who pass the entrance examination, or who can satisfy the Principal that their previous education is sufficient. After passing the examination at the end of their third year, students may obtain the Polytechnic diploma. The fees amount to £13 13s. per session of three terms. The ordinary three-years' course covers the work in electrical engineering required for the London B.Sc. degree in engineering. There is also a special course on wireless telegraphy extending over two or three years. Evening classes and labcratory instruction are given in various electrical subjects at low fees (from 5s. to 22s. 6d. per session, according to the number of hours and character of the class), and there is also a complete five-years' evening course. The head of the electrical engineering department is Mr. A. W. Ashton.

The Borough Polytechnic.

The Borough Polytechnic Institute (103 Borough Road, S.E.) is chiefly devoted to evening classes. The courses of instruction in electrotechnology are arranged to cover a period of several years. For students who do not possess any theoretical knowledge of electricity, a first-year course has been drawn up, which deals with general elementary principles. The second-year course is devoted to the more technical applications, including electric wiring. The third-year course deals with more advanced subjects in electrotechnics, including continuous-current machinery, &c. The fourth-year course is a continuation of the third-year work, and takes up the principles of alternating-current working, &c. Students may present themselves for examination by the Board of Education (science and art department) and the City and Guilds of London Institute. The fees are low for all the courses. The head of the electrotechnical department is Mr. J. Henderson.

The Hackney Institute.

Evening courses in electrical engineering are held at the Hackney Institute (Dalston Lane, N.E.), and courses consisting of laboratory work, as well as lectures, can be taken to prepare for the examinations of the London University, Board of Education, City and Guilds of London Institute, and other bodies. The principal, Mr. P. Kirk, is head of the engineering department, and Mr. W. H. F. Murdoch, who has two assistants, is head of the electrical engineering and physics department. The fees are about 10s. per session for each course.

The Crystal Palace School of Practical Engineering.

Electrical engineering subjects can be included in the general engineering course given at the Crystal Palace Co.'s School of Practical Engineering. The electrical work is intended to follow the mechanical and civil courses, which occupy one year. The ordinary curriculum for the electrical section is of two terms duration, including instruction, both theoretical and practical, in the shops and offices of the school; and directed practical work on the electrical installation in the Crystal Palace and grounds. Excursions are made by students to places of engineering interest. The complete fees for the mechanical and civil engineering courses, either of which may be taken alone, or the two one after the other, are £54 and £64 respectively, and the fee for the subsequent electrical course is £21 per term. Each student must also pay 10s. 6d. for an annual season ticket to the Crystal Palace. The principal is Mr. J. W. Wilson.

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THE DESIGN OF HIGH-TENSION SWITCHGEAR WITH A VIEW TO SIMPLICITY

By W. S. Burge

As the object of this Paper is to discuss the possibilities of a system of high-tension switchgear having many radical departures from the present-day standard practice of cellular construction, it will first be necessary to point out the way in which a few of the features of existing types of switchgear fall short of ideal requirements. Speaking generally, high-tension switchgear should fulfil, as nearly as possible, the following conditions:—

The control of the circuits should be accomplished with the smallest necessary number of switches, instruments, conductors, and insulators, and the whole switchboard should be reduced to the simplest possible arrangement. The design, while being reduced to the most simple arrangement, should yet be capable of adequately meeting a very wide range of requirements so that the manufacturer may be safe in standardising his gear, and thus attain a certain degree of finality in design that is very valuable to the manufacturer, and ensures extra reliability due to the perfection of one design. In order to ensure against discontinuity of supply, it is very desirable to duplicate all switches and conductors.

In order to meet emergency conditions, it should be possible to isolate any part or section of the switchboard without discontinuity to any other section. The mechanical design at any point of the board should be sufficient to withstand the instantaneous breakdown capacity of the generating plant, and the copper dimensions and insulators must be chosen with a view to withstanding abnormal mechanical strains, as well as the current and voltage effects due to fault conditions. The switchgear should require a minimum of attention and cleaning, and so should be impervious to dust and water moisture.

The author considers that the usual high-tension cellular construction with bare conductors falls short of these conditions in several ways.

From the point of view of simplicity, cellular construction with bare conductors anchored on porcelain insulators necessitates the introduction of a considerable amount of apparatus, the function of which is other than that of controlling the circuits, and should therefore be eliminated as far as possible. The mere presence of a bare H.T. conductor supported on an open insulator necessitates a suitable means for isolating the same, and this can only be accomplished by the introduction of isolating switches, which, in turn, introduce other bare conductors supported on other insulators, so it will be seen that the simple necessity of one switch for controlling each circuit is very greatly exceeded.

This gives rise to a great variety of design, both as regards the general lay-out of the switchgear, the dimensions and construction of the cells, and the actual number and type of switches, and it is in this respect the designer introduces difficulties in the way of obtaining what has been referred to above as finality of design.

It will, however, be seen hereafter that with other systems in which bare copper conductors and open insulators are eradicated, it is possible to arrive at one simple and final design that will meet all possible conditions of working without any departure from the standard construction, and this is a very valuable feature to both the manufacturer and the customer.

The only serious attempt to duplicate any portion of high-tension switchgear has resulted in the practice of duplicating the main bus-bars, and it will be readily understood that the expense of duplicating the main switches and the connections between them and the duplicate bus-bars is generally prohibitive on account of the enormous number of extra insulators, selector switches, conductors, and cell construction, that would be necessary with the cellular system. This question of duplicating the entire switchgear may at first appear to be somewhat unnecessary, but it should be remembered that no engineer would run his station continually without any stand-by plant. Why, then, should not the main switchboard, which has to collect and distribute the total output of the station, be duplicated?—particularly as a fault on the main switchboard almost invariably shuts down the entire plant that feeds on to and from the switchboard.

The necessity for isolation primarily arose from the inherent characteristics of the cellular gear, as it was found imperative to afford means for isolating all bare conductors and open surfaces of insulators for purposes of cleaning and inspection, and although this precaution is quite necessary, it will be seen that the necessity in itself introduces a considerable amount of auxiliary apparatus with their accompanying elements of danger to life and risk of failure while in commission.

On power-station boards in which a large capacity of plant is running behind the switchgear, it is of the utmost importance that all supporting insulators should afford sufficient mechanical anchorage to the conductors to withstand the very heavy strains that occur in the event of a serious fault, and in this respect the brittle nature of porcelain insulators is a continual source of danger.

Although the cost of upkeep on high-tension switchgear is comparatively small, it is very important to reduce the necessity for cleaning and inspection to a minimum on account of the accompanying danger to the man whose duty it is to attend to it. The open surfaces of porcelain insulators require continual cleaning and inspection on account of dust settling and water moisture condensing on the cold surfaces of the insulators, and in the manipulation necessary to isolate the gear for this inspection there must always be a very serious danger of accident.

From the foregoing remarks it will be seen that although the cellular system of switchgear has been largely instrumental in the safe and reliable operation of high-tension plant, there is still sufficient room for improvement to warrant our attention being turned to other systems, and so I now propose to discuss the advantages or otherwise of a system in which there are no bare conductors or porcelain insulators, and the conductors are enclosed in an earth metallic sheath. The principal feature of the system which the author suggests is the use of lead-covered cables, terminating through special sealing ends into the necessary switches and contacts. Lead-covered cable gives an ideal protection against moisture, dust, and dirt, and in the event of any fault causing fusion of the conductor, a lead-covered cable will sufficiently muffle the arc to prevent the volatilised copper spreading the fault, but it will not offer sufficient resistance to the volatilised copper and insulation gases to cause any serious explosive force.

The production of a simple design of panel containing the bare necessity of one switch for each circuit suitable for all conditions that obtain in modern practice, and capable of having any part isolated or duplicated without discontinuity, seems to lie in the production of a selector oil switch of the carriage type, designed that the carriage contacts may plug into sealing end receptacles from which lead-covered cables are taken to duplicate bus-bars and the circuit to be controlled, the oil switch contacts being capable of selecting on to either or both sets of the bus-bars. In a simple design developed on these lines, the writer proposes to bring three single-core lead-covered cables from the circuit to be controlled through plumbed joints into three tubular porcelain insulators cemented one above the other into a concrete slab built into a brick wall. The cables terminate inside the insulators in special female contacts. On either side of these three insulators, and in line with them, are a set of three similar insulators with lead-covered cables leading straight on to two sets of duplicate bus-bars. Thus the concrete slab has nine tubular insulators cemented solid, the insulators being open on the front face of the slab and closed through plumbed joints on the back of the wall. The centre row of insulators lead away to the circuit to be controlled, while the two outside sets lead away to the two sets of bus-bars which are held on suitable brackets fixed on the back of the wall. The bus-bars simply consist of single-core lead-covered cables, each strapped down into a trough, which is supported on the brackets. The board also includes a bus-bar coupling switch which plugs on to a concrete slab containing six tubular insulators into which the two sets of bus-bars terminate.

The carriage-type selector oil-switch consists essentially of two independent sets of moving elements whose function is to close the circuit between the centre stationary element, which corresponds to the circuit being controlled, and either of the two outside stationary elements which correspond to the two sets of bus-bars. The two sets of moving elements operate inside separate oil-tanks, so that we have virtually two independent oil switches mounted on a common casting and operated from one mechanism. The complete switch can be isolated from or coupled up to the cable-end contacts while alive, but a mechanical device is provided by which it is impossible to withdraw the isolating contacts without first tripping the oil switch, and it is also impossible to close the isolating contacts with the oil-switch contacts closed; thus the switch is proof against making or breaking load on the isolating contacts.

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The necessary current transformers for automatic protection and instruments are housed in hermetically sealed cast-iron boxes, the primary leads being led into and out of the boxes through plumbed joints; and in order to preserve a uniformity throughout the whole board, and render it entirely moisture-proof, the secondary wiring from the transformers is taken through single- or multi-core lead-covered cables plumbed on to small glands in the transformer casing.

The introduction of potential transformers on this type of switchgear offers a design having several important points of advantage over the ordinary transformer tapped off bare connections. The primary leads are taken through lead-covered cables which terminate through plumbed joints inside hollow insulators which are cemented solid into a horizontal casting. The transformer itself is situated inside an oil-tank, and has a set of primary contacts placed so as to engage with the contacts in the hollow insulators when the tank is raised on to the horizontal casting, and the fuses are fixed so as to be immersed under the oil in the tank. The secondary leads are led away through lead-covered cables plumbed on to small glands in the top plate of the transformer.

It will be seen that a carriage-type selector oil-switch offers a duplicate course for each circuit throughout the entire board; thus in the event of a fault occurring on one set of bus-bars, the circuits may be all changed over to the other set of bars by simply operating the handwheels of the switches. Also, should one set of switch contacts become badly burned due to a heavy fault, the circuit may immediately be fed through the other side of the oil-switch on to the other bus-bars.

A lead-covered cable is certainly more expensive than a similar length and size of bare copper conductor, but from the foregoing description it will have been seen that the adoption of lead-covered cables renders possible a design in which an enormous number of auxiliary switches, insulators, lengths of conductor and structural protection can be eliminated, so that the question of extra price is more than compensated for by these eliminations.

NEW FLAME ARC LAMP

THE latest production of the General Electric Co., Ltd. (67 Queen Victoria Street, London, E.C.), is a flame arc lamp to be known as the "Butt" lamp. This lamp is being manufactured at the Witton works of the company. Its chief features are its low price and its simplicity. The lamp has already met with considerable success in Germany, where it is known as the "Conta" lamp. It is of the type in which the tip of one carbon rests on a support below the economiser, there being no clockwork feeding-gear. As shown in Figs. 1 and 2, one carbon *a* (in the D.-C. lamp, the negative) is perpendicular, and the other carbon *b* is inclined, and is swung for striking and regulating by means of a sliding collar *h* on the base-plate *f*. This collar is pivoted at *k*, and is swung by the rod *l* which is attached to the plunger of the series solenoid. The holders of the two carbons are mechanically linked together and feed down as the carbons are consumed. The tip of the perpendicular carbon rests on a swinging support *d* pivoted at *g*. Between the upper arm of the support and the carbon is a pin *e*, which is pressed against the carbon and prevents it from bearing on the lower support with the full weight of the carbons and holders so long as the tip of the carbon rests on the lower arm. When the carbon burns away, the support swings just sufficiently to release the pressure of the pin *e*, and this allows the carbon to feed slightly so that the tip again rests on the support. By supporting the carbon chiefly from the side in this manner, the breakage of the point is avoided. The support is very massive, so as to conduct the heat away quickly from the end, and, further, the arc itself is some five millimetres distant from it, so it does not require frequent renewal. The lamp can be used on either A.-C. or D.-C. circuits without any alteration. The efficiency is given as 0·13 watt per candle-power.

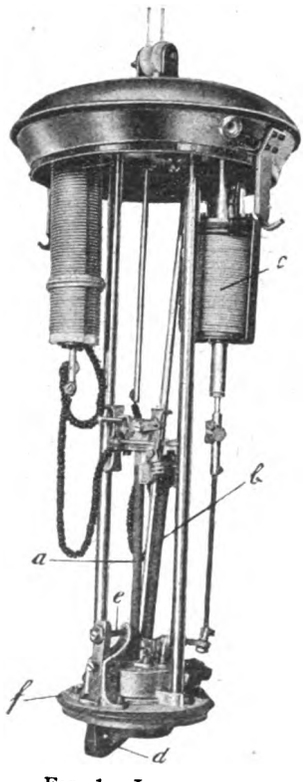


Fig. 1.—Interior of "Butt" Arc Lamp.

An important feature of the lamp is the provision of an automatic arrangement whereby one of the carbons is dropped out of its holder when the carbons have burned down to a certain point. The fire-clay economiser is supported from the base-plate by a metal ring, as shown in the sketch of Fig. 2. On the left of the plate is an electromagnet for providing the necessary weak field to steady and expand the arc. The carbons fit the apertures in the base-plate very closely, and it is practically impossible for any fumes to rise into the body of the lamp. Further, a careful system of ventilation is provided for. An inner globe close to the arc is well swept by the air currents, and is thus kept free from deposit. Air enters at the top of the outer globe, passing down between the two globes, up through a perforated ash-

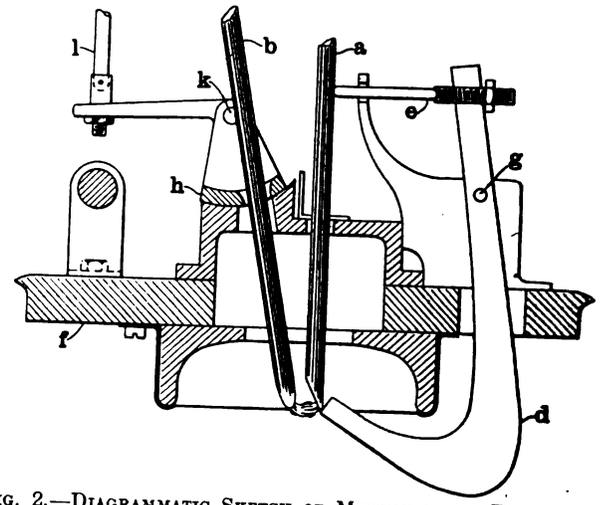


Fig. 2.—Diagrammatic Sketch of Mechanism at Base-plate.

tray in the bottom of the inner globe, and from thence up all round the economiser to the outside of the lamp. Ordinary metal-cored flame carbons are used in these lamps, but with alternating currents only one need be mineralised. The lamps burn singly on 65 volts, or any number may be run in series. The short-hour pattern gives from eight to ten hours on one trim, the long-hour pattern 16 to 18 hours.

For special purposes, a double-carbon pattern can be obtained. The mechanism of this lamp is identically the same as that described above, except that it is in duplicate, and a change-over arrangement is provided so that directly one pair of carbons is burnt out, the other pair is switched in without any interval, so that the change-over is hardly noticeable. From 32 to 38 hours' burning are obtained with this lamp. An important feature is that it is unnecessary to renew both pairs of carbons on each trim, as a partially consumed pair can be left in to be used during the next period of burning. The two arcs can also be run in series, burning simultaneously.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

HAND AND BICYCLE LAMPS.—A new illustrated list has been issued by Messrs. L. E. Wilson & Co. (20 Cross Street, Manchester), giving prices and particulars of the patent "Thomson" accumulator hand-lamp. This lamp is much used by meter readers, inspectors, night watchmen, and others, and we understand that it has found considerable favour in the police force. Several patterns are described, including a bicycle lamp in two sizes, giving 15 and 30 hours of light. These have accumulators in leather cases, and weigh only 1 lb. 8 oz. and 2 lb. 8 oz. respectively.

WATER-TUBE BOILERS.—A booklet from Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, contains a description of the Woodeson water-tube boiler, which the company have supplied in considerable numbers. These boilers have an equal number of upper and lower drums of Siemens-Martin steel connected by groups of straight solid-drawn tubes in a nearly vertical position. The arrangement of the tubes discharging direct into the drums ensures ample steam release area. It is important to notice that no castings are used in the construction, and that only one diameter and length of tube is used.

OIL ENGINES.—A leaflet from the London office of the Maschinenfabrik Augsburg-Nürnberg A.-G. (Caxton House, Westminster, S.W.) gives illustrations of some Nuremberg oil engines for marine purposes from 150 B.H.P. upwards.

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CORRESPONDENCE

THE ASSOCIATION OF CONSULTING ENGINEERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I think it must be generally admitted that a consulting engineer should have had at least such an education as would entitle him to the Associate Membership of the Institution of Civil Engineers; but I also think that it would be a great mistake to make such membership a *sine quâ non* of the proposed Association of Consulting Engineers.

The reasons for objecting to a compulsory membership of the Institution of Civil Engineers are so numerous that one cannot put them all in a short letter. Among the most important, however, is the fact that there are many men holding degrees or diplomas of more importance than the A.M.Inst.C.E., who do not see any advantage in belonging to the Civil Engineers, and who are unwilling or unable to increase their annual subscription list.

For instance, in Manchester a consulting engineer may be D.Sc. in Engineering, and a Whitworth Scholar; he may also find it necessary to belong to the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Manchester Association of Engineers, the Literary and Philosophical Society, and the Society of Chemical Industry. If he has got together a fair practice by honest and straightforward means, his income may still only be very moderate. What possible reason can be alleged for compelling such an individual to join the Institution of Civil Engineers in order to become a member of the new Association of Consulting Engineers? Presumably the new Association will require a subscription, so that at least five guineas a year will be added to the annual list of our supposed individual with little corresponding advantage.

Another objection is to be found in the ill-feeling which I think such a compulsory measure would foster between the members of various societies. It would, in fact, have a tendency to force men against their will to subscribe to one society when they would rather be members of another, and such a state of affairs, besides being unjust to the various societies involved, would also engender undesirable rivalry.

Finally, it is hard to see what object the proposers can have in putting forward this suggestion. It cannot surely be a difficult thing to draw up conditions of membership of the new Association which shall safeguard all the necessary qualifications without giving undue advantage to any society.

The Civil Engineers themselves have been obliged to allow certain well-known examinations to stand in place of their own, and therefore, if an individual is eligible for membership according to their rules, it would be quite as good a test of his qualifications for the new Association as actually forcing him to subscribe to the Civil Engineers first.

Yours faithfully,

20, Mount Street, Manchester. W. CRAMP.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—It is with pleasure that I respond to your request for some contribution to a discussion about the newly-formed Association of Consulting Engineers. The active attention that I give to consulting work is necessarily restricted by the demands of my primary occupation, but I may claim to have some personal interest in the question in addition to a general and mere platonic one.

That such an association has great merits appears to be generally agreed, and discussion may be devoted to the actual details of constitution and procedure. In those, however, will be found some pitfalls and difficulties. For instance, since manufacturers and salesmen will obviously not be admitted, how will the committee regard the fortunate inventor of an important process, system, or machine? Is he not greatly interested in the sale of certain objects? Consider, for instance, the case of the late Dr. John Hopkinson and the three-wire patent, which we may do without offence, because the inventor did actually sell the patent outright, and was not further interested in it. Suppose he had not sold it. Would he, if alive to-day and the patent still in force, be eligible? We can hardly imagine otherwise; but it does not seem strictly logical, for the inventor is clearly subject to just that pecuniary influence or bias which the whole status of the consulting engineer has been devised to avoid. This may serve to show, not, of course, that Dr. Hopkinson ought to have avoided invention, but that the definition of consulting engineer must be drawn with somewhat elastic limitations.

One point in the rules, as at present formulated, seems open to some criticism on the score of undesirable particularism. I refer to the temporary decision that membership of the Institution of Civil Engineers should be a *sine quâ non*. The grounds given for this decision are that this Institution has been the first to require an examination at entrance, and has been the chief mover in all efforts to improve the status of the profession.

While agreeing cordially with the statements, it is permissible to question their cogency. There seems a suggestion that on account of the examination, membership ensures such sound general and technical education as is desirable in a consulting engineer; but it may be roundly stated that most of the present full members joined the Institution before the examination idea was started. Hence, although this restriction will have in this respect some real meaning in the future, it has none at present, and the rule, therefore, appears to be largely of the nature of a delicate compliment to the Institution. However well deserved the compliment, I cannot think that the rules and constitution of a new association are the proper place for its expression.

It is obvious that there are many gentlemen engaged in electrical, mechanical, mining, metallurgical, chemical engineering, and shipbuilding, who deservedly prosecute a good practice in their respective branches without membership of the Institution of Civil Engineers. No doubt they are eligible for membership in the terms of the charter, but why they should be morally compelled to join two new associations is a question they may reasonably ask. If all members of the association must be members of the Civils, why should not the Civils issue a list of its own members who are consulting engineers according to definition? That would serve all the purposes of the new association, except the addition of some letters after each member's name. One good and sound reason for this decision I can understand, to wit, that for very many years the Civils have been a powerful body, so that all their living members have been elected on a basis not greatly differing in essentials from the present standard, whereas in the younger institution there are many who joined when the standard was much lower than it is now. Hence in these bodies the fact of membership has different values. But though this position is intelligible, it can scarcely be considered courageous. For it shirks the onus of deciding whether in respect of eminence in his profession a man is a fit and proper person to enter the association. As this decision is the chief function of the association in its relation to the presumptive member, it does not seem a happy beginning that it should seek shelter under the ægis of another Institution, however unexceptionable, if thereby its constitution will be sensibly distorted. Such a procedure may, indeed, defeat its own ends, for if the association be too closely bound up with the Institution of Civil Engineers, it will be possible for others to argue that they are not concerned with it, and its influence in other branches will materially suffer. For while originally civil engineering was antithetical only to military engineering, and embraced all forms, the meaning usually given to it now is much more restricted, and the Institution, not, perhaps, quite correctly, is regarded as mainly concerned with the restricted meaning. No doubt the Institution would legitimately repudiate this narrowing of its scope, but we must take the meaning of words to be the present and generally accepted significance, not their archaic and chartered definition. The ordinary public attaches a distinct meaning to the term "civil engineer," and the Institution is commonly considered to be an association of such people. Indeed, as time goes on some such process of specialisation must take place.

As it is particularly in the less codified branches of the profession that the influence of the new association will be most beneficial, it would be a great pity to leave any grounds on which possible "free lances" could justify their condition of lawless freedom.

FRANCIS G. BAILY.

Heriot Watt College, Edinburgh.
August 17th, 1910.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Aug. 18th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

17,520/09. **Short-circuiting Device for Induction Motors.** J. H. Holmes & Co. The switch for short-circuiting the rotor-winding when the machine has reached its full speed rotates with the rotor, and is held in its closed position by springs. The switch is held open during starting by means of an external handle, which brings rubbing surfaces into contact and draws the contacts apart. When the switch is in the closed position there are no rubbing surfaces in contact. Seven figures.

25,383/09. **Metal Filament Lamps.** C. G. Redfern (*Compagnie Generale d'Electricité*). This patent covers an apparatus for fusing metal filaments to their supports. A split ring of platinum or carbon is fixed horizontally, and the filament-carrier, with the joints already prepared, is arranged so that the joints are close up to this ring. The whole is enclosed in a glass globe, which is filled with an inert gas. The ring is then raised to incandescence, and the radiant heat fuses the joints. Two figures.

27,976/09. **Storage Battery Plates.** H. de Laminière and Société Anonyme des Accumulateurs de Laminière. A paste for storage battery plates consists of a mixture of oxide of lead, such as minium or litharge, with a solution in distilled water of potassium or sodium tartrate. This paste is said to be very adhesive and suitable for plates of both Planté and Faure formation. It is also claimed to be porous and hard, and to resist entirely the action of sulphuric acid.

349/10. **Metal Filament Lamps.** O. Krause (Deutsche Gasglühlicht A.-G., Berlin). A glass tubular carrier with arms at top and bottom for holding and supporting the filaments surrounds a rigid or elastic stem on which it is elastically supported. The terminals of the filament are connected to the leading-in wires by springs. Various modifications of this construction are described and illustrated. Eight figures.

7,822/10. **Control of Induction Motors.** Siemens Bros. Dynamo Works, Ltd. (*Siemens Schuckertwerke Ges.*). The rotor current of the polyphase motor to be controlled is fed into the A.C. side of a rotary converter, and the continuous current generated is supplied to a D.C. motor coupled to the rotor of the main motor. The starting resistances of the main motor are placed in series between the rotor and the rotary converter, so that the armature of the latter forms the neutral point for starting up. As the rotary converter is excited before the main motor is started up, the rotor currents run it up in step with the main motor, so that synchronising apparatus is not required. One figure.

8,219/10. **Train-Lighting Dynamo.** H. Leitner (Woking). Instead of exciting the machine partly from subsidiary brushes, the main brushes are made to cover a wide arc of the commutator, and the pole pieces are arranged to cover a larger proportion of the pole pitch. The current due to the short-circuiting of turns by the broad brushes gives rise to a cross-magnetising field in the pole tips, which, in conjunction with the main and armature fields produces a resultant furnishing a constant E.M.F. at the main brushes, independent of variations in speed. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Siemens Bros. & Co., and Bradley [Twin projectors] 17,904/09; Lewis [Electrodes] 18,469/09 and 15,977/10; Campe and Regener [Globes] 1,198/10.

Dynamos, Motors, and Transformers: Allgemeine Elektricitäts Ges. [A.-C. commutator machines] 10,665/09; Taylor and Scotson [Automatic regulation of machines] 17,739/09; Siemens Bros. Dynamo Works, Ltd. (*Siemens Schuckertwerke Ges.*) [Single-phase commutator machines] 29,090/09, and [Regulating gear for winding engines and rolling mills] 29,446/09.

Electric Ignition: Robert Bosch, 13,589/10, 13,899/10, and 14,575/10.

Electrometallurgy and Electrochemistry: Evans-Jackson (*Hiorth*) [Induction furnaces] 24,302/09; Petersson [Charging of resistance furnaces] 27,674/09; Newlands and Parkinson [Electrolyte for primary cells] 9,176/10.

Switchgear, Fuses, and Fittings: Jukes-Brown [Switches] 17,895/09; Kenny [Lift control] 17,998/09, and [Combined wiring conduit and picture rail] 17,999/09; Matear, Kenny, and Woodhouse [Lift control and indicating mechanism] 19,203/09; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Circuit-breakers] 10,771/10.

Telephony and Telegraphy: Brown, Judd, and Hardie [Telegraphy] 17,774/09; Marconi's Wireless Telegraph Co. and Marconi [Wireless telegraphy receiving apparatus] 18,922/09; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Automatic telephone exchange] 27,458/09; Kitsee [Telegraphic relays] 2,349/10.

Traction: Blackall and Newman [Signalling] 17,675/09; Jellinek and De Tóváros [Suspension of trolley wires] 8,831/10.

Miscellaneous: Webber [Electric clock-winding mechanism] 17,888/09; Birkbeck (*European Regenerator Co.*) [Exhaust steam accumulators] 18,115/09; Clements [Advertising signs] 18,310/09; Anschutz & Co. [Gyroscopes] 22,602/09; Soc. D'Electricité "Nilmelior" and Colas [Indicating and registering devices] 827/10; A.-G. Brown, Boveri et Cie. [Marine turbines] 1,432/10; Hartman [Electrical purification of liquids] 1,461-2/10; Phillips-Woodey [Fire and burglar alarm] 5,510/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: Malachowski, 5,660/10; August Schwarz Bogenlampenfabrik [Double carbon lamp] 16,841/10.

Electrometallurgy: Helfenstein [Electric furnace] 17,650/10.

Instruments: Siemens & Halske A.-G. [Recording frequency meters] 16,342/10.

Traction: Mahoney [Electric braking systems] 15,836/10.

Opposition to Grant of Patents

17,349/08. **Wireless Telegraphy.** E. von Lepel. This patent has been granted in spite of opposition. It covers the discharger used in the Lepel system of wireless telegraphy, in which the metal discs are separated by a thin piece of paper. (See Electrical Engineering, Vol. V., 1909, pp. 434 and 1086.)

6,424/09. **Wireless Telegraphy.** W. P. Thompson (*Ges. für Drahtlose Telegraphie*). The grant of this patent has been allowed. It covers apparatus for producing slightly damped oscillations by the Wien "shock excitation" method, and consisting of parallel metal plates with a ring of insulating material between them to enclose the sparking area.

16,328/09. **Tungsten Filaments.** C. H. Weber. This patent has been granted in spite of opposition. It covers a process for treating tungsten powder to render it less liable to oxidise. (See Electrical Engineering, Jan. 6th, 1910, p. 16.)

27,590/09. **Gyroscopic Mono-rail Apparatus.** R. Scherl. Opposition has been entered to the grant of this patent, which covers apparatus to cause forces to act on the gyroscope proportional to the precessional speed.

Amendment of Specification

8,438/08. **Prepayment Meter.** C. E. Hibberd. This specification has been amended in order to remove certain ambiguities.

Restoration of Patent

17,879/04. **Terminals.** J. Schade. This patent, covering a spring-clip terminal, has been restored to the Fahnestock Electric Co. (See Electrical Engineering, February 17th, 1910, p. 128).

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

19,246-7-8 of September 1st, 1896. **Steam Turbines.** C. K. Mills (*C. G. Curtis, U.S.A.*). The first two of these three important patents cover the principle and construction of the Curtis parallel-flow steam turbine, in which the steam is passed first through an expansion nozzle, and then through a series of velocity stages. The third patent covers a method of governing by varying the volume of steam without altering its initial velocity.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Starting device for mercury-vapour lamp] 9,431/05.

Distribution Systems, &c.: A. Whalley and E. A. Bayles [Fireproof cables] 10,430/04.

Dynamos, &c.: B. G. Lamme [A.C. commutator motor] 7,295/05.

Electrometallurgy, &c.: M. Otto [Apparatus for treating gases with electric discharge] 11,010/97.

Instruments, &c.: W. D. Watson and T. Humphreys [Prepayment meter] 11,045/97.

Switchgear, &c.: J. B. Meiklejohn [Ceiling rose] 10,177/98; G. Mower (*H. H. Cutler, U.S.A.*) [Time-element overload relay] 10,437/98; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Oil switches] 10,460/04, and [Motor starter] 10,461/04.

Miscellaneous: J. C. Dobbie [Ships' log indicator] 10,314/04.

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LOCAL NOTES

Accrington: *Bonus System Condemned.*—The Local Trades Council are supporting a movement for the abolition of the bonus system on the tramway system. It is argued that the system is calculated to cause drivers to run the risk of accidents.

Acton: *Electricity Undertaking.*—An account is given in the annual report of the Borough Accountant of the working of the electricity undertaking during the past year. Expenditure decreased from £13,285 to £12,065, whilst the income increased from £8,341 to £11,390, or a net increase of £3,048. The deficiency on the year was £675, compared with £4,944 for 1908–9. The reduced charges made by the Metropolitan Electric Supply Co., which came into operation on July 1st, 1909, resulted in the Council obtaining 242,468 more units than in the previous year, for a decreased payment of £763. The average price paid for each unit purchased from the Company was 0·86d., as against 1·26d. in 1908–9. On the income side of the account sales increased by 188,004 units, of which increase 79,273 units were accounted for by the reinstatement of the electric street lighting on the main roads, and 95,824 units by the demand made by the sewage pumps. The gross profits on the year's working was equal to 1·32d. per unit sold.

Bulk Supply.—At the last meeting of the Council it was suggested that in view of the possibility of the negotiations of the Metropolitan Electric Supply Co. falling through, it was advisable for the electrical engineer to obtain definite information as to the approximate cost of erecting a generating station. It was decided to discuss the matter fully at the next meeting of the Council.

Barnsley: *Electricity Accounts.*—The accounts of the electricity undertaking for the year to March 31st show a net profit of £1,800 after meeting capital charges. The number of units sold were 1,491,945, and the total maximum supply demanded 822 kilowatts.

Blackburn: *Short Circuit on Tramcar.*—As the workmen's early car was leaving Salford Bridge for Wilpshire on Saturday, it was discovered that the whole ironwork of the tram was "alive," due to a fault in the trolley standard. Two Corporation employees received somewhat severe injuries, one being burned on the left hand and one side of the face.

Bournemouth: *Electricity v. Gas.*—Speaking at the annual meeting of the local Gas & Water Co. last week, Mr. G. C. Whiteley, the Chairman, said they had nothing to fear from electricity. Whilst the latter was not standing still, neither did the Gas Company intend to stand still, and the shareholders could look forward with perfect confidence to the ability of their engineers to meet any serious competition which might arise by the lessening of the price of electricity by also lessening the price of gas.

Brumby and Frodingham: *Street Lighting.*—A scheme for the lighting of the streets by electricity has been referred to a special meeting.

Canada: *Edmonton: Electric Supply.*—An offer of the Edmonton Heat and Power Co. to supply 10,000 horse-power at £4 per h.p. per annum for 30 years is now being considered by the City Commissioners. At present, says the *Standard* correspondent, the city is using 4,000 h.p. per annum, at a cost of £12 per horse-power.

Croydon: *Through Tram Fares.*—Mr. T. B. Goodyer, General Manager of the Croydon Tramways, reports that during the first year of through booking with the London County Council trams, which has just expired, 1,078,052 passengers availed themselves of the new facilities. Of these 508,504 booked from the London to the Croydon line, and the remainder from the Croydon to the London line.

Dundee: *Bonuses to Tramwaymen.*—A bonus system is to be instituted on the Corporation tramways, the points which will be considered being financial result, personal appearance and conduct. The grants, which will be divisible in equal proportions between the driver and conductor, will be £6, £4 and £2.

East Ham: *School Lighting.*—The Medical Officer of Health to the Education Committee, in his annual report, says that the gas lighting in many of the schools is unsatisfactory, and recommends that electric light should be installed in schools in future.

Glasgow: *Tramway Employees' Grievances.*—According to the local papers, the Corporation tramway employees are discontented regarding their hours of labour, holidays, and other matters. Meetings are to be held under the auspices of the Municipal Employees Association.

Haslingden: *Supply in Bulk.*—The Council, after having considered the terms offered by the Rawtenstall and Accrington Corporation and the Lancashire Electric Power Company, have decided to accept the offer of the Accrington Corporation for the supply of electricity in bulk.

Hastings: *Dolter System and Eyesight.*—In the Hastings County Court last week a motorman recently employed by the Hastings Tramways Co. endeavoured to establish a claim for workmen's compensation on the ground that his eyesight had been injuriously affected by the continual flashing from the studs of passing cars on the Dolter surface-contact system, which is in use on the sea-front there. It was alleged that as a consequence of the flashes so caused, the man's eyesight had been weakened to such an extent that he was declared medically unfit to drive a car. At the close of the plaintiff's case the Tramway Company's legal representative submitted that on the evidence there was no case to defend, and an adjournment was taken to consider this point. The case will not come on again before October, and should the Judge decide that a case has been made out on behalf of the motorman, then the action will proceed and evidence for the Company be taken.

Ipswich: *Electric Supply Accounts.*—The past year's working shows a net profit, after meeting capital charges, of £1,080, of which £735 have been placed to reserve. The balance has been allocated in respect of preliminary expenses and rebuilding boiler settings. The number of units sold increased by 10·2 per cent. During the year the Admiralty wireless station in Portman Walk was connected up. The free wiring (rental) system has now been in operation for upwards of two years, and during the past year has been the means of obtaining 51 out of the 128 new consumers connected. The Installation Department has been kept well employed throughout the year. The value of work done (which does not include the value of free wiring work) has been £3,043, showing a profit of £166.

Tramway Accounts.—The revenue for the past year shows an increase of £714, but it was necessary to call upon the rates to the extent of £2,796 in order to meet the deficit on the year of £1,732 and the deficit of £1,056 brought forward from the previous year. A small surplus is thus carried over.

Leeds: *Tramway Rail Corrugation.*—The Corporation Tramway officials have been carrying out tests with regard to the cost and expenditure of corrugation on the City tramway rails. The tests in question are part of the general enquiry which has been inaugurated by the Municipal Tramways Association.

Leith: *Halfpenny Tramway Fares.*—As a result of an agitation by the ratepayers, halfpenny fares have been reintroduced by the Corporation. They were abandoned some time ago owing to their being unremunerative.

Llandudno: *Promenade Lighting.*—Complaints are being made as to the inadequate electric lighting of the promenade.

Lowestoft: *New Condenser.*—The Council recently agreed to purchase a condenser for the electricity works, and intended shortly to invite tenders. The engineer now reports that a condenser suitable for the purpose is offered for sale by the Westminster Electric Supply Corporation, and it has been decided to inspect and purchase this if found suitable.

Municipal Wiring Powers.—The question of supporting the proposed Bill to confer wiring powers upon all municipalities has been referred to the Electrical Engineer and the Town Clerk.

Maidstone: *Municipal Wiring.*—The Electricity Committee recommend that the Council support the proposed Bill of the I.M.E.A. for conferring wiring powers, &c., upon municipalities, and also that financial support to the extent of £25 be given.

Manchester: *Ratepayers and Loan.*—The Manchester Ratepayers' Association have been in communication with the Local Government Board concerning a loan of £40,000 for electrical extensions, which has been granted without a local enquiry. The Association protest against this procedure

OSRAM LAMPS

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and requests to be informed as to the authority upon which such a course of action was taken. It is suggested that the Local Government Board are compelled to hold an enquiry into every application for a loan. The latter request was sent on July 29th, but owing to the Parliamentary vacation or other circumstances, no reply has yet been received.

NEWCASTLE: *Trackless Trolley System.*—A survey is being made of the proposed route for the trackless trolley cars between Heaton, Gosforth, and Benton. A report is to be prepared and presented to the Council.

OLDHAM: *New Car Depôt.*—The new car depôt which the Corporation have erected at Hollinwood, at a cost of £22,760, was formally opened on Thursday. Accommodation is provided for sixty cars.

PORTSMOUTH: *Tramway Profits.*—The Council have decided to allocate £5,000 from the tramway profits to the relief of rates.

RIO DE JANEIRO: *Street Lighting.*—A cable message from South America states that the Rio de Janeiro Tramway, Light, & Power Co. have erected 2,000 arc lamps for street lighting under the terms of the new contract with the municipality.

SKIPTON: *Electric Lighting.*—The Town Hall is being wired for electric lighting in connection with arrangements for giving cinematograph exhibitions.

SOUTH WALES: *Electric Supply in Ammanford.*—The Ammanford Electric Light Co. have added a new gas-driven generator set to their plant to meet the increasing demand for electrical energy.

WALSALL: *Through Tramway Running.*—An agreement has been come to with the Wolverhampton District Electric Tramways, Ltd., whereby the Corporation shall pay an increased allowance for working expenses in respect of the mileage run by the Corporation cars on the Company's lines in Willenhall.

WEYMOUTH: *Tramways.*—The Electric Lighting Committee have presented a report upon some means of locomotion in the town, in which the merits of motor 'buses, electric and petrol-electric 'buses, trolley 'buses, and electric tramways are considered. The Committee dismiss both the omnibus propositions, and regard the trolley omnibus as of too experimental a character. The tramway scheme which is recommended will involve a capital expenditure of £27,000, and annual charges amounting to £5,680. It is recommended that the Council should apply for a Tramways Provisional Order in the next session of Parliament.

WHITLEY: *Tramway Communication.*—The Council are in communication with the Tynemouth Electric Traction Co. with regard to the extension of the tramways to Whitley and Blyth.

WIMBLEDON: *Municipal Wiring.*—The Council have decided to support the proposed Bill of the I.M.E.A. conferring wiring powers upon all municipalities, and to contribute £25 towards the cost.

YORK: *Completion of Tramway System.*—With the completion of the structural alterations to the Lendal Bridge, the York tramway system is now practically completed.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

ALDERSHOT.—The sanction of the Local Government Board has been received for borrowing £1,500 for mains and services.

BURY ST. EDMUNDS.—An enquiry is to be held concerning a loan of £1,463 for electrical extensions.

CARLISLE.—Tenders are invited by September 5th for a coal storage and conveying plant at the electricity works. Particulars from the City Electrical Engineer.

DARLINGTON.—The condensing plant is to be extended at the electricity works at an estimated cost of £1,500.

HEYWOOD.—A loan of £4,000 is to be taken up for cables.

HOYLAKE AND WEST KIRBY.—Mains extensions are to be carried out and the economiser is to be overhauled.

IPSWICH.—Tenders are to be invited for a year's supply of cables.

LITTLEBOROUGH.—Tenders are invited by September 13th for a supply of single and three-phase electricity meters. Particulars from the Town Clerk. Forms of tenders may be seen at the offices of Messrs. Hawtayne & Zeden, 9 Queen Street Place, London, S.W.

RAWTENSTALL.—Tenders will shortly be invited for additional switchboard panels and a negative booster in connection with the Whitewell Valley Tramways scheme. An extension of the high-tension switchboard is also required.

SPAIN.—The Belgian Consul at Granada points out in a recent report that electrical energy is extensively used in the province of Granada, mainly for lighting purposes. There are three large power stations there, and about a dozen smaller stations in the province. Plans are being drawn up for the utilisation of other large waterfalls in the Sierra Nevada, with the object of supplying electrical energy to the neighbouring provinces.

STALYBRIDGE.—The Stalybridge Joint Tramways and Electricity Board propose to borrow £22,268.

TRANSVAAL.—According to the *Elektrotechnischer Anzeiger*, a large power station is to be erected at Tweefontain, Transvaal, for the purpose of supplying electric power to a steel works and electrochemical works for the manufacture of calcium carbide, nitric acid, artificial nitrate fertilisers, and other electrochemical products.

WEST HAM.—The Local Government Board have now sanctioned loans amounting to £118,525, which includes the loan of £67,025, to which sanction was refused some time ago. The remainder was applied for last month.

MISCELLANEOUS

AUSTRALIA.—Tenders are invited by the Deputy Postmaster-General, Melbourne, by October 4th, for the supply of telephone material (Schedule No. 363). A deposit will be required with each tender. Local representation is necessary. Copies of the specification and form of tender may be obtained on application from the High Commissioner for the Commonwealth of Australia, 72 Victoria Street, London, S.W.

Tenders are invited by the Deputy Postmaster-General, Melbourne, by October 4th, for 5,000 insulators, porcelain, with two groves, triple shed, as per schedule No. 22.

GORING-BY-SEA.—A scheme of public electric lighting is under consideration by the Council.

GRANGEMOUTH.—Tenders are to be invited for street electric lighting fittings.

HUNGARY.—It is stated that the municipal authorities of Kecskemet (Hungary) have arranged to contract a loan of £62,500 for the construction of an electric tramway.

LEEDS.—The Leeds Tramway Committee have settled the terms of an agreement with the Morley Corporation for the extension of their tramways through Morley.

MANCHESTER.—The Tramways Committee invite tenders for steel girder tramway rails. Particulars from the General Manager, and tenders by September 6th.

POWELL DUFFRYN STEAM COAL CO.—Tenders are invited by September 12th for general stores, including electrical goods. Particulars from Stores Manager, Aberaman Offices, near Aberdare, and tenders to 101 Leadenhall Street, London.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

PROVINCES.

ABERDEEN.—Extensions to St. John's Church (£30,000). Chairman of Committee.

ABERTILLERY.—Aberbeeg Council School. Education Committee.

ALTRINCHAM.—Additions to Conservative Club. Architect, Mr. T. Blagburn, 21 Station Buildings.

ARUNDEL.—Development of West Arundel Estate for garden city. Builders, Greenwood & Son, Halifax.

BARNSLEY.—Carnegie library at Penistone. Town Council.

BARRY.—Large iron and steel works. Mr. Dundrett, Secretary, c/o Barry Steel & Iron Co.

BATH.—The widow of Alderman Proctor Baker has made a gift of £10,000 for the erection of a sanatorium for consumptives at Winsley, near Bath.

BELFAST.—Block at the Royal Victoria Hospital. Governors.

BIRMINGHAM.—Secondary schools, Charles Arthur Street, St. Benedict's Road, Cherrywood Road. Education Committee.

Electric theatre, Longmore Street.

New baths, Brearley Street and Bacchus Street.

BOURNEMOUTH.—Extension to workhouse infirmary (£16,000). Clerk, Board of Guardians, Bournemouth.

BLACKBURN.—New Baptist Church, Montague Street. Architect, Mr. F. J. Parkinson, 9 Richmond Terrace.

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Boston.—Alterations and additions to barracks. Architects, Scorer & Gamble, Bank Street Chambers, Lincoln.

Clydebank.—Alterations and additions, 32-4 Alexander Street, for the Clydebank Co-operative Society.

Crompton.—New street. Mr. Arthur Clegg.

Dumbarton.—Theatre, Church Street. A. C. Denny, Architect, 37 Church Street, Dumbarton.

Dunfermline.—Additions to Town Hill School. Architects, Ure and Beveridge, 43 Carnegie Street.

Edinburgh.—Alterations at Chalmers Hospital. Architect, A. H. Paul, 16 Rutland Square.

Additions to Grove Biscuit Factory, Slateford Road. Architect, R. R. Hogg, 96 Mayfield Street.

Salvation Army building, corner of West Port and Vennel. Apply Headquarters, London.

Glasgow.—Extensions at Royal Asylum Laundry. Architects, J. Burnet & Sons, 239 St. Vincent Street.

Reconstruction of Court Houses, Jail Square. Architects, Clark & Bell, 212 St. Vincent Street.

Warehouse and offices, corner of Killearn Street and Saracen Street. Architects, Wylie & Blake, 219 St. Vincent Street.

Gravesend.—Boiler-house, &c., for the Imperial Paper Mills, Ltd.

Hamilton.—School at Auchincampbell (£40,000). Architects, Messrs. Cullen, Lochhead & Brown.

Hitchin.—The Town Hall is to be wired for electric lighting.

Hornsey.—Rebuilding on site of Tabernacle.

Hyde.—Infectious Diseases Hospital. Town Clerk.

Isle of Man.—School, Douglas. Architects, Messrs. Harrison & Co., London.

Kingston-on-Thames.—Drill hall for the 6th Battalion East Surrey Territorials.

Lincoln.—Carnegie library (£10,000). Public Library Committee.

Maidstone.—Offices and workshops, Rogers Wharf (£2,000). W. T. Burrows, Builder, Maidstone.

Manchester.—Enlargement of Council Chamber (£6,000). R. F. Vallance, City Surveyor.

Middlesbrough.—Enlargement of workhouse. Clerk, Board of Guardians.

Middlesex.—Alterations and extensions to the Guildhall, Westminster (£71,907). Architects, J. S. Gibson and the County Engineer.

Middleton.—Conservative club, Monmouth Street. Secretary.

South Wales.—Tenders are invited for carrying out certain alterations and additions to the Treherbert branch of the Ton Co-operative Society, Ltd. Architect, W. D. Morgan, 194 Ystrad Road, Pentre, Rhondda.

A row of 50 houses is to be erected at Duffryn Rhondda for the Duffryn Rhondda Building Club. Architect, F. B. Smith, Port Talbot.

Business and dwelling premises near Merthyr. Architects, Johnson & Richards, Merthyr Tydvil.

Stirling.—Municipal buildings. Surveyor, Stirling Town Council.

Todmorden.—Town Hall. Town Clerk.

Weymouth.—Elementary school (£3,068). Crickmay & Sons, Architects, 49 St. Mary Street, Weymouth.

Winchester.—Elementary school. A. H. Johnson, Architect, Hilcote, Headbourne Worthy.

TENDERS RECEIVED AND ACCEPTED

Barnet.—The Guardians have accepted tenders for the three sections of their electric lighting scheme as follows:—Section A, £185; Section B, £99; Section C, £368. At the last meeting it was stated that the North Metropolitan Electric Power Supply Co. quoted a price about three times as high as that at which the Guardians will be able to generate with their own plant.

Belfast.—Tenders of the British Insulated & Helsby Cables, Ltd., for cable, aggregating £305, have been accepted.

London.—The Steeplejack and Engineering Co., of Nottingham, have received instructions to put in hand extensive repairs to the two chimney shafts at the Bankside power station of the City of London Electric Lighting Co., Ltd.

Maidstone.—The tender of Messrs. Arthur Lowcock, Ltd., for a condenser at £343 10s. has been accepted.

Rawtenstall.—The Corporation have accepted the tender of Messrs. Wm. Underwood & Brother, of Dukinfield, for the construction of the permanent way of the new tramway in the Whitewell Valley.

The tender of Messrs. W. T. Glover & Co., Ltd., of Manchester, has been accepted for cables and ducts for the Whitewell Valley Tramways, and that of Messrs. Clough Smith & Co., Ltd., for overhead equipment.

Rochdale.—Contracts have been placed for 5,000 tons of coal for the electricity works. This is about 1,000 tons more than last year. The average price is about the same as last year.

Skipton.—The tender of the National Gas Engine Co. has been accepted for a gas engine in connection with the electric lighting of the Town Hall, and that of Mr. J. Banks, of Skipton, for a dynamo.

Walsall.—The tender of Messrs. J. & F. Wootton, of Bloxwich, for making various alterations and additions to the tramway depôt, Bloxwich Road, has been accepted at £1,916 13s.

West Ham.—The tender of Mr. J. T. Halsey, of Stratford, has been accepted at £288 for the wiring of the West Silvertown Schools.

APPOINTMENTS AND PERSONAL NOTES

We congratulate Mr. Maurice Solomon, of the General Electric Co.'s Witton carbon works, on the occasion of his marriage, on the 16th inst., to Miss Christine Davis, eldest daughter of Arthur Davis, M.A., of Roundhay, Leeds.

The late Hon. Maurice Raymond Gifford, C.M.G., a director of the British Columbia Electric Railway Co., left estate valued at £36,966, with net personality at £26,902.

The salary of Mr. R. H. Wilkinson, manager of the Huddersfield tramways, has been increased from £375 to £400 per annum.

Councillor J. Speakman, of New Cross, has been elected President of the Association of Tramway and Vehicle Workers for the coming year.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. (last week £58 5s. to £58 10s.).

BANKRUPTCIES, LIQUIDATIONS, WINDINGS-UP, &c.—F. Peacock, electrician, 59 North Station Road, Colchester, has been adjudicated bankrupt.

The last day for receiving proofs in the bankruptcy of T. L. Callender, electrical engineer, trading as the Shamrock Cycle Co., Grove Place, St. Heliers, Isle of Jersey, is September 3rd. The trustee is Mr. E. W. Humphreys, 4 Castle Place, Nottingham.

The Telewriter Syndicate, Ltd., is to be wound up voluntarily, the assets having been sold to the National Telewriter Co., Ltd. Mr. John Craggs, the Chairman, is liquidator.

PORCELAIN INSULATORS.—H.M. Trade Commissioner for New Zealand (Mr. G. H. F. Rolleston) reports that a firm at Wellington wish to get into communication with British manufacturers of porcelain insulators. Communications in this connection, together with catalogues and price-lists with discounts, should be addressed to H.M. Trade Commissioner, 9 Grey Street, Wellington, New Zealand.

HOLIDAYS.—Messrs. Ferranti's works and offices at Hollinwood will be closed from Friday evening, August 26th, until Monday morning, September 5th. A small staff will be retained to deal with urgent correspondence.

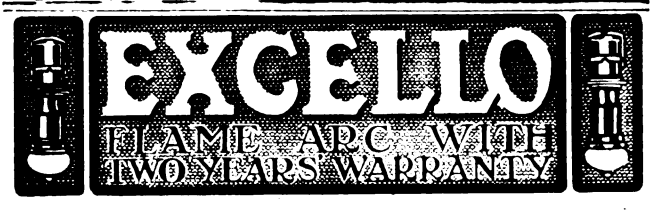
MISCELLANEOUS CITY NOTES

GENERAL BERLIN TRAMWAYS CO.—Herr Rathenau, general manager of the Allgemeine Elektricitäts Gesellschaft, has been appointed a director. There have been disputes between the municipality and the tramways company, and it is hoped that this step will help to put an end to this, as Herr Rathenau is also chairman of the Berliner Elektricitäts-Wirke, which supplies the power to the tramways company.

DIVIDENDS ANNOUNCED.—South America Light & Power Co., 5 per cent. for the year to March 31st, placing £1,500 to reserve and carrying forward £558.

MORTGAGES AND CHARGES.—Cleveland & Durham Electric Power Co.: Particulars have been filed of an issue of August 6th of £8,500 debentures, part of an issue of £150,000.

LLANELLY ELECTRIC LIGHT & TRACTION CO.—A prospectus has been issued offering 60,000 cumulative 6 per cent. £1 preference shares at par. The company have entered into a contract with the District Council to provide the whole of the public lighting for ten years, the installation comprising 40 arc lamps and 500 incandescent lamps. In addition, 7½ miles of light electric railway will be constructed, for which the contractors, Messrs. Balfour, Beatty & Co. will accept £48,000 in cash or in 5 per cent. debentures at 95, and the balance of £20,250 in cash or fully paid ordinary shares, at the option of the company. A general private supply of electricity will also be given by the company.



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Adams Watkin Co., Ltd , 36, Victoria St., S.W.
Briscoe (W. H.) & Co., 32 & 33, Cox St., Birmingham.
Clarence Engineering Co., Ltd., 3, Cherry Tree Court, E.C.
Ferabin Lamp and Electrical Accessories, Ltd., 118, Queen Victoria St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co., Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
Belliss & Morcom, Ltd., Birmingham.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Jandus Arc Lamp and Electric Co., Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.

ARMATURE REPAIRS.
Higginbottom (J.) & Co., Blenheim St., Chelsea, S.W.
Marryat & Place, 28, Hatton Garden E.C.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
Concordia Electric Wire Co., Ltd., Cricklewood Lane, N.W.
Connolly Bros., Ltd., Blackley, Manchester.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CLUTCHES (Friction).
Bridge (David) & Co., Ltd., Castleton, Manchester.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Mirrlees Watson & Co., Ltd., Glasgow.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Mountford Rubber Co., Ltd., 13, Weaman Street, Birmingham.
Traun (Heinr.) & Sons, 8, Redcross St., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
Crossley Bros. Ltd., Openshaw, Manchester.
Key Engineering Co., Ltd., 4, Queen Victoria St., E.C.
Mirrlees, Bickerton, & Day, Ltd., Hazel Grove, Nr. Stockport.

HEATING AND COOKING APPARATUS.
British Prometheus Co., Ltd , Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87-9, Cleveland St., Fitzroy Sq., W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.
Wilkinson (F. A) & Partners, Ltd., Harpenden, Herts.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.
Nalder Bros. & Thompson, Ltd., 34, Queen St., E.C.
Paul (R. W), New Southgate, London, N.
Phillips (J. W. & C. J.), 23, College Hill, E.C.
Weston Electrical Instrument Co., Audrey House, Ely Pl., Holborn, E.C.

INSULATING MATERIAL.
Weidmann (H.). Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.
Ruberoid Co., Ltd., 81 & 83, Knightrider St., E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LAGGING.
Newalls Insulation Co., Ltd., Mosley St., Newcastle-on-Tyne.

LAMPS (Incandescent).
British Thomson-Houston Co., Ltd., Rugby.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
Sunbeam Lamp Co., Ltd., Park Rd., Gateshead-on-Tyne.
Welsbach Incandescent Gas Light Co., Ltd., 314—354, Gray's Inn Rd., W.C.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Church Hill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS AND METER PARTS.
Bastian Meter Co., Ltd., Kentish Town, N.W.
Bernhard Thormann, 25-26, Wassmannstr. Berlin.
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

MINE EQUIPMENTS AND APPARATUS.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
British-Thomson Houston Co . Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Phœnix Dynamo Mnfg. Co., Ltd., Thornbury Works, Bradford.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
Adnil Electric Co., Ltd., Artillery Lane, E.C.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Ingleby & Co., Elland Road, Leeds.
Lecoche & Cattaneo, 39, Victoria St., S.W.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Phœnix Dynamo Manfg. Co., Ltd., Thornbury Works, Bradford.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wilson-Wolf Engineering Co , Ltd., Bradford.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.
Sokal (S.), 55, Chancery Lane, W.C.

PORCELAIN INSULATORS.
Macintyre (Jas.) & Co., Ltd., Burslem, Staffs.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
Matthews (Wm. G.) & Co., Brookside Works, Moston Lane, Manchester.
Willans & Robinson, Ltd., Rugby.

SOLDERING IRONS (Gas Heated).
The Etna Lighting & Heating Co., Ltd., 295, Broad Street, Birmingham.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby.
Wolf (R.), Norfolk House, Laurence Pountney Hill, E.C.

STEAM PIPES AND VALVES.
Aiton & Co., Derby.

STREET LANTERNS.
Haydn Harrison, 11, Victoria St., S.W.
Wardle Engineering Co., Ltd., 112, Portland St., Manchester.

SWITCHGEAR.
Adams Manufacturing Co., Ltd., Bedford.
Adams Watkin Co., Ltd., 36, Victoria St., S.W.
British Thomson-Houston Co., Ltd., Rugby.
Cowans, Ltd., 4, Queen Victoria St., E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
Reyrolle & Co , Ltd. Hebburn-on-Tyne
Spagnoletti, Ltd., Goldhawk Rd., Shepherd's Bush, W.
Bertram Thomas, Worsley St , Hulme, Manchester.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
Colonial Office Journal, Waterlow & Sons, Ltd., Gt. Winchester St., London.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422 Mansion House Chambers, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.

VENTILATION AND FANS.
Ozonair, Ltd., 96, Victoria St., S.W.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122-124, Golden Lane, E.C.

WATCHES (Non-Magnetic).
Batty (W.), & Sons, Ltd., Market St., Manchester.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

No. 192 [Vol. VI., No. 35] THURSDAY, SEPTEMBER 1, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

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United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
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Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Small Advertisements and Official Announcements, *Wednesday first post.*

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All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 208-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

OUR Monthly Supplement on Electrical Engineering in Mines is included in this issue, and contains an illustrated article on the three-phase electric winder installed at the Abercwmboi Colliery of the Powell Duffryn Steam Coal Co., which is a fine example of the simplest form of electric winder without load-equalising flywheel plant. We understand that the evidence given before the Committee appointed by the Home Secretary to consider the special rules relating to electricity in mines will be printed and published. The report of the chairman will be presented before the end of the year. Some notes on electrical mining patents published during August are included in the supplement.

MR. HORACE BOOT writes with reference to the new Association of Consulting Engineers, emphasising the need for such a body, but criticising the qualifications required. (Page 560.)

IN consequence of an accumulation of mussel spawn and other marine growth in the condenser pipes at the Southwick electricity works of the Brighton Corporation, a new system of circulating pipes will have to be installed, as it is impossible to clean them out. The new turbine now being erected is to be connected to an entirely new system of piping. (Page 566.)

A NEW Post Office Metropolitan telephone exchange, equipped on the Peel-Conner system, will be opened on Saturday. We publish a description, together with photographs, diagrams, and illustrations of new apparatus. The system is a further development of that employed at Glasgow and described in our columns a fortnight ago, and the difficulty of using it in connection with small private branch exchanges has been overcome. (Page 561.)

A BRITISH Consular report suggests the formation of a limited company by British engineering manufacturers, with headquarters in Russia, for extending British engineering trade with that country. (Page 563.)

AMONG the specifications published by the Patent Office on Thursday was one by S. G. Brown and others for a telegraph relay with continually vibrating contacts.—I. Kitsee covers the use of graphite contacts for telegraph relays.—The manufacture of flame carbons with a tubular hard core and an outer sheath of flaming material is described by F. M. Lewis.—Marconi's Wireless Telegraph Co. cover the use of receiving circuits tuned to the group frequency of the trains of waves.—In spite of opposition, patents have been granted to J. H. Howden & Co. for an exhaust steam accumulator in the form of a boiler intermediate between the high-pressure engine and the low-pressure turbine. (Page 564.)

A FINE catalogue of switchgear, transformers, and accessories, just issued by Ferranti, Ltd., constitutes a new departure in catalogue compilation. (Page 565.)

AN offer by an American company to erect a wireless

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station at Hong Kong has been refused by the British Government. A wireless news agency is to be inaugurated by Marconi's Wireless Telegraph Co. (Page 565.)

BELFAST Corporation will contribute £20 towards the proposed Municipal Wiring Bill.—A large electric power scheme is to be undertaken in Bombay.—Keighley Tramways Committee recommend postponing further tramway extensions in order to investigate trolley omnibuses.—An arbitration will shortly be held in London regarding the proposed conversion of the Dolter surface contact system at Torquay to the overhead system.—Complaints are being made as to the lack of electric supply in Newark.—Stockholm municipality have agreed to the introduction of trolley omnibuses. (Page 567.)

LOANS are to be taken up for electrical extensions as follows: Gravesend (£11,000); Halifax (£10,000); Bury St. Edmunds (£1,463); Littleborough (£2,800); Peterborough (£2,100); Bispham (£9,855); and Todmorden (£300). Six new tramcars are required at Wigan; and telephone cable, instruments, and switchboards by the Australian Government. (Page 566.)

THE receipts of the Mersey Railway Co. have increased by 120 per cent. since the introduction of electric traction. The Yorkshire Electric Power Co. show a net profit of £2,612 for the June half-year. (Page 569.)

MUSSEL BEDS AT THE BRIGHTON ELECTRICITY WORKS

Condenser Pipes Stopped

MR. J. CHRISTIE, Chief Electrical Engineer to the Brighton Corporation, reports serious trouble with mussel spawn and other marine growth in connection with the condenser circulating system at the Southwick electricity works. There is a five-foot suction pipe from the harbour, which, some ten feet inside the face of the quay, branches off into two 30-inch pipes. The works diver went up the five-foot pipe as far as the branch, and reports that beyond it there are clusters of large mussels and other marine growth, some seven inches thick, all round the inner surface of the pipes. This reduces the effective bore of the 30-in. pipe to some 16 ins., greatly restricting the flow of water to the condensers, and putting an overload on the pumps and motors, which they were never designed to carry, in order to circulate sufficient volume of cold sea water to maintain the high vacuum necessary for the efficient operation of the turbines.

In the absence of Mr. Arthur Wright, the Corporation's consulting engineer, who, unfortunately, is detained in South Africa by illness, Mr. Christie has discussed the matter with Mr. Wright's deputy, and has also consulted several expert marine biologists, and a few station engineers who have to work their plant under somewhat similar conditions. They all agree that there is no cure for this trouble except scraping the growth off the pipes by some mechanical means. It is quite impossible to do this at Brighton, and the only alternative is to provide a new system of pipes laid above the floor, with suitable manholes to give access to them for the periodical scraping and removal of any growth that may accumulate. The new turbine, which will shortly be erected, was originally intended to be coupled up to the existing circulating system. In view, however, of this unfortunate development, Mr. Christie deems it advisable to connect it up to an entirely new system of piping. Messrs. Richardsons Westgarth & Co., Ltd., who are supplying the turbine, have offered to carry out the new piping arrangement at a cost of £870, and the Electricity Committee recommend that this be accepted.

Although Mr. Christie thinks he will be able to get through the coming winter without dealing with the existing machines in this way, he recommends that tenders should be invited for running a new piping system to all the other turbines, the estimated cost of which is put at £1,800, exclusive of excavation and erection, which is put at £200. In this the Electricity Committee also concur.

The Brennan Mono-rail System.—Mr. L. Brennan has been awarded the Grand Prize by the Japan-British Exhibition authorities for his gyroscopic mono-rail system.

CORRESPONDENCE

THE ASSOCIATION OF CONSULTING ENGINEERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In reply to your request for my views with respect to the new Association of Consulting Engineers, I have for a long time thought it necessary to have some sort of association that will look after the interests of the consulting profession.

At the present moment commercial travellers—in fact, anybody who is out of a job—seem to practise as consulting engineers; but perhaps the most serious stigma to the profession is the way in which the insurance companies carry on their consulting business. It is well known that they utilise their boiler inspectors and their commercial travellers to find out if there is any insurance work to be done—which is their legitimate business. But they go further than that, and ascertain if there is an opportunity of obtaining any consulting work; this is done in the name of the company. Now, if I or any other consulting engineer were to employ commercial travellers to go round and seek for jobs—utilising some other subterfuge, such as goods to sell, for obtaining an *entree*—I should at once be cashiered by the Council of the Institution; but the Councils of our Institutions seem to allow it to be done in the manner I have set forth, to the detriment of the consulting engineers, by any who like to form themselves into a company.

Although I have nothing to grumble at with respect to the amount of work I have in hand, I am constantly hearing from my professional *confrères* that they scarcely have a job in the office, and I cannot help thinking that this is largely due to the fact that there is no association to look after the consulting engineers' interests. We continue to pay our subscriptions to the various institutions, but fail to get any protection so far as our own profession is concerned.

By the same post as your letter came another letter from a man who is endeavouring to sell boiler composition covering, and I enclose his letter herewith: You will notice he is an Associate Member of the Institution of Civil Engineers, and styles himself as "Civil and Mechanical Consulting Engineer." Is it any wonder that so many consulting engineers find it hard to make a respectable and honest living when the institutions which we support allow such a thing to take place.

I regret that the founders of the Association of Consulting Engineers consider the only qualification necessary is to belong to the Civil Engineers; I should have thought it would have been better if they had required their members to have carried out important works when practising as a consulting engineer.

For my own part, there are already far too many institutions, none of them doing us any good in keeping up the status of the profession.

Yours faithfully,

HORACE BOOT.

4 Great George Street,
Westminster, S.W.
Aug. 22, 1910.

The letter sent by Mr. Boot for our inspection is dated from a suburban address, and reads as follows (we have omitted the names) :—

. . . . . , A.M.Inst.C.E.,
Civil and Mechanical Consulting Engineer.

DEAR SIR,

. . . . . Coy., Ltd., and . . . . . .

During my Sojourn at . . . . . , I saw they were putting down a New Boiler etc. at the Princess Hotel, on inquiry, I was told that you was the Consulting Engineer for the work, as there will be a little non-conducting covering work to be done I shall deem it a favour if you will Consider the above Coy. with whom I am connected.

I enclose you our No. 4 Catalogue giving particulars of the different classes of coverings.

Thanking you in anticipation

Yours faithfully

. . . . . .

Obituary.—The death occurred suddenly on Tuesday of Sir Charles Euan-Smith, K.C.B., C.S.I., a director of Marconi's Wireless Telegraph Co., and Chairman of the Marconi International Marine Communication Co. He was also chairman of the Cape Electric Tramways and Lisbon Electric Tramways Co., and director of the Chilian Electric Tramway & Light Co.

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A NEW METROPOLITAN TELEPHONE EXCHANGE

Interesting Departures from Existing Practice

ON Saturday a new metropolitan telephone exchange will be opened by the Post Office, which, although of medium size, has several features of exceptional interest. It will be the first London exchange to adopt a 40-volt common battery in place

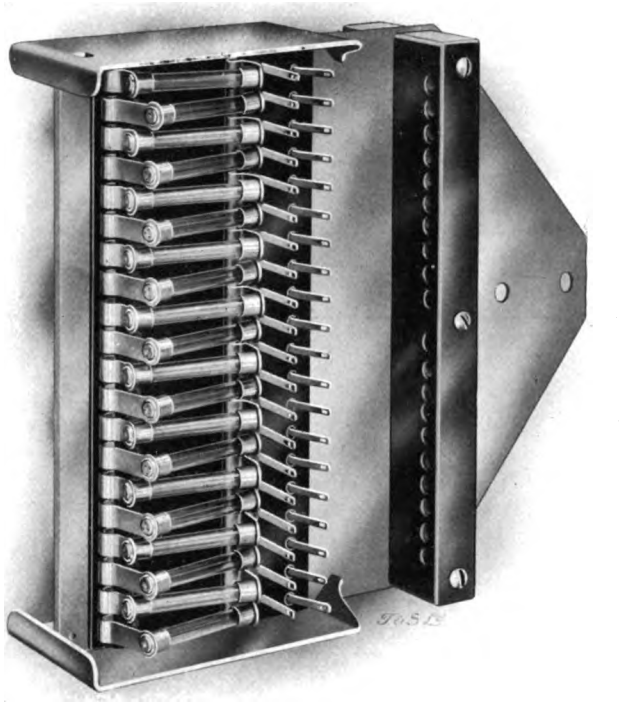


FIG. 1.—STRIP OF TWENTY PAIRS OF LINE FUSES.

of the customary 11-cell battery, and it will employ the new circuit introduced by the Peel-Conner Telephone Works, Ltd., at the new Glasgow telephone exchange (see ELECTRICAL ENGINEERING of August 18th, 1910), modified to suit London requirements. The equipment of the exchange has been carried out by the Peel-Conner Co. under the supervision of the Post Office engineers.

The exchange is in Willesden, and is equipped for 2,760 subscribers' lines with an ultimate capacity of 8,100. There are 208 in-coming junctions, 240 out-going junctions, and 40 in-coming order wires.

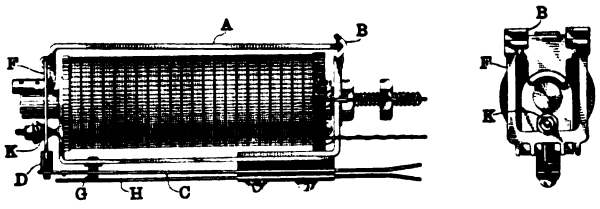


FIG. 2.—PLAN AND END ELEVATION OF RELAY. (HALF SIZE.)

The new features in design start at the main distributing frame on which, as at Glasgow, both the line and exchange side are arranged vertically, and the cables come up on the exchange side of the frame and are led across to the line side within the horizontal channel iron of the frame, leaving a clear space for the "jumper" wires. The same new type of fuse fitting is employed, each strip containing 20 pairs of glass-tube line fuses "staggered" as shown in Fig 1. (This figure is slightly less than half-scale; the actual length of the mounting strip for 20-line fuses is 8½ ins.)

Fig. 2 is a drawing of the relay employed throughout the circuits; we published a perspective view in our description of the Glasgow exchange, but the drawing—which is to scale—shows the construction in greater detail and also indicates clearly the method of adjustment. The armature *A* is hinged in simple manner at *B*, and is controlled by the flat brass spring *C*, which is an extension of the connection tab, and also carries one of the contacts. It presses the

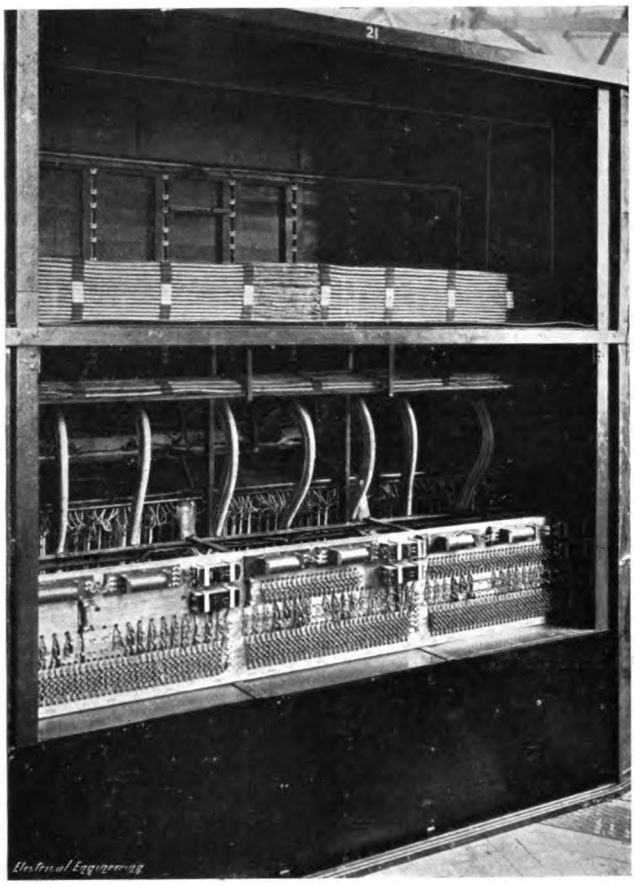


FIG. 3.—BACK OF SUBSCRIBERS' SWITCHBOARD.

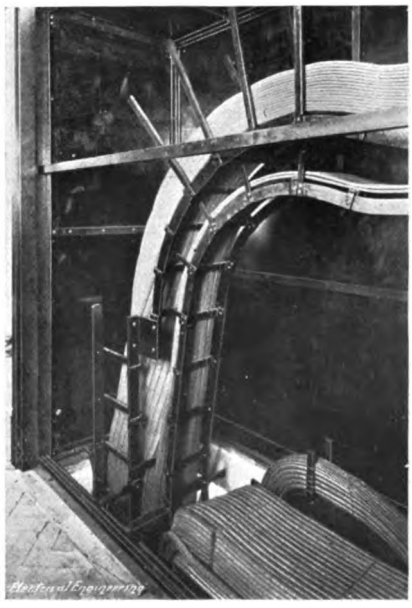


FIG. 4.—CABLE-TURNING SECTION.

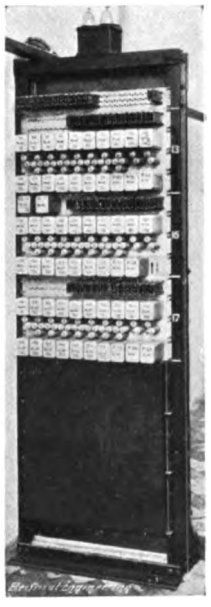


FIG. 5.—AN APPARATUS RACK (SUBSCRIBERS' BOARD).

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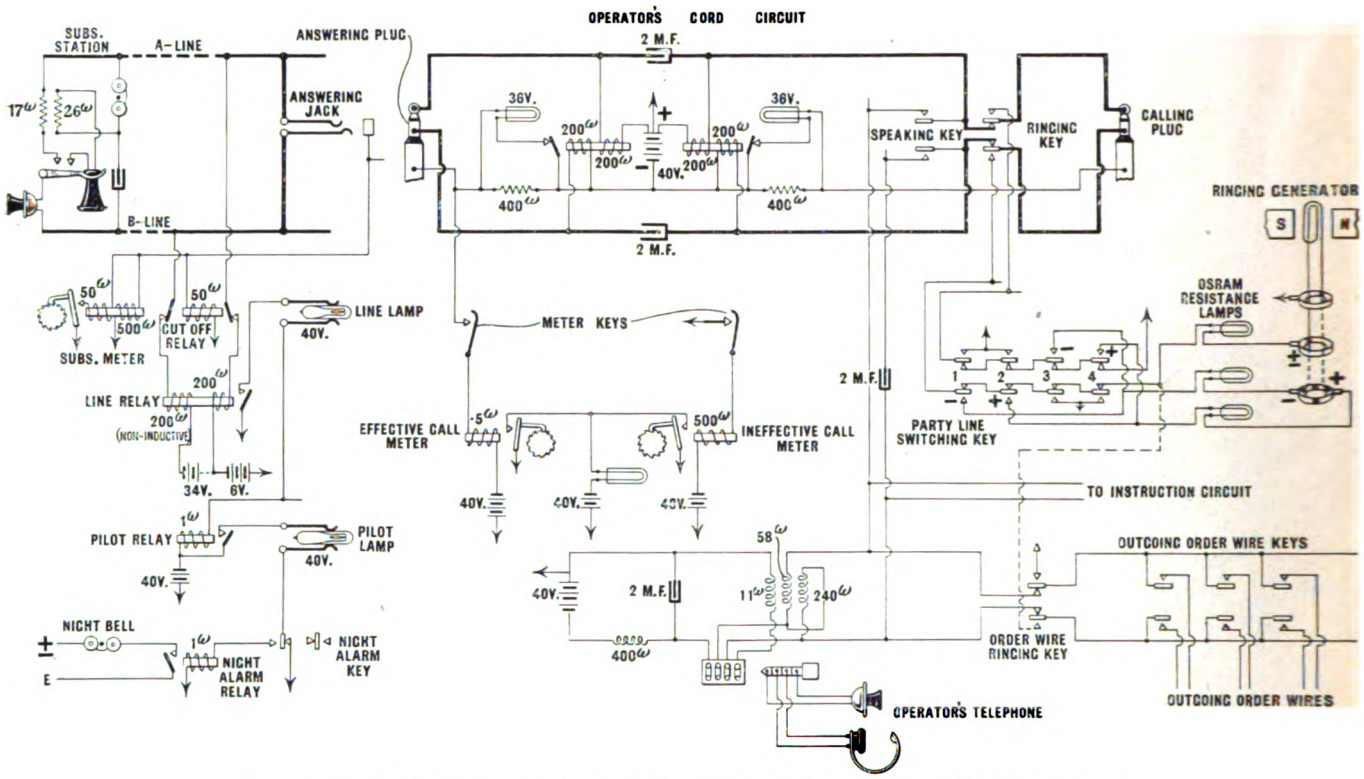


FIG. 6.—DIAGRAM SHOWING SUBSCRIBERS' LINE AND OPERATORS' KEYBOARD CONNECTIONS.

armature outwards through the small ebonite piece *D*, which is fixed to the stirrup *F*. *G* is merely an ebonite distance-piece to keep the lower contact spring *H* in position, and the spring *C* has a hole in it just sufficiently large to allow it to clear *G* as it moves backwards and forwards. The end of the armature is brought inwards and curved to embrace the extension of the core of the coil, and this end of the armature is shod with thin sheet brass to prevent sticking. All the iron parts are galvanised. It is seen that this is a considerable departure from the knife-edge type of relay, and that its construction is of such a stiff mechanical nature as to withstand a considerable amount of handling in erection without its requiring readjustment. The adjustment is, however, not the least ingenious part of its design. A conical nut *K* with a lock nut is placed on a set-screw in the brass bracket which supports the coil and core. The stirrup

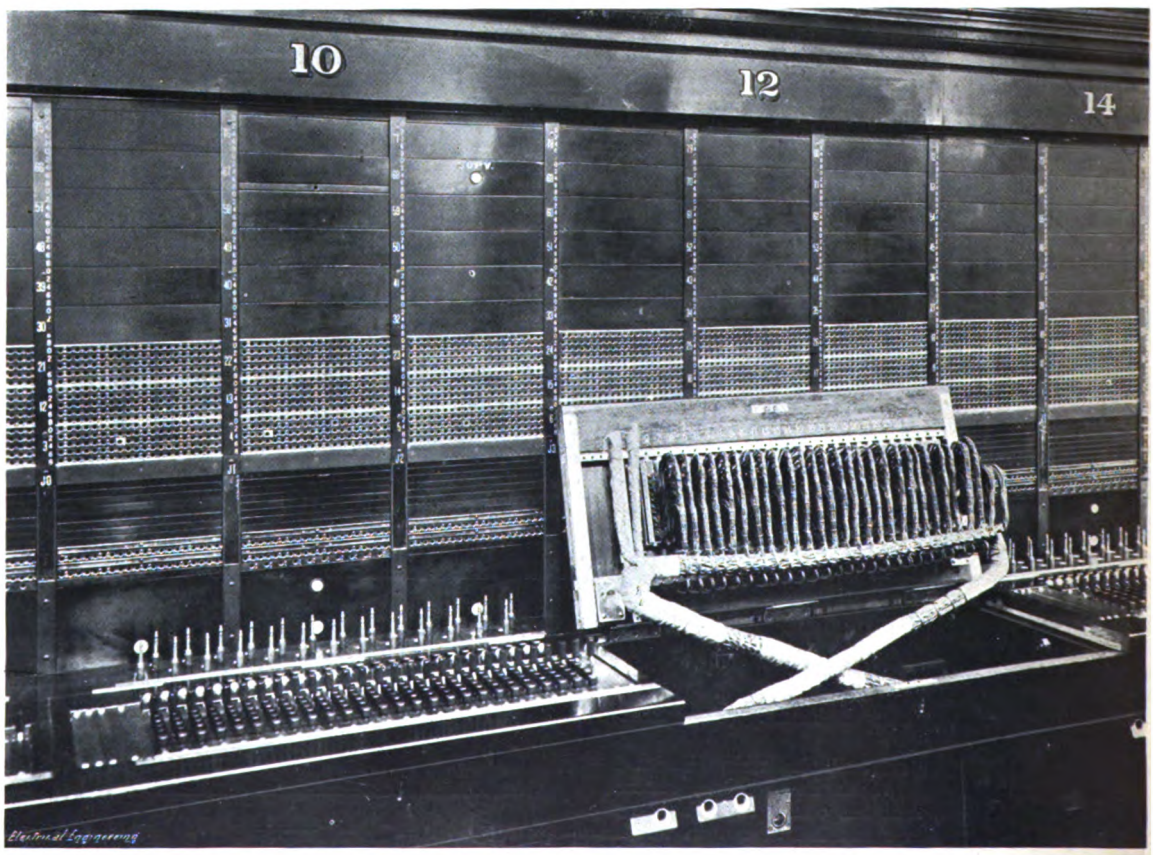


FIG. 7.—JUNCTION BOARD. (ONE POSITION OF KEY-SHELF OPENED TO SHOW WIRING.)

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "The Editor, Electrical Engineering, 203-206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

THREE-PHASE WINDER AT ABERCWMBOI COLLIERY

THE Abercwmboi Colliery is one of a group of nine pits in the Aberdare Valley some 20 miles north-west of Cardiff, worked by the Powell Duffryn Co. A comprehensive system of electrical supply for the whole group from a central generating station was inaugurated in 1905, and the electrical equipment of the station and of the collieries was described in a Paper read the following year before the Institution of Electrical Engineers by Mr. Charles P. Sparks, the consulting electrical engineer to the company. Since that date the plant, both in the power station and in the collieries, has been considerably extended, and the total number of motors installed (all three-phase) for winding, haulage, pumps, fans, air-compressors, &c., is now more than 130, representing over 9,300 brake horse power.

The subject of this article is one of the very latest additions to the plant—a three-phase main winder installed by the A.E.G. Electric Co. at Abercwmboi under Mr. Sparks's supervision. This winds from a depth of 230 yards, and is designed for a nett output of 194 tons of coal per hour. Each cage, weighing 30 cwt., carries two 10-cwt. trams, each holding 27 cwt. of coal. The winding rope weighs 3·5 lb. per foot, and a balance rope of equal weight is provided. For the purposes of determining the requisite size of the winding motor, the following conditions were assumed: A nine-second period of acceleration with an average expenditure of 630 h.p.; a drop of 19·5 seconds at the full speed of

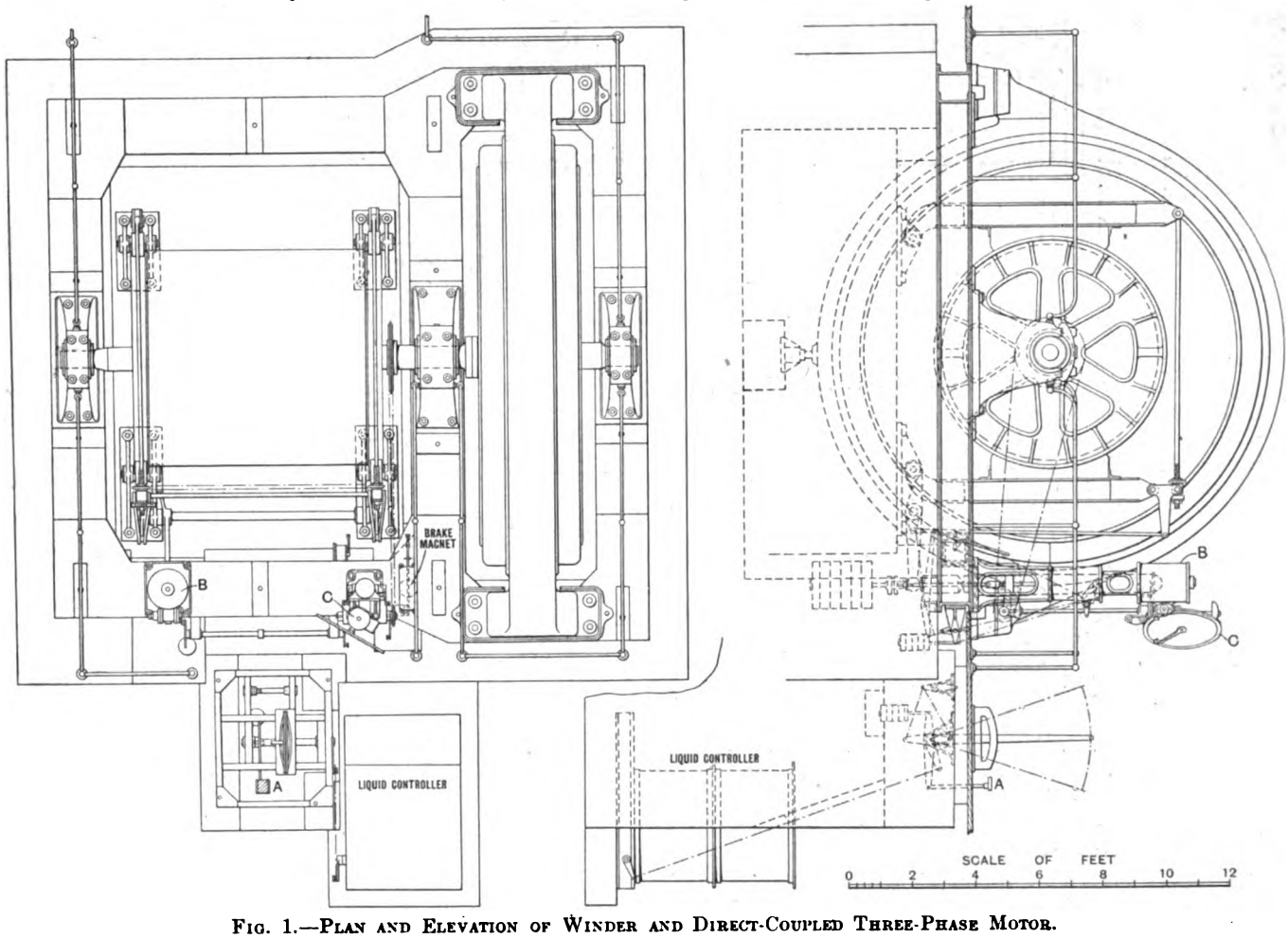


Fig. 1.—Plan and Elevation of Winder and Direct-Coupled Three-Phase Motor.

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26 feet per second, during which the power required would be 345 h.p.; and a seven-second period of retardation. Including a stoppage of 14·5 seconds, this gives a total time of 50 seconds per wind. The motor installed has a continuous rating of 375 h.p., and develops a starting torque equivalent to 650 h.p. When we inspected the plant a week or so ago, the instruments indicated an average current of some 110 amperes per phase at 3,000 volts during the accelerating period,

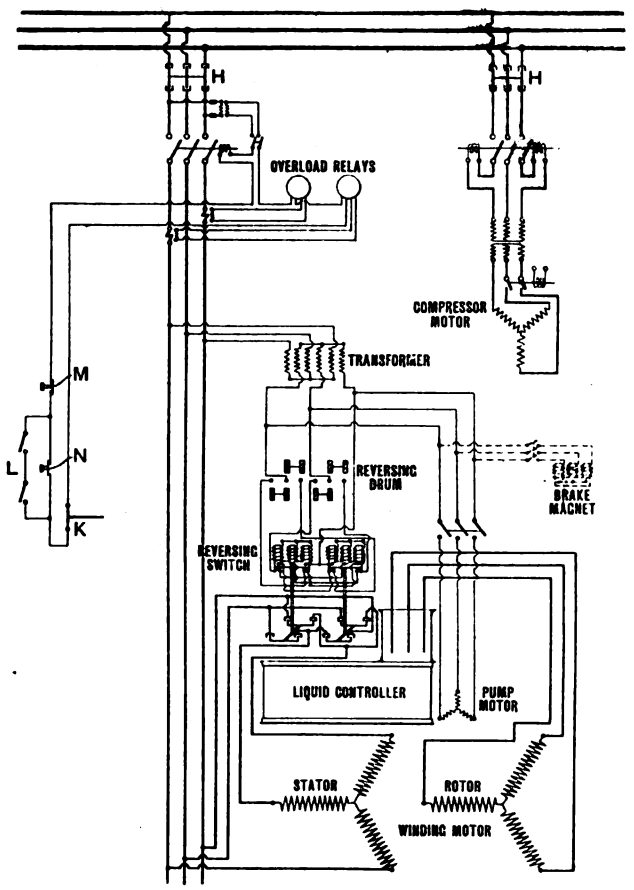


FIG. 2.—DIAGRAM OF CONNECTIONS.

which fell to from 60 to 75 amperes during the full-speed period. The winding motor is connected direct to the 3,000-volt distribution mains without the intervention of any flywheel load-equalising plant, so that this load, fluctuating between zero and some 400 kw. (perhaps some 550 k.v.a.) every 50 seconds, is thrown direct on to the main generators. A Tirrell regulator is employed at the station, however, and the pressure is maintained sufficiently constant to prevent any trouble with the other plant. The average power-factor of the motor is, we are informed, about 0·76. We understand that when the winder is operating at full load, *i.e.*, 54 cwt., the *approximate* consumption is 3·44 kw. hrs. per wind, or some 1·275 kw. hrs. per ton of coal raised. We are also informed that the full-load efficiency is about 87 per cent.

The mechanical portion of the winder, by Messrs. Fraser & Chalmers, Erith, is illustrated in Fig. 1. It comprises a steel drum 7 feet in diameter and 7 feet wide, over which is wound the 1¼-in. steel wire rope. At full speed the drum rotates at 72 r.p.m. On either side of the drum are two massive wooden brake blocks bearing on the rims. These are applied by heavy weights, and are normally held off by compressed air supplied by an electrically driven compressor. The valves of the brake gear, *B*, are worked by the driver by means of a foot-lever, *A*. To take off the brakes, compressed air is admitted to the upper cylinder of the gear, and this lifts the weights. To apply the brakes, the air is released, but to avoid a too sudden application of the brakes, a second cylinder is provided to act as a dash-pot. The compressed air is stored in a reservoir, which is fed from an intermittently working electrically driven 7-h.p. compressor supplied at 500 volts through a 5-k.v.a. transformer. As indicated in the diagram of Fig. 2, the compressor is started automatically when the pressure in the reservoir falls below 50 lb. per sq. in., while to avoid too frequent starting and stopping, it is not switched off until the pressure reaches 80 lb. per sq. in. The automatic starter comprises an air-operated relay, which closes a local circuit. This switches in the stator of the compressor motor, and also operates a three-phase solenoid starting switch in the rotor circuit. A fan retarding device is provided to ensure slow starting up. The compressor and its control gear are situated in the basement under the winder, where is also the starting and reversing switch-gear for the main motor.

The winding motor is a 3,000-volt, 50-cycle, 450-h.p. A.E.G. induction motor, bar-wound and provided with slip-rings and composition carbon brushes. Its no-load speed is 75 r.p.m., and its full-load speed 72 r.p.m. The motor is coupled direct to the drum, and is controlled by a single lever. This lever is mechanically connected with the main liquid starter, and also with a contact drum controlling the 500-volt operating solenoids of the main reversing switch. The latter is a 3,000-volt oil-immersed switch with main contacts of the plunger type, and auxiliary contacts to take the arc at break. We understand that the continual arcing makes it necessary to change the oil once every week. The liquid controller providing the resistance for the rotor circuit is shown in section in Fig. 3. It comprises an upper chamber containing the electrodes, *D*, and a lower chamber for the electrolyte, a solution of soda. The latter is continually pumped up from the lower into the upper chamber by a small ¼-h.p. centrifugal pump. A vertically sliding gate or sluice, *E*, is provided at one end of the upper chamber, and this

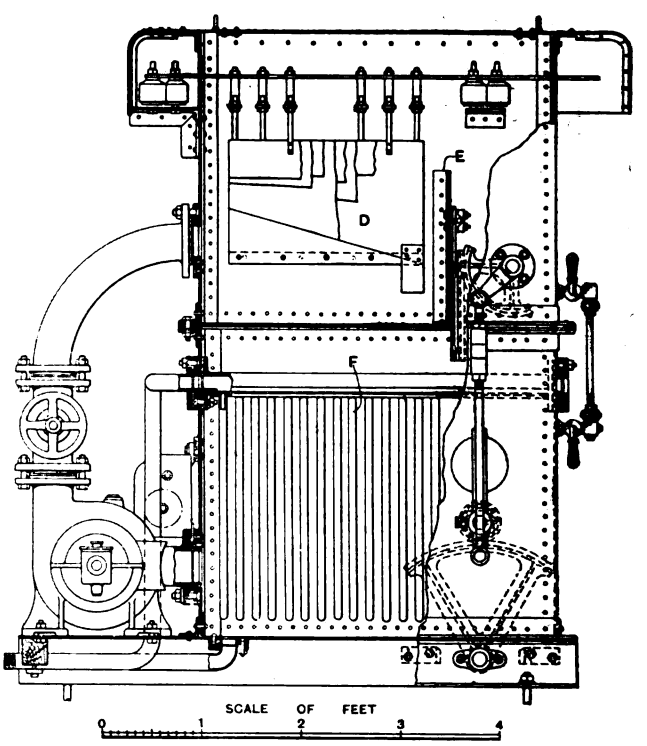
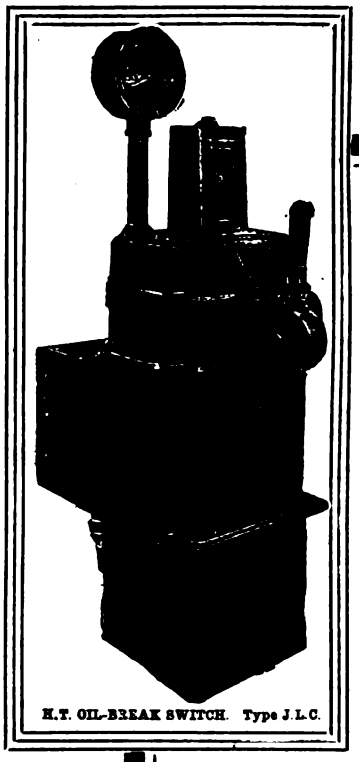


FIG. 3.—SECTIONAL ELEVATION OF LIQUID CONTROLLER.

is raised or lowered by the main controlling lever. On starting up the motor, the gate is slowly raised and the level of the electrolyte rises with it, gradually reducing the resistance between the plates. The elec-

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H.T. OIL-BREAK SWITCH. Type J.L.C.

MINING SWITCHGEAR

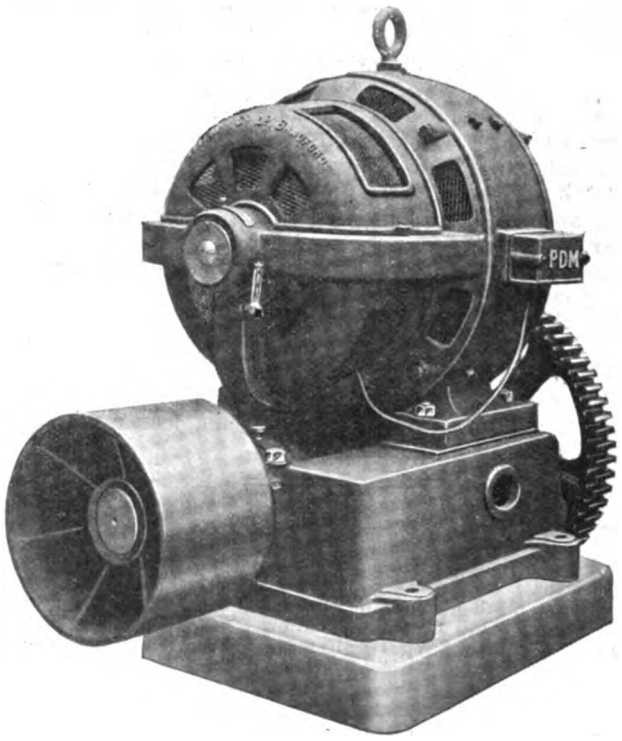
We have made a specialty of the design and manufacture of high-tension switchgear particularly adapted for mines, and which will operate successfully for an indefinite period and with a minimum of attention, under the severe working conditions which almost invariably obtain

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trolyte is continually overflowing into the lower chamber, and is there cooled by a system of water-circulating pipes, *F*. This controller is capable of maintaining a speed of 2·34 r.p.m. with one-tenth normal torque for a period of 15 minutes for inspection of the rope, &c.

For indicating to the driver the position of the cage and for preventing overwinding, a Whitmore overwinding gear is provided. This is shown at *C* in Fig. 1, and comprises a dial and nuts moving along two vertical threaded rods, which are set in rotation from the winder shaft by chain gear. Should either nut reach the top (which would happen if the cages were overwound), a switch (*K* in Fig. 2) in series with the no-voltage relay of the main switch is opened. The power is instantly cut off and a three-phase brake magnet operates the compressed air brakes. It will be noticed that the brake magnet only operates when overwinding takes place, or when the supply fails.

The general connections of the winder are shown in Fig. 2. A 75-mm. 3-core cable is led in underground from the sub-station at Abercwmboi, where the main 3,000-volt overhead feeders of the ring distributing system are brought in, and where the necessary switchgear and lightning protection apparatus is installed. From the main 'bus-bars in the winder house, the current passes through air-isolating switches, *H*, to the oil switches of the winder and compressor circuits for 200 amp. and 3 amp. capacity respectively. A voltmeter, a watt-meter, and an integrating watt-hour meter are provided, but are not included in the diagram. The local circuits of the two time-element overload relays in two of the phases are in series with the no-voltage release of the main oil switch, two limit switches, *L*, at the pit head, and a push-button emergency switch, *M*, on the driver's platform. Each of the relays is set to break the local circuit at 130 amps. after 23 seconds, and as the discs were continually commencing to rotate, the current per phase must frequently exceed this for periods of two or three seconds. The pressing of the emergency switch, the opening of the limit switches at the pit-head, failure of supply, or the operation of the switch of the Whitmore overwinder, all result in the motor being switched off and the brakes applied. A second push-button switch, *N*, is provided on the driver's platform. This short-circuits the limit switches, *L*, in order that the winder may be worked and the cages set in motion so as to move them away from the limit switches, which can then be closed again.

At the same colliery is a second but smaller electric winder over the up-cast shaft. This is used mainly for winding men four or five times a day only. The 3,000-volt, 125-h.p., three-phase motor is geared to the drum, and is controlled by an ordinary resistance starter.

In concluding this article, we should like to acknowledge our indebtedness to Mr. E. M. Hann, the Engineer and General Manager of the Powell Duffryn Co. for giving us permission and affording us facilities to inspect the winder, and to Mr. J. W. Price, the mechanical engineer to the Aberdare Valley group of collieries, and Mr. W. L. Harliss, his assistant, for conducting us over the plant.

Electric Shot-Firing Accidents during 1909. The annual report of H.M. Inspectors of Explosives records no less than 367 accidents in connection with shot-firing in mines and quarries during 1909. Of these, however, only seven were cases of electric shot-firing. These resulted in two deaths and injuries to eight persons out of a total of 40 deaths and injuries to 397 persons. All except one of the seven electrical accidents occurred in collieries where "permitted" explosives were used. One was caused by the firing leads accidentally coming in contact with the terminals of a dry battery while the shot-firer was connecting the detonator leads to the cable. The other six were caused by the shot being fired before the persons near the shot-hole had taken cover.

REVISION OF THE SPECIAL RULES FOR ELECTRICITY IN MINES

NO further evidence will be heard by the special departmental committee appointed by the Home Secretary to inquire into the working of the existing special rules for the use of electricity in mines, and to consider the advisability of their amendment. The sittings of this committee at the Home Office, Whitehall, have been of a strictly private nature, but we understand that the proceedings, comprising the evidence of some forty witnesses, will be printed and published. When the committee resumes its sittings in the autumn, the draft report of the chairman, Mr. R. A. S. Redmayne, H.M. Chief Inspector of Mines, will be under consideration, and it is expected that this will be presented to the Home Secretary before the end of the year. The other members of the committee, besides Mr. Redmayne, are Mr. C. H. Merz and Mr. R. Nelson, H.M. Electrical Inspector of Mines.

MINING PATENTS OF AUGUST

AMONG the patent specifications of interest to mining engineers published during August was one (No. 17,235 of 1909) by H. Hirst, of Dewsbury, for an electric coal-cutter especially adapted for narrow work, such as the driving of headings for roads. The machine is carried by means of two pairs of wheels running on the lower flanges of two side channel girders. The latter are carried by uprights from cross sleepers, and are provided with spikes which fit into holes cut in the face of the heading. A toothed wheel on the machine engages with a rack on one of the girders. The swivelling carrier which carries the cutter bar spindle is cast in one piece with a large worm-wheel geared with a worm carried at the forward end of a longitudinal shaft passing along one side to the rear of the machine and provided with a handle.

Patent No. 9,543 of 1910, by H. Friese, of Bochum, Germany, covers a device for indicating the presence of fire-damp by means of a selenium cell and a safety lamp. When the air contains only a slight proportion of fire-damp, the intensity of the flame is increased, and when a large proportion, the intensity is decreased. Either variation is caused to actuate a signal by means of a relay in series with the selenium cell and a battery.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during August.

Aug. 4th.—Supplement on "Electrical Engineering in Mines," opening with an article on colliery supply in Northumberland and Durham and the work of the large power companies in that district. A short account of a visit to the electrical installation at a lead mine. Some extracts from the reports of H.M. Inspectors of Mines, and an abstract of a Paper putting in a plea for the use of earthed concentric cables in collieries. Articles dealing with American regulations for electricity in mines, mining cables, and accessories and mining patents published during July.

Aug. 11th.—Some notes on the care of commutators, and a description of a safety device to enable repair work to be done on live overhead high-tension lines. An article discussing the possibility of an Association of Motor Manufacturers on the lines of the Cable Makers' Association.

Aug. 18th.—An illustrated description of the Grille water-tube boiler. Particulars of the courses at the various Universities and Technical Colleges in the provinces. Correspondence with regard to the newly formed Association of Consulting Engineers.

Aug. 25th.—An article criticising the current practice in the design of high-tension cellular switchboards. Particulars of the courses in electrical engineering at the various technical colleges in London. A description of a new flame arc lamp.

Tyndall Studentship.—The first year's income of the Tyndall Mining Research Fund, established in memory of the late Prof. John Tyndall, will be devoted to the establishment of a studentship for study and research on subjects relating to mining and the safety of miners. The value will be about £35. It will be open to any British subject. The applicant should state the particular kind of research he proposes to carry out, his qualifications, and the place where he intends to carry on the work. The application, which should be sent in to the Assistant Secretary of the Royal Society not later than September 15th, 1910, should be accompanied by not more than two testimonials or references in its support. The student elected will be at liberty to follow his ordinary avocation if it is consistent with the aims of the studentship.

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F rests on this nut in its normal position, and by turning the nut in one direction or the other a very delicate adjustment is obtained of the distance between the core and the curved projection of the armature.

In the construction of the switchboard, the fire-proof arrangement adopted by the Post Office is used. Fig. 3 shows a portion of the back of the subscribers' switchboard with the protecting covers removed, Fig. 4 the cable-turning section, and Fig. 5 the front of one of the apparatus racks in the space behind the subscribers' switchboard. In accordance with Post Office practice, these racks contain the relays, resistances, and condensers, which are no longer fixed on the back of the switchboard.

Fig. 6 is a diagram of the subscribers' line and operators' keyboard connections. The difference between this and the circuit fully described in our issue of August 18th, is an alteration to adapt it for use on the London system, of which the extended use of small private branch exchanges is a feature. The A-line side of the line relay, which is connected to the earthed side of the battery in the Glasgow circuit, is connected here to a six-volt tapping; and the B-line side of

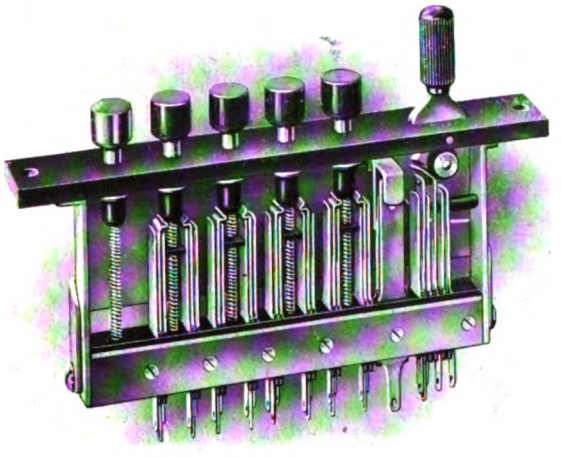


FIG. 8.—SET OF RINGING KEYS FOR JUNCTION BOARD.

the line relay is wound non-inductively. Current can thus be taken from between the B-line and earth to work a small private branch exchange without actuating the line relay or affecting the proper working of the cord circuit.

The subscribers' board is made up in eight-panel sections, with nine-panel multiples, and three operators' positions per section. There are six sections, the last being partly equipped. Seventeen pairs of cords are provided per position. Except in the points that have been mentioned, the equipment of the subscribers' board is similar to that at Glasgow. The local jacks are at ¾-in. centres allowing space for labels, and the multiple jacks at ⅜-in. centres. The junction board (Fig. 7) has nine-panel sections, with nine-panel multiples, and three positions per section. The illustration shows the set of five ringing keys on each junction cord, and Fig. 8 indicates the construction of the keys.

In conclusion, a brief reference may be made to the remainder of the equipment of the exchange and the general lay-out. The cables entering the exchange are all underground; they are joined up in the basement through the usual lead sleeve joints with an inlet for air-drying, to lead-covered silk and cotton cables in the ordinary way, and the latter come up to the main frame and where they are terminated in the manner already described. The apparatus-room occupies a large space on the ground floor of the building, and in addition to the main frame, wire-chief's desk, the I.D.F., and the relay and condenser racks, &c., contains at the far end the power plant, switchboard (both supplied by the General Electric Co., Ltd.), and the ringing generators; the battery room (E.P.S. cells) is adjacent. The switch-room is on the first floor, and is lofty and well lighted from the roof, there being no floor above it.

ELECTRIC TRACTION IN JAPAN.—It is stated that a company has been formed to construct an electric railway between Tokio and Yokohama. The line is to have a length of about 15 miles, and a branch line nearly four miles long is to be built to Kamata, on the State railway. The line will be double track on a 3 ft. 6 in. gauge. The cost of construction is estimated at about £357,300.

ELECTRICAL TRADE WITH RUSSIA

A BRITISH Consular report dealing with the trade of Russia during 1909 makes some interesting remarks concerning British trade with that country, which, although of general application, are pertinent to the electrical industry in view of the increasing use of electricity there. Mr. Vice-Consul C. Blakey, reporting upon the Kharhoff district, suggests the formation of a limited company with an establishment, say, in Moscow, to cover all kinds of engineering supplies. Such an office, he is convinced, could be relied upon to do a trade and to look after the interests of the manufacturers far more satisfactorily than an agent. The idea is not new, but to get over the difficulties it is necessary to find a group of manufacturers who wish to trade in Russia, and are convinced of the incapacities and limitations of travellers and agents.

Reporting on trade with Odessa, Mr. Consul-General C. S. Smith states that electrical enterprise in Russia seems unattractive to British firms. Electric tramways are a Belgian speciality; there are Belgian concessions or installations (or both) in many towns—Odessa, Kursk, Kharkov, Nikolaiev, Sevastopol. Electric installations of other kinds seem to be mainly German. He has heard of one German firm which is believed to have had a turnover in 1909, mainly in the Donetz district, of about £300,000. It sold 20 steam turbine generators of 500 to 1,200 kilowatts. A considerable trade in electric lamps and fittings is going on in the Kharkoff district, especially in the Donetz mining district, and with the sugar factories. At Nicolaiev the municipality are raising a loan of £1,000,000, one of the chief objects of which is to buy out the horse tramway company and convert the lines to electric traction. A sum of money has also been assigned for the improvement of telephonic communication between Nicolaiev and Odessa.

Australian Tramways.—According to an American Consular report, there were 226 miles of electric tramways in Australia at the end of 1909. These were distributed as follows:—New South Wales, 105 miles; Victoria, 34 miles; Queensland, 31 miles; Western Australia, 47 miles; Tasmania, 9 miles. The total gross revenue of all these systems during 1909 was £1,400,000.

Electric Lighting Provisional Order Applications.—The Board of Trade have issued some new rules relating to applications for electric lighting provisional orders. These differ in some important respects from the old ones, although the general procedure is the same. Applications in future must be most complete in their details, the deposits with the Board of Trade including a statement showing that a definite scheme (including an estimate of the cost) for the supply of electricity, in the case of municipalities, has been prepared and considered, and a report by an electrical engineer on the proposed scheme. In the case of a company, a statement of the capital proposed, and the manner in which it will be provided, has to be put in. The usual fee of £50 has been reduced to £35, but if additional expense is incurred by reason of inquiries, &c., the amount is charged to the applicant. Applications by Joint Boards are on similar lines, with additional statements as to the proposed constituent authorities. The greater powers given to the Board of Trade to grant provisional orders under the Electric Lighting Act, 1909, are reflected in the provisions for orders relating to acquiring generating stations outside area of supply, compulsory acquisition of land, breaking up of roads, &c.

THE TRAMWAY BRAKES OF AUCKLAND.—A Royal Commission consisting of Prof. J. Scott and Mr. A. L. Beattie (Chief Engineer of the New Zealand Railways), appointed to report upon the brakes of the Auckland electric tramways, has sent in a report to the Government condemning the present equipments, recommending that pneumatic brakes and pneumatic sanding gear be fitted to all cars, and that the existing track brakes be reconstructed, so that it will be possible to transfer 45 per cent. of the weight of a loaded car to the slipper blocks. Magnetic brakes are said to be unsuitable on account of the construction of the Auckland cars, the cost of such equipments and the limiting effective speed. The standard of upkeep and efficiency at Auckland is compared unfavourably with that at Wellington, Christchurch, and Dunedin, and the appointment by the Government of an electrical inspector of extended experience in tramway working is recommended. It is also suggested that the Government should take powers to be able, if necessary, to insist on any tramway system being equipped and worked with due regard to the safety and convenience of the people. Apparently, therefore, there is nothing corresponding to Board of Trade regulations in New Zealand.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Aug. 25th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

17,739/09. **Automatic Pressure Regulation.** H. M. TAYLOR and R. H. SCOTSON (Middlesborough). To maintain the voltage of a machine at a constant value, a small booster and a resistance are connected in series with its shunt field winding. The field of the booster is connected in series with an adjustable resistance across the mains, and is short-circuited by an automatic solenoid switch when the voltage of the mains rises above a predetermined value. Five figures.

17,774/09. **Telegraph Relay.** S. G. BROWN, W. JUDD, and A. R. HARDIE (London). The speed of working and distinctness of the signals are increased by relieving the sluggishness of action at the contacts which are maintained in a continual state of vibration. This vibration of the contacts is obtained by electromagnetic mechanism independent of the relay. Thirteen figures.

17,999/09. **Wiring Conduit.** P. T. KENNY (New York, U.S.A.). This specification describes split metal wiring conduit which also serves as a picture rail. The body has longitudinal grooves to receive the cables, and a similar groove on the underside which fastens over the screwheads or other fixing devices projecting from the wall. A metal cover is sprung over the body. The groove on the underside is constricted, but has openings at intervals to receive the fastening device. Fourteen figures.

18,469/09 and 15,977/10. **Flame Lamp Carbons.** F. M. LEWIS (Brighton). The first patent covers a process of manufacturing flame carbons consisting of a tubular or solid core of hard carbon with an outer sheath of flaming material compressed over the core. Sixteen figures. The second patent covers a flaming mixture of equal parts of calcium flouride and silicon carbide with a binder of gold size. A sheath of this material 1·4 mm. thick is applied to a core 11 mm. in diameter with a 6 mm. central hole. After baking, the electrode is given a protective coating of water glass. Two figures.

18,922/09. **Wireless Telegraphy.** G. MARCONI and MARCONI'S WIRELESS TELEGRAPH CO., LTD. (London). Instead of tuning the receiving circuits to the period of the transmitted oscillations, they are tuned to the group frequency of the trains of waves. Two circuits inductively coupled, and containing a detector and a telephone respectively, are employed. An intermediate resonant circuit may also be used, all three circuits being tuned to the group frequency of the trains of waves. Four figures.

2,349/10. **Telegraph Relays.** I. KITSEE (Philadelphia, U.S.A.). To increase the sensitiveness of relays such as are used on submarine cables, the contacts are of graphite. A graphite disc is enclosed in a metal ring and revolved by an electric motor, while the contact attached to the coil consists of a thin aluminium wire with a graphite end. The contacts are bridged with a capacity of two micro-farads. Three figures.

8,831/10. **Trolley-wire Suspension.** M. JOLLINCK and J. F. DE TÓVÁROS (Budapest). When trolley wires are suspended by hangers from carrier wires and are kept in tension by weights acting on the ends of the sections, it is necessary to allow for longitudinal movement. This patent covers a yielding suspension or hanger comprising a wire connected to the carrier wire at two points and passing freely under the bolts of the trolley wire clamps. Four figures.

Opposition to Grant of Patents

25,231-2/07. **Exhaust Steam Accumulators.** J. HOWDEN & CO., LTD., AND W. H. OWEN. These two patents have been granted in spite of opposition. The first covers the use of a minimum pressure boiler intermediate between the high-pressure engine and the low-pressure turbine, which acts both as a steam accumulator and as a source of steam when the supply of exhaust steam fails. The second patent covers the use of a superheater between the steam accumulator and the turbine.

12,844/09. **Magneto Massage Machine.** B. SEACOMBE. This patent has been refused as the result of opposition. The specification describes an apparatus consisting of a roller with a corrugated metal surface, driving a magneto-generator through a gear train. By means of a contact-making device, an intermittent current is passed from the roller through the part being massaged, and back through the hands.

19,466/09. **Arc Furnace for Treating Gases.** SALTPETERSÄURE INDUSTRIE-GES. The grant of this patent has been allowed in spite of opposition. Between the main electrodes are two auxiliary electrodes, connected by a resistance. Each of the auxiliary electrodes forms with its adjacent main electrode an arc expanding device of the horn pattern. Should the main arc be blown out, two arcs are formed at the two horn devices, and expand out until they meet and thus restrike the main arc.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: SIEMENS BROS. & CO. and DIESELHORST [Insulator for high-tension circuits] 25,536/09; BRITISH THOMSON-HOUSTON CO. and WEDMORE [Protective arrangements for distribution systems] 6,668/10; BROWN, GATENBY, and GOURLAY [Conduit threaders] 10,705/10.

Dynamos, Motors, Transformers: OLMSTED [Speed-governing device for electrically-driven machines] 30,187/09; MARTIN [Motors] 2,894/10; SIEMENS BROS. DYNAMO WORKS, LTD., and PARKER [Ventilation of D.C. machines] 8,409/10; ALLGEMEINE ELEKTRICITÄTS GES. [Centrifugal air-pumps and compressors] 12,338/10; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [Prevention of residual magnetism in machines] 14,153/10, and [Production of braking action in polyphase commutator motors] 14,355/10.

Electrometallurgy and Electrochemistry: SAUVAGEON [Furnaces for continuous manufacture of glass] 18,118/09; PRESSER [Production of oxides of nitrogen] 7,319/10; POLITZ [Protection of pipes from electrolysis] 9,094/10.

Incandescent Lamps: BEUTIELL [Mounting of lamps] 24,950/09.

Instruments and Meters: HANSFORD and WRIGHT [Prepayment meters] 10,934/09; HEDLEY and DOYLE [Instrument for recording "coasting" time of cars] 485/10; SPRAGUE and CHAMBOTAIN & HOOKHAM, LTD [Prepayment meters] 5,250/10.

Storage Batteries: MARINO [Protection of lead supports of positive plates from per-oxidation] 18,590/09.

Switchgear, Fuses, and Fittings: THOMAS and THOMAS [Switches] 15,681/09; JEVONS and GREEN [Circuit-breakers for welding machines] 18,036/09; FIELD and FERRANTI, LTD. [Switch contacts] 18,221/09; RORKE and RORKE [Switch] 18,687/09; BERRY and MARKHAM [Switch-fuses] 21,185/09; JÄHDE [Lamp-globes] 1,699/10; FELTEN & GUILLEAUME LAHMEYERWERKE A.-G. [Limit-switches] 2,432/10.

Telephony and Telegraphy: COLIN and JEANCE [Wireless telephony] 18,436/09; MARCONI and MARCONI'S WIRELESS TELEGRAPH CO. [Transmitters] 18,524/09, and 20,229/09; SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Telephone exchange circuits] 11,251/10.

Traction: CONSOLIDATED BRAKE & ENGINEERING CO. [Brake mechanism] 18,696/09; STAHL [Signalling apparatus] 7,143/10; HEILMANN [Brake] 8,989/10.

Miscellaneous: MORISON [Condensing plant] 11,043/09; HOPE-JONES [Electric clocks] 18,405/09; HUTCHINSON [Magnetic separators] 18,420/09; LEAKE and RUSHWORTH [Fire alarms] 18,771/09; ROGERS [Audible electric signalling] 23,802/09; SCHERL [Gyroscopic apparatus] 27,840/09; HARLÉ ET CIE. [Reproducing movements at a distance] 28,164/09; OTIS ELEVATOR CO. (*Otis Elevator Co., U.S.A.*) [Ammunition hoists] 29,132/09; PATHER IRON & STEEL CO. [Clutch for rolling mills] 4,484/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: HEIMANN and SCHÄFFER [Working arc lamps in series with incandescent lamps] 11,581/10.

Electric Ignition: R. BOSCH [Sparking-plugs] 13,901/10.

Storage Batteries: ACCUMULATEURS TUDOR SOC. ANON. [Packing charged negative plates for transport] 18,398/10.

Miscellaneous: AUB [Electrodes for electro-medical apparatus] 15,634/10.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: W. ARMISTEAD and M. J. TILNEY [Booster-battery or flywheel load-equalising systems] 9,940/05; W. S. SMITH and W. P. GRANVILLE [Cables with leakage resistances] 10,047/05.

Dynamos, &c.: MORGAN CRUCIBLE CO. and C. W. SPEIRS [Plumbago commutator brushes] 9,875/05; SIEMENS BROS & CO. (*Siemens-Schuckertwerke Ges.*) [Ventilation of machines] 10,085/05; H. LEITNER and R. N. LUCAS [Train-lighting system with A.-C. generator and rectifiers] 10,118/05.

Electrometallurgy, &c.: A. VOELKER [Resistance furnace] 10,873/04.

Switchgear, &c.: G. W. MASCARD [Motor-operated switches] 10,652/03; P. C. HEWITT [Control of vapour rectifiers] 8,972/05.

Telephony, &c.: E. J. STELJES [Type-printing telegraphs] 10,575/04; P. J. KENNY (*E. Molyneux, India*) [Field telegraph and telephone apparatus] 9,702/05.

Miscellaneous: G. GREGORY, N. H. ELLIS and P. E. PLATER [Signalling lamp] 10,550/04; G. DONINGER [Electric lamp for illuminating targets] 10,103/05.

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SWITCHGEAR, TRANSFORMERS, AND ACCESSORIES

IT has been our duty—sometimes a pleasant one, sometimes the reverse—to read and review many catalogues, but seldom have we seen such an excellent production of this nature as the one just issued by Ferranti, Ltd. (Hollinwood, Lancs.). An entirely new arrangement has been adopted. Each section not only contains a catalogue and price list, but also descriptive and technical articles on the apparatus in question and its uses; the intending purchaser is fully educated in the details of what he is buying, and is afforded the clearest possible guide to making a proper selection. The engineering staff, and notably the Chief Engineer himself (Mr. M. B. Field), have taken a leading part in its compilation. In spite of the size of the book and the large amount of ground it covers, the arrangement and indexing is such that a reference to any particular matter is quick and easy.

The catalogue is in the form of a substantial file made up of a number of pamphlets, some of them price catalogues, and others devoted to descriptions of complete switchgear installations or the discussion of technical points arising out of the proper use and purpose of various devices. It is divided into seven sections, dealing respectively with measuring instruments, relays, transformers, switches and plug gear, rheostats and motor-starters, fuses, and, lastly, standard panels and sundries. A marginal index sheet and a sectional index are provided at the commencement of each section. All future pamphlets also will be marked with section, list, and page numbers, in order that the catalogue may be kept up-to-date; the file cover is designed to render their insertion easy, and considerable gaps have been left in assigning list and page numbers.

A novel feature of the catalogue is the chart index in the form of a genealogical tree provided in the instrument section. Thus, under the heading "wattmeters" are the three words "recording," "indicating," and "integrating"; each of these has "A.C." and "D.C." branches, each of which is again divided into "switchboard" and "portable," and in some cases "house service." These are again divided into further distinguishing characteristics. By following out the tree along the required features, one arrives at the list and page number of the instrument required with the minimum of time and trouble. In most of the other sections an alphabetical index or one arranged in an order dictated by the relations which the items bear to one another has been adopted.

Among the descriptive pamphlets is one describing the remote-control automatic high-tension A.-C. switchgear of the St. Andrew's Cross station of the Glasgow Corporation. Another deals with the heavy continuous-current switchgear installed in the Dickinson Street station of the Manchester Corporation in connection with the 12,000 ampere-hour storage battery, which was also fully described in ELECTRICAL ENGINEERING last April. Several other special types of switchgear are described and illustrated, including iron-clad high-tension gear, especially designed for collieries and mines. Among the other articles in the catalogue are a Paper on the use of electrostatic voltmeters as ground-detectors, and the determination of the neutral point of unearthed systems by Mr. M. B. Field, Chief Engineer to the company, and some "Technical Considerations regarding Watt-meter and Power-factor Measurements," especially prepared for the purpose by Mr. M. B. Field, which is a subject upon which many power station engineers will welcome accurate information of a kind not to be found in the usual text-books. Another particularly interesting section is that on relays. The purpose, construction, and operation of the various types are described, and a large number of diagrams and photographs of the mechanisms are given. The section on transformers covers auto-transformer starters, current and potential transformers for instruments and relays, static balancers, and power transformers up to 100 k.v.a. A descriptive pamphlet by Mr. Field discusses the use of current and potential transformers in conjunction with trip-coils and relays. For facilitating the choice of transformers for instruments, relays, trip coils, &c., a special pamphlet giving the volt-ampere consumption of the various patterns of these devices is provided.

The section on switches is most complete, the items listed ranging from small knife-switches to the heaviest automatic iron-clad oil switchgear with remote-control, and there is a similar completeness in the pages dealing with rheostats, motor-starters, switchgear accessories, and special switchgear. Every possible device is briefly described and illustrated, and a distinctive feature of the whole catalogue is the excellence of the illustrations which more often show the interior construction of the apparatus in question, and greatly assist the reader in grasping the method of working.

Euston-Watford Electric Railway.—One of the last obstacles in the construction of the electric railway from Euston to Watford was removed on Saturday night. The line has to cross the railway from Hampstead to Acton, which runs on an earth embankment. The necessary portion of this embankment was removed, and a girder bridge put in its place for carrying the Hampstead to Acton line over the new electric line.

WIRELESS TELEGRAPHY

AN American Consular report states that those interested in merchant shipping desire that a commercial wireless station be established in Hongkong, and the local Chamber of Commerce and many influential residents in the colony have strongly urged it. A proposal was made last year by an American company to establish a wireless station at Hongkong capable of communicating with Manila, Singapore, Shanghai, and Yokohama, and though they did not believe that the station would be profitable for some time they were prepared to bear the early losses in consideration of a licence giving them the sole right to conduct a commercial wireless telegraph business for 25 years, with the proviso that the Government should have the right to purchase the station and business at a valuation at the end of 10, 15, 20, or 25 years. The proposition was referred to the Colonial Office in London, but was not accepted. At present there are no facilities in the colony for handling commercial messages by wireless, although the American, German, and Japanese mail steamers calling at the port are being equipped with the apparatus.

A Press agency has been started by Marconi's Wireless Telegraph Co. for the distribution of news received from the principal liners at sea.

The Vienna correspondent of the *Globe* reports that Turkey is negotiating with the Marconi Company for the installation of a series of wireless stations along the coast, and also at various places in the interior, for the use of the Army and Navy in particular. It is added that all the Turkish warships will be fitted with wireless apparatus at an early date.

A Reuter telegram from New York states that a wireless message was successfully transmitted on Saturday from a moving aeroplane at a height of 500 feet, a mile from the Sheepshead Bay aviation track.

The Australian Commonwealth has read the first time the Navigation Bill, under which passenger ships, including those of foreign countries, may be required to instal wireless telegraph apparatus.

The Association of Mining Electrical Engineers: *Proposed Scottish Branches.*—A special meeting of the above Association will be held in Glasgow on September 17th, in order to promote the formation of one or more Scottish branches. The President, Mr. W. Maurice, General Mine Manager, Hucknall Colliery Co., Notts, and Messrs. J. Glynn Williams, H. W. Clothier, and H. J. Fisher will attend as a deputation from the Council. The meeting will be held at the Beaconsfield Room, Grosvenor Restaurant, Glasgow, at 6 p.m., Saturday, September 17th, and any gentlemen connected with the application of electricity to mining will be welcome. Mr. J. Glynn Williams will also hold informal meetings to explain the objects of the Association, as follows:—September 3rd, Victoria Hotel, Glasgow, 4 p.m.; September 5th, Royal Hotel, Dunfermline, 6 p.m.; September 6th, Milnes Hotel, Edinburgh, 6 p.m. There are already thirty-four Scottish members enrolled.

ELECTRIC STREET LIGHTING IN HAMPSTEAD.—In our article on the displacement of gas by electricity for street lighting in Marylebone, Hampstead, and Shoreditch, last week, we referred to the fact that in Hampstead the capital cost per post was higher than it would otherwise have been owing to the lamps being switched on by Venner time switches from sub-stations, which necessitated the laying of a switch-wire for each group of lamps. Messrs. Venner & Co. inform us that this extra cost is only to a very small degree due to the time switches themselves, the cost of which works out to less than 3s. per post.

ELECTRIC POWER IN THE TRANSVAAL.—In his presidential address to the Transvaal Institute of Mechanical Engineers, on July 16th last, Mr. J. A. Vaughan dealt chiefly with the question of electric power on the Rand, and expressed his approval of the new Power Act. The use of power on the mines which have contracted with the power companies for its supply is calculated, he said, to lead to a saving of over 10d. per ton crushed, this estimate referring to operations after October 1st, 1912, when the price per kilowatt hour is to be reduced to 0·525d. for 70 per cent. load factor or over. The mines which are not so contracting, but which have been formed into groups with sufficiently large power requirements to justify the erection of large central power stations, expect to obtain their power at an equally cheap rate. Mr. Vaughan estimates that, in a few years' time, the old figure of 2s. for power costs per ton crushed will be reduced by one-half. He also suggested that the extended application of electric haulage would tend to increase the ratio of white to native labour.

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LOCAL NOTES

AUSTRALIA: *Perth Tramway Employees Strike.*—A strike of the tramway employees of the Perth Electric Tramways, Ltd., has been going on for the past six weeks. According to Reuter messages, the service is suspended, all the cables having been cut.

BELFAST: *Municipal Wiring.*—The Corporation have decided to contribute £20 towards the cost of the proposed Bill to confer wiring powers upon all municipalities.

Electrical Exhibition.—The Electrical Engineer is to report upon holding an electrical exhibition in the Ulster Hall, to demonstrate the use of electricity for lighting, power, and heating.

BIRKENHEAD: *Tramway Jubilee.*—Birkenhead has been celebrating the jubilee of its tramways, which were first introduced on August 30th, 1860, the original line having been the first to be constructed in this country by the late Mr. George Train. The line had a gauge of 5 ft. 2 ins., the rails projecting nearly an inch above the surface of the roadway.

BLACKROCK (IRELAND): *Electric Lighting.*—At the meeting of the Council last week, a letter from the Board of Trade was read asking what action the Council intended to take in regard to their Electric Lighting Order, which will shortly expire. After discussion it was decided to apply for a further extension of time.

BRAUNTON: *Electric Supply.*—Messrs. Crompton & Co. are carrying out an electric lighting scheme, and offer to supply the Council with current at 2·15d. per unit. At present the streets are lighted by oil.

GLASGOW: *Electricity Accounts.*—The accounts of the Electricity Department for the year to May 31st show a gross profit of £140,521. After meeting capital charges, there is a balance of £43,665, all of which, with the exception of £190, has been placed to depreciation. The number of consumers increased from 18,158 to 19,893 during the year.

GREYSTONES (IRELAND): *Public Lighting.*—The Council desire to enter into a contract with the local electric lighting company for public lighting, but have been informed by the Local Government Board that they have no power to spend money in this connection without a Provisional Order from the Board of Trade.

HALIFAX: *Proposed Tramways.*—The Tramways Committee suggest that Parliamentary powers should be sought next session for the construction of tramways up Westgate, along Southgate and Princess Street, and down Crossley Street into Northgate to join the present lines; the doubling of lines on various routes, and the revival of powers to construct tramways to Stainland and Ripponden.

ILKESTON: *Electric Light Cut Off.*—There has been some trouble in Ilkeston with the lessees of the Coliseum, and the Corporation on Thursday cut off the supply of electricity for the reason that the bill was unpaid. The owner of the premises subsequently arranged matters, and the performances were continued on Friday.

INDIA: *New Electric Power Scheme.*—The Bombay correspondent of *The Times* states that an Indian company is being formed for the generation of electricity by water storage at Lanauli, in the Western Ghats, for transmission to mills and factories at Bombay. The company is to have a capital of 170 lakhs of rupees (£1,133,320), 70 per cent. of which has been already subscribed. The scheme is to furnish 30,000 horse-power, with a reserve of 10,000 and possibilities of expansion to 50,000. The issue is under the auspices of the Tata firm, the owners of the Tata Ironworks.

KEIGHLEY: *Trolley 'Bus.*—A recommendation of the Tramways Committee has been approved to the effect that further extension of the tramways should be deferred pending the receipt of further information regarding the trackless trolley system. The Committee hope to ask the Corporation to sanction an application to Parliament for powers to utilise trolley omnibuses. After some adverse discussion, the Tramways Committee at the last meeting of the Corporation were given sanction to inspect some existing installations on the Continent.

LLANDUDNO: *Light Railway Extension.*—The Light Railway Commissioners have granted an extension of the Llandudno light electric railway system to Colwyn. Objections to the confirmation of this Order by the Board of Trade should be sent to the Board by September 15th.

NEWARK: *Electricity Supply Wanted.*—The Council are endeavouring to boom Newark as an industrial centre, but recognise the drawback of an absence of electricity supply. The Council some ten years ago obtained a Provisional Order, but there was considerable opposition to a municipal electricity works, and subsequent negotiations for a company to take over the Order fell through.

RAMSBOTTOM: *Electric Supply.*—The Lancashire Electric Power Co. have now completed their transformer station at Ramsbottom. Low-tension mains have been laid through the principal streets, and several local business firms are availing themselves of the supply.

RUSSIA: *Electric Tramways.*—The construction of electric tramways has been commenced in Odessa. The concession is held by the Société Anonyme des Tramways d'Odessa. The proposal of the Belgian company in Kharkoff to change its present horse trams to electric traction was refused. Unless some agreement is come to, says a British Consular report, the main streets will be served by very poor horse trams during the eleven years which remain of the Belgian concession. The municipality, however, is building some electric tramways. The first municipal cars came from Germany, the new ones are, however, of Russian make, the motors being fitted by the Russian Westinghouse Co. and a German firm.

SOUTH AFRICA: *Benoni Electric Supply.*—The work of erecting a substation in connection with a bulk supply has been commenced. Originally power was to have been taken from the New Kleinfontein Co., but a misunderstanding has arisen between them and the Council. Should this arrangement fall through, power will, in all probability, be taken from the Victoria Falls Power Co.

STEVENAGE: *Electric Supply.*—It is stated that the Council have transferred their electric lighting Provisional Order to a Manchester firm.

SWEDEN: *The Trolley 'Bus.*—The Stockholm municipality has granted a concession to a local company to instal the trackless trolley system there.

TORQUAY: *Tramway Dispute.*—The *Western Morning News* states that an application has been made by the Torquay Tramways Company to the Board of Trade to appoint an arbitrator to settle the differences which have arisen between the company and the Corporation with reference to the system of electrical traction on the Torbay-road, the Corporation having refused their consent to the company's proposal to convert the present Dolter surface-contact system to the overhead trolley system. The Board of Trade have appointed Mr. Archibald Reed, barrister-at-law, to conduct the arbitration, which will take place in London on September 12th.

WIGAN: *Condition of Tramways.*—The Tramways Committee have decided that certain of the recommendations made by Mr. C. W. Mallins, the Liverpool Tramways Manager, regarding the Wigan tramway undertaking, shall be acted upon. We summarised Mr. Mallins' report in our issue for August 18th, p. 541. Certain new loops and additional passing-places are to be constructed, and six new double-deck, single track, top-covered cars are to be purchased for the Standish route. These latter cars will be smaller than those now in use.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

ADWICK-LE-STREET.—A Local Government Board inquiry has been held into an application by the Doncaster Rural District Council for a loan in connection with a scheme of main sewerage, in which electrically driven centrifugal pumps will be used. Consulting Engineers, Messrs. D. Balfour & Son, 3 St. Nicholas Buildings, Newcastle-on-Tyne.

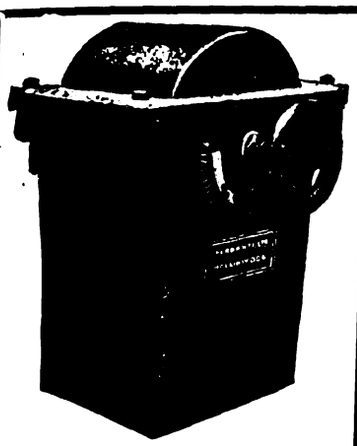
ALDERSHOT.—The Council require a chain grate mechanical stoker. Particulars from the electrical engineer.

BLACKPOOL.—Bispham Council have decided to apply for a loan of £9,855 for electric lighting purposes.

BURY ST. EDMUNDS.—An enquiry was held last week concerning a loan of £1,463 for extensions to the municipal electricity undertaking. Of this sum £943 are for an engine, £55 for switchgear, £75 pipework, £330 mains, and £15 provisional sums for additions. A new 200 kw. set is being installed.

CALCUTTA.—The Calcutta Electricity Supply Corporation require motor generators, and turbo-alternators and condens-

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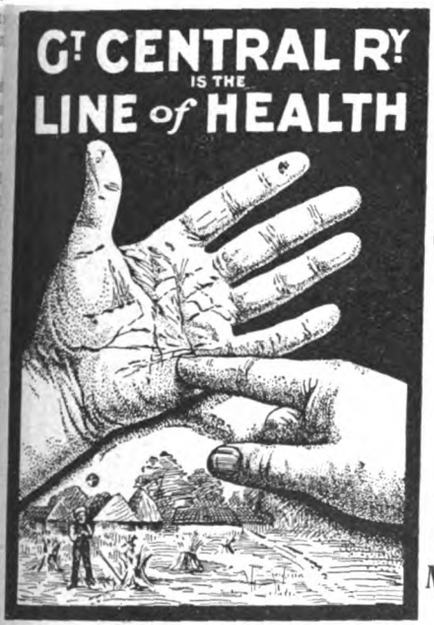
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The Telephone and Historical Pageants.
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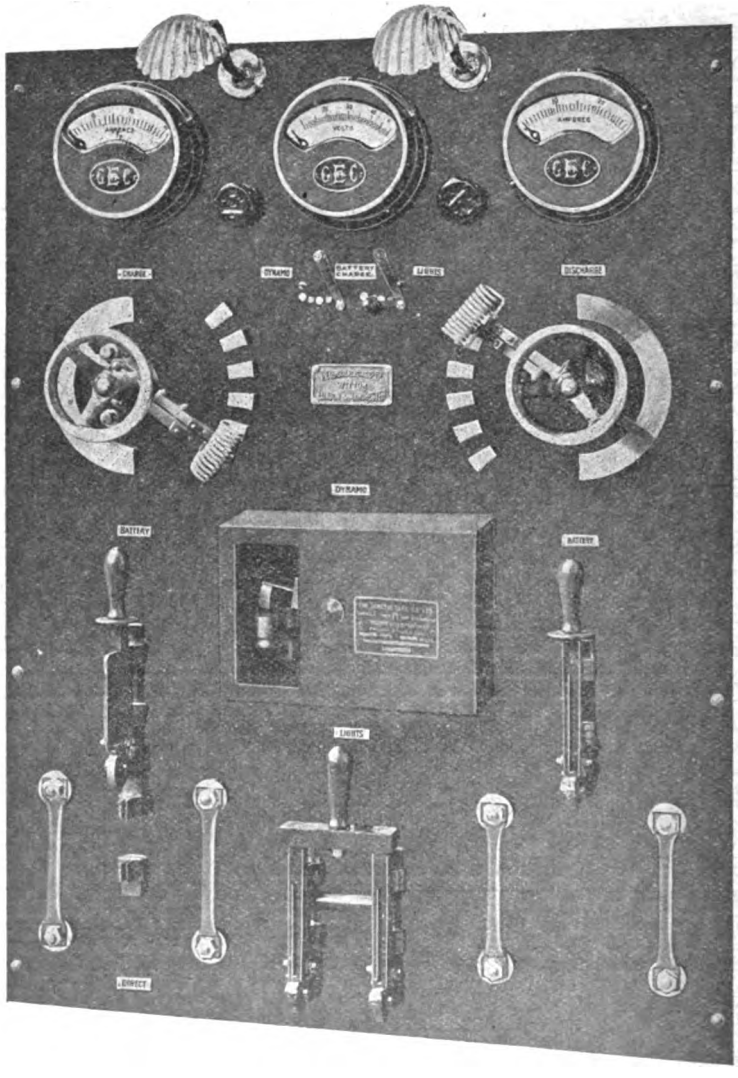
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STANDARD ACCUMULATOR PANEL.

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ing plant. Particulars from the Secretary, Salisbury House, London Wall, London, E.C.

CANADA.—The Seaforth (Ontario) municipality are to take electrical energy from the Hydro-Electric Commission, and will spend £5,000 on the necessary sub-station plant.

GRAVESEND.—A loan of £11,000 is to be applied for, for additional generating plant, mains, feeders, and distributors.

HALIFAX.—The Electricity Committee propose to spend £10,000 upon new generating plant.

JUTLAND.—A British Consular report states that an electric railway is being planned between Aarhus and Randers, in conjunction with a general supply of electricity. Another scheme proposes the construction of an electric power station at Marlbo.

LITTLEBOROUGH.—The local District Council have decided to advertise for a loan of £2,800 on the electricity account. Sanction has been obtained from the Local Government Board.

PETERBOROUGH.—An enquiry was held last week concerning a loan of £2,100 for mains extensions. There was considerable opposition, it being contended that the undertaking could never be made profitable, and that the loss to date on it was £7,547. The proposed extensions are in order to meet numerous applications for power supply.

RUSSIA.—The *Anglo-Russian Gazette* states that State-Councillor Chatelaine, of the St. Petersburg Polytechnic Institute, is proceeding to America, on behalf of the Minister of Commerce, to investigate water-power electrical installations. The aim is to develop the immense water power within the empire for the generation of electricity. Our contemporary holds out the prospect that Russia will be purchasing a vast quantity of electrical machinery in the near future.

TODMORDEN.—An inquiry was held on Friday into a loan of £300 for lighting the Town Hall by electricity.

MISCELLANEOUS

AUSTRALIA.—Tenders are invited by the Deputy Postmaster-General, Hobart, by October 17th, for telephone cable, instruments, switchboards, battery material, wire, insulators, ironwork, &c. Local representation is necessary. Copies of specifications may be seen at 72 Victoria Street or 73 Basinghall Street, London.

BRADFORD.—A sub-committee of the Tramways Committee has been formed to put into effect the Corporation's power to run trolley omnibuses.

MOUNTAIN ASH.—The Council require electrical stores. Particulars from the electrical engineer.

NEWCASTLE.—The Tramways Committee recommend that the tramways be extended to Shieldfield, by way of Clarence Street, on to Jesmond Road, and to Armstrong Bridge. From the bridge the lines will be extended down the bank and on to Heaton Cemetery; from the last-named place on to Chillingham Road and Shields Road. It has also been decided to recommend that a trackless trolley service be arranged between Scotswood and Newburn, and also to Blaydon.

WIGAN.—Six new double-deck, top-covered tramcars are required, and some additional track work is to be carried out.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. The sums in brackets indicate, not the estimated value of the electric light installation, but the estimated cost of the whole building.

LONDON.—Electric Theatre, Stockwell. British Bijou Cinematograph Theatres, Ltd., 17 Coleman Street, E.C.

Discharge block and staff quarters, Eastern Fever Hospital, Homerton. W. T. Hatch, Metropolitan Asylums Board, Thames Embankment, E.C.

PROVINCES.

ABERDEEN.—Roman Catholic Church. Bishop Chisholme.

BANBURY.—Premises for Banbury Co-operative Industrial Society. Architect, F. J. Cooke, 33 Bridge Street, Banbury

BARRHEAD.—Masonic hall. Lennox and McMath, architects, 103 Bath Street, Glasgow.

BASINGSTOKE.—New County Asylum at Park Brewett Farm. Hants County Council.

BOLTON.—Six shops, offices and warehouses, Bradshawgate (£9,000). T. E. Smith, architect, Central Chambers, Bolton.

BRAY.—Pavilion. Amusements Committee.

BROUGHTY FERRY.—New School. Education Committee.

BURY.—Enlargement of Post Office. H.M. Office of Works

CLEETHORPES.—Proposed tea-room, bandstand and conveniences, Kingsway. Surveyor, Cleethorpes Council.

CLITHEROE.—Secondary School. Education Committee.

CREWE.—Lyceum Theatre, Heath Street. Mr. Yoxall, builder, Stoke.

DARLASTON.—New Schools. Education Committee.

DARWEN.—School at Spring Bank. Mr. R. W. Smith-Saville, Borough Engineer.

DENNISTOWN (GLASGOW).—School. Architects, Watson and Salmond, 225 St. Vincent Street.

DUBLIN.—Nurses' Home, St. Vincent Hospital. Architects, W. H. Byrne and Son, 20 Suffolk Street, Dublin.

DUNDEE.—Observatory. T. M. Cappon, architect, 32 Bank Street, Dundee.

DUNFERMLINE.—Extensions and alterations at Townhill schools. School Board.

DURHAM.—Theatre and concert hall. Architects, Gibson and Steinlet, Camden Street, North Shields.

EDINBURGH.—Extensions to warehouse for Lamb, Reid and Drummond. Architect, R. F. Shearer, 143 George Street, Edinburgh.

Additions to Henderson and Sons' biscuit factory. R. R. Hagg, 96 Mayfield Street, Edinburgh.

GLASGOW.—Additions to Royal Gartnawl Asylum (£2,000). J. Burnet and Son, architects, 209 St. Vincent Street, Glasgow.

Extensions to Victoria Infirmary, Langside. H. E. Clifford, architect, 225 St. Vincent Street, Glasgow.

School, Kingarth Street (£20,367). Thomson and Sandilands, architects, 4 Jane Street, Glasgow.

Warehouse and offices. Killearn Street and Saracen Street, Architects, Wyle & Blake, 219 St. Vincent Street.

GOVAN.—Extensions to works of Thermotank Ventilating Co., Ltd. Office, 55, West Regent Street, Glasgow.

GRIMSBY.—Extension Public Library. Borough Engineer.

GREENOCK.—Extensions to library. Public Library Committee.

HALIFAX.—St. Paul's Church. Jackson and Fox, architects, 7 Rawson Street, Halifax.

HASTINGS.—Rebuilding Hastings, St. Leonards, and East Sussex Hospital.

HULL.—Isolation Hospital at Patrington. Clerk, Rural District Council.

HYDE.—New police buildings and municipal offices.

ILFORD.—Four houses, Holcombe Road. C. M. Crickmer, 1, Lincoln's Inn Fields, W.C.

Ten houses, Perth Road. B. Bailey & Co.

Ten houses, 176-94, Coventry Road. F. E. Clark, 133, Shelbourne Road, Tottenham.

LANCASTER.—New Post Office. H.M. Office of Works.

LLANDUDNO.—New police station. Carnarvonshire Joint Police Committee.

LINCOLN.—Public Library on Greyfriars. Borough Surveyor.

Elementary school at Legsby. Architects, Scorer & Gamble, Bank Street Chambers.

MAIDSTONE.—Cinematograph theatre for the Maidstone Electric Theatre Co.

MANCHESTER.—Elysian Street and Ravensbury Street Schools. Education Department.

MARGATE.—Open-air concert hall near Fort. Town Clerk.

MORECAMBE.—Art and Technical School. County Architect, 16 Ribblesdale Place, Preston.

MOSSLEY.—New school. Education Committee.

NELSON.—Church, Burnley Road.

NEWMARKET.—Fire station, pumping station, and depôt. Town Clerk.

OXFORD.—Council buildings. County Surveyor.

POOLE.—Elementary School, South Road. Borough Surveyor.

PORTOBELLO.—Church. Architect, G. Mackie.

PRESTON.—Boys' Grammar School. Education Offices.

ST. HELENS.—Boys' Secondary School, Cowley Hill Lane. Education Committee.

SUNDERLAND.—College, Durham Road. Education Committee.

TORQUAY.—New central fire station. Town Clerk.

WALLSEND.—Fire station; also public baths. Town Clerk.

WATFORD.—Grammar School. Russell and Cooper, architects, 11 Gray's Inn Square, W.C.

WEST HAM.—Gainsborough Road School. Architect, W. Jacques, 2 Fen Court, Fenchurch Street, E.C.

WISHAW (LANARK).—School. Steel and King, architects, Wishaw.

WOLVERHAMPTON.—Secondary School for Girls. Town Clerk.

TENDERS RECEIVED AND ACCEPTED

BELFAST.—An order has been placed by the Corporation with the Worthington Pump Co. for a surface condensing plant at £400.

BOLTON.—The Electricity Committee have accepted the tender of Messrs. Newton, Chambers & Co. for a feed water tank.

DUNDEE.—The tender of a local firm, Messrs. T. C. Keay, has been accepted at £323 for five hundred electric lamps for stair lighting.

FLEETWOOD.—The Congregational Church is to be lighted with electricity, and Mr. R. Barron, of Albert Street, has been entrusted with the work.

LONDON: *Battersea*.—An order for a new feeder switchboard has been placed with Messrs. Pooley & Austin, 25 Victoria Street, London.

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Deptford.—Messrs. C. A. Parsons & Co. are supplying two 5,000-kw. turbo-generators with Brown-Boveri-Parsons generators to the London Electric Supply Corporation. This further extension of the station will be necessary to supply the London, Brighton & South Coast Railway when the electrical equipment of the Crystal Palace line is completed.

MORECAMBE.—The following tenders have been accepted :—Feeder pillars, Messrs. Boydell & Sons; arc lamp carbons, Messrs. G. Hill & Co.

SOUTH AFRICA.—The tender of the Western Electric Co., Ltd., for about a mile and a half of high-tension cable at £142 10s., has been accepted.

WALTHAMSTOW.—The Council have accepted the following tenders in regard to six double-deck tramcars :—Hurst, Nelson & Co., Ltd. : car bodies (with spring fenders) £1,860, trucks £426; Brush Electrical Engineering Co., Ltd. : electrical equipments, £1,684. The tender of Bartlett & Sons, at £112, for a weighbridge at the electricity works has also been accepted.

The following tenders have been accepted during the past month by the Government Departments named :—War Office : Paper insulated cables, Western Electric Co., Ltd.; conductors and supports, British Insulated & Helsby Cables, Ltd.; electric motors, Electric Construction Co., Ltd., Siemens Bros.; internal wiring institution, Ewshott Camp, G. E. Taylor & Co. India Office, Store Department : Accumulators, &c., Pritchetts & Gold; cables, British Insulated & Helsby Cables, Ltd.; dynamos, &c., Stone & Co.; fans, Veritys, Ltd.; motors, Lancashire Dynamo Co.; troughing, Dorman, Long & Co. General Post Office : House telephone apparatus, Gent & Co., Ltd.; india-rubber and cotton-core cable, British Insulated & Helsby Cables, Ltd., W. T. Henley's Telegraph Works Co., Ltd.; cable paper core, Johnson & Phillips, Ltd., Callender's Cable & Construction Co.; submarine cables, India Rubber, Gutta Percha, &c., Works, Ltd.; supply of and laying cable, also dry cells, Siemens Bros. & Co., Ltd.; insulators, Bullers, Ltd., Bourne & Son.

APPOINTMENTS AND PERSONAL NOTES

An electrical engineering apprentice is required. (See an advertisement on another page.)

A first-class salesman is required by a large electrical manufacturing firm in the Manchester district. (See an advertisement on another page.)

An assistant is required in sales department of wholesale electrical firm, Manchester district. (See an advertisement on another page.)

Travellers and salesmen required for wholesale electrical supplies in Lancashire and Yorkshire district. (See an advertisement on another page.)

The Textile Institute Journal.—The first issue of this publication is to hand. It is the official journal of the Textile Institute, which was inaugurated in Manchester in April of this year for the purposes of promoting the application of scientific methods in the textile industry.

"Osrams" in a Synagogue.—The *Jewish World* states that an installation of electric light has recently been added to the Bradford Synagogue, consisting of three six-light electroliers, carrying 50-candle power "Osrams" in the body of the synagogue and two seven-light "Osram" candle fittings on the menoroth, on the two sides of the Holy Ark, besides lamps in the organ loft, and the two schoolrooms. They were lit for the first time on Shevuoth, and proved a great success. The whole of the expense was defrayed by Mrs. von. Halle, in memory of her husband, who died last winter.

Long Distance Telephony.—The *Elektrotechnische Zeitschrift* states that a telephone service will shortly be inaugurated between some of the chief cities of France and Spain. In the latter country, the line will pass through Irun, San Sebastian, Tolosa, and Pamplona, and will connect with the towns of Madrid, Barcelona, Reus, Lerida, Igualda, and Tarragona. The route in France is not yet published. The fee for a three-minutes conversation will vary from 1·5 to 8 francs, according to the place. A conversation between Paris and Madrid will cost 6 francs.

OSRAM·LAMPS

CATALOGUES AND PAMPHLETS, &c., RECEIVED

TELEPHONES AND ELECTRIC BELLS.—In the Sterling Telephone & Electric Co.'s new catalogue (200 Upper Thames Street, E.C.) we find the interesting statement that, with a few unimportant exceptions, all the telephones, bells, &c., sold by the firm are made at their new works in Dagenham, Essex. The excellent finish of the "Sterling" instruments has been known for so long that many customers who have hitherto refrained from placing orders for foreign-made instruments will welcome this announcement. Besides the domestic and exchange sets and bells, a number of strong and watertight types are listed, including a special telephone for mines, and bells, both of the totally enclosed "Thruster" and other waterproof patterns. A speciality of the company has always been their intercommunication instruments, and new features are introduced in their "Secret" and "Double Line," and common battery systems. The arrangement of the catalogue is good, but a 76-page book such as this should have an index.

TELEPHONE APPARATUS AND SUPPLIES.—The Western Electric Co., Ltd. (Norfolk House, Victoria Embankment, E.C.) have issued a new catalogue and price list. It deals not only with exchange equipments and apparatus, with which the firm is particularly identified, but also almost every class of telephone instrument. Sets for house installations range from a 7s. 6d. hand set for connecting directly to bell circuits up to the highest class domestic instruments, inter-communication sets, and small exchanges. Instructions for connecting up, and other information concerning the instruments is included. Some solid-looking mining telephones are listed, and the section on tools and "telephone supplies" covers a wide range from lead sleeves to motor bicycles. The book is well illustrated, particularly the parts relating to exchange equipment, which include pictures of practically every piece of detail apparatus. The only thing we have to criticise is a rather amateurish cable code. We can fancy the consternation at the W. E. Co.'s office on the receipt of a telegram, "Cord, Contact, and Pingres all useless. Replace and send another Blundering Monster and Certify," although this only means : "4 in. diagonal-cutting pliers, 7½ in. and 5½ in. parallel pliers all useless. Replace and send another Haven's Clamp for No. 8 B & S. wire, a 1 in. socket-framing chisel, and a short Fletcher wall bracket."

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METAL FILAMENT LAMPS.—A leaflet from the Electrical Co., Ltd. (122 Charing Cross Road, London, W.C.), gives revised lists of standard sizes and prices of "Aegma" metal filament lamps. High candle-power lamps for street and shop lighting and candle lamps are included.

SMALL MOTORS AND MOTOR-GENERATORS.—The Crypto Electrical Co. (155 Bermondsey Street, London, S.E.) have sent us a list of their single-, two- and three-phase motors of from ¼ to 20 h.p. These can be obtained with short-circuited or wound rotors, and are listed for a variety of frequencies. Another leaflet describes the firm's small combined motor-generator. This has an output on the secondary side of from 350 to 400 watts.

SWITCHGEAR FOR MINES.—Messrs. A. Reyrolle & Co., Ltd. (Hebburn-on-Tyne), call our attention to the fact that they are manufacturing a new design of mining panel in large quantities. The interlocking arrangements are such that an isolating switch cannot be opened until the corresponding oil-switch is in the "off" position, and also the oil-switch cannot be closed while the isolating switch is open. Each door is interlocked, so that it cannot be opened until the whole panel has been made "dead" by opening the isolating switch. The panels can be designed to accommodate current and potential transformers and instruments if desired. Where flame and explosion-proof gear is required, the enclosure of the various parts in stronger cast-iron boxes with wide machined joints is recommended, as this has been found to be an effective protection against the emission of flame.

Robertson and Osram Sports.—The employees of the General Electric Co.'s Robertson and Osram Lamp Works held their annual sports at Shepherd's Bush, London, on Saturday last. A series of tugs-of-war with Osram, Robertson's, and G.E.C. teams was won by Robertson's. The winner of the men's one mile championship was Mr. L. Hipwell. Mrs. C. Wilson presented the prizes.

Strike at Dick, Kerr's Works.—In connection with the patterns for the Bergmann steam turbine, the manufacture of which Messrs. Dick, Kerr & Co. have in hand at their Preston works, some 70 additional pattern makers were employed, it having been decided to make all the standard patterns without delay. Taking advantage of the rush, the men so employed struck for an additional two shillings per week. The firm refused to accede to the demand, and the men's notices have expired. About 90 men are concerned in the strike.

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COMPANIES' MEETINGS REPORTS, &c.

DUBLIN & LUCAN ELECTRIC RAILWAY CO.—The report and accounts for the June half-year, which were adopted at the half-yearly meeting on Thursday, show a balance of £612, after meeting the preference dividend. The balance is carried forward.

ABERDEEN SUBURBAN TRAMWAYS CO.—There was a profit of £1,260 for the June half-year, making an amount of £2,531 available for distribution. The sum of £1,200 is added to renewal and depreciation account, and a dividend of 2½ per cent. declared, carrying forward £508. An amicable arrangement has at last been come to with the Aberdeen Corporation for the supply of energy, the price agreed being 1·75d. per unit.

MEXICO TRAMWAYS CO.—The general prosperity of the company was commented upon at the annual meeting recently held in Toronto. The chairman said that Mexico had almost entirely recovered from the late dulness.

MEXICAN LIGHT & POWER CO.—At the annual meeting recently held in Toronto it was stated that the water storage capacity for running the power stations had been increased to 20,000,000 cubic metres. Dividends of 7 per cent. on the preference stock and 4 per cent. on the ordinary stock have been declared.

NAIROBI ELECTRIC POWER & LIGHTING CO.—The report for 1909 shows that the number of consumers increased from 178 to 228, and the equivalent of 8-c.p. lamps connected from 3,628 to 4,728. The h.p. of motors increased from 64 to 80.

BLACKPOOL & FLEETWOOD TRAMROAD CO.—The accounts for the June half-year show a balance of £5,228. A 4 per cent. dividend is paid on the ordinary shares, £750 placed to depreciation, £500 to reserve, and £1,028 carried forward.

MERSEY RAILWAY CO.—Mr. James Falconar presided at the half-yearly meeting on Friday. We summarised the accounts on p. 543 of our issue for August 18th. The passenger traffic has increased by 120 per cent. since the last half-year of steam working, and the receipts by 85 per cent. The Act of Parliament which the company secured last session enables the debit to revenue account to be placed to capital. This now amounts to £11,821, and after January 1st next, the net revenue will be available for dividends on the debenture stocks.

SOCIETE ANONYME WESTINGHOUSE.—£4,443 carried forward after provision for reserve.

YORKSHIRE ELECTRIC POWER CO.—Net profit of £2,612 for June half-year, after meeting mortgage interest. It is proposed to issue a further £100,000 six per cent. preference shares.

ASCOT GAS & ELECTRICITY CO.—Interim dividend at the rate of 5 per cent. per annum, less tax.

OXFORD ELECTRIC CO.—Interim dividend at the rate of 6 per cent. per annum, les tax.

BRITISH INSULATED & HELSBY CABLES, LTD.—The transfer books will be closed from September 5th to 12th inclusive.

NEW COMPANIES

S. C. G. DEVELOPMENT CO.—Registered by Slaughter & May, 18 Austin Friars, London. Capital, £5,000. Railway and tramway constructors, contractors for public works, &c.

SIRENO CO., 46 Brewer Street, London. Capital, £3,000. Manufacturers of electric warning signals, motor horns, projectors, switches, &c.

CARTMAN & CO.—Registered by Jordan & Sons, 116 Chancery Lane, London. Capital, £5,000. To take over the electric piano and musical instrument business carried on at Manchester as the "Tel Electric Co."

TAYLOR & ROMANY, 35 Little Pulteney Street, St. James's, London. Capital, £2,000. To acquire the business of furnishing ironmongers, electrical and mechanical engineers, &c., now carried on at the above address.

W. L. COOPER.—Registered by Shaw & Sons, Fetter Lane, London. Capital, £1,000. To take over the existing business of electric and general engineers, &c.

CHILIAN CONSTRUCTION CO.—Registered by Linklater & Co., 2, Bond Court, Walbrook, London, E.C. Capital, £500,000. Financiers and constructors of railways, tramways, electrical undertakings, &c.

CHILIAN NORTHERN RAILWAY CO.—Capital, £500.000. To work a concession granted by the Government of Chili for the construction and operation of a railway from Pueblo to Lagunas, and to construct railways, tramways, electric light and power works, &c.

T. & J. JACKSON, 14 Park Road, Regent's Park, London. Capital, £11.000 (5.000 preference, 5.000 ordinary, and 1,000 deferred). Electrical and mechanical engineers.

The Encyclopædia Britannica.—The University of Cambridge has taken over from the *Times* the control and copyright of the Encyclopædia Britannica, and will publish an entirely new and complete (eleventh) edition about the end of this year. This has been in preparation for eight years, and will comprise 28 quarto volumes, of which the last will be an index.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 5s. to £58 15s. per ton (last week, £58 to £58 10s.).

METAL FILAMENT LAMP PATENTS.—The Brush Electrical Engineering Co., Ltd., write us regarding recent announcements that legal proceedings have been commenced by the proprietors of certain metal filament lamp patents, and draw the attention of their customers to the fact that as their "Metallum" lamps are manufactured under the Colloid-Tungsten master patents, they do not incur any liability. In any event, the Brush Co. will indemnify one and all against any possible legal proceedings.

CHANGE OF ADDRESS.—The British Electric Calibrated Fuse Co. have removed their works from Harpenden to Luton. The new telephone number is 278 Luton, and telegraphic address "Fuses, Luton."

AGENCIES.—Messrs. Balcke & Co. have appointed the following new agents:—Scotland: Messrs. Morris, Warden & Co., 68 Gordon Street, Glasgow. Birmingham District: Messrs. Frank R. Cerrito & Co., Exchange Buildings, Stephenson Place, Birmingham.

ELECTRICAL COOKERS.—The Berry Construction Co., Ltd., have appointed Messrs. Gillespie & Beales, of Amberley House, Norfolk Street, Strand, W.C., as sole wholesale agents. Messrs. Gillespie & Beales are now appointing local agents in the most go-ahead districts.

BANKRUPTCIES.—The public examination of J. Szek, patentee, 53 Chancery Lane, London, will be held on November 1st, at 11 a.m., at Bankruptcy Buildings, Carey Street, London.

The public examination of F. Peacock, electrician, 59 North Station Road, Colchester, will be held at 11.30 a.m., on September 9th, at the Law Courts, Colchester. The first meeting of creditors will be held on the same day at 11 a.m., at the Cups Hotel.

The trustee in the bankruptcy of S. Emerson Smith, electrical engineer, 271 High Street, Lincoln, has been released.

The trustee in the bankruptcy of W. C. Ellis, electrician, Applegate Street, Leicester, has been released.

A first and final dividend of 3s. in the £1 will be paid on September 6th at Messrs. Corfield & Cripwell, 12 Cherry Street, Birmingham, in the bankruptcy of H. J. Burdett, electrical engineer, 16 Regent Street, Rugby, and 32 Earl Street, Coventry.

LIQUIDATIONS.—A meeting of creditors of the Polesworth Electrical Appliances Co., Ltd., will be held at 36 Cannon Street, Birmingham, on September 6th, at 3 p.m.

NEW ANGLO-FRENCH TELEPHONE CABLE.—The tests of the telephone cable recently laid between England and France, in which Pupin loading coils were used, have proved thoroughly satisfactory. As we have already announced, the French Government will also lay a telephone cable across the English Channel, and now that the tests of the one recently laid by the British Post Office have shown such good results there is little doubt that the new cable will be of a similar character. We gave a detailed illustrated technical description of the British cable in our issue for March 17th, p. 179.

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Welsbach Incandescent Gas Light Co., Ltd., 344—354, Gray's Inn Rd., W.C.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
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Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

No. 193 [Vol. VI., No. 36] THURSDAY, SEPTEMBER 8, 1910. [Price One Penny.
All rights reserved. *Registered as a Newspaper.*

"Electrical Engineering," although the Cheapest Electrical Paper (Price 1d. weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

The Allgemeine Elektricitäts Gesellschaft has taken over the Lahmeyer works at Frankfort. The Felten & Guilleaumé Co., which will drop the name Lahmeyer from its title, will in future devote itself to cable and wire manufacture. (Page 572.)

Our monthly article on new electrical supplies and accessories includes illustrated descriptions of a light electric oven with an internal air circulation, and a heavy range after the pattern of gas cookers. Some new fittings include an arc lamp case adapted for use with a high candle-power metal-filament lamp, inverted metal-filament lamp fittings, an adjustable dining-room pendant, and strip reflectors. Among the other novelties described are a line of iron-clad switchgear, an enclosed arc lamp, a complete series of tungsten-filament lamps, and a wiring system. (Page 573.)

The Solicitor-General has just affirmed the decision of the Patent Office of July, 1907, to grant a patent to a German company in spite of strenuous opposition. The patent in question covers the heating of tungsten filaments to a temperature close upon the melting-point of tungsten previous to their use. (Page 576.)

The report of the Chief Engineer of the British Engine, Boiler & Electrical Insurance Co., Ltd., notifies an increase of 9·8 per cent. in the number of machines insured, and a satisfactory decrease of over 4 per cent. in the number of breakdowns amongst insured machines. The primary cause of the damage resulting in failure was unascertained in nearly half the number of breakdowns. Some interesting cases are described. (Page 577.)

An article on the present position with regard to the proposed municipal wiring bill, with some comment on the attitude taken by central station engineers with regard to house wiring, will be found on page 577.

In our notes on "The Wiring Contractors' Point of View," we deal with the new tariff of the Metropolitan Electric Supply Co., the relations between wiring contractors and central station engineers, and the amicable proceedings at Leicester which have followed the acceptance of the Corporation of the judgment against them. (Page 578.)

An amalgamation of interests has been effected between the Anglo-German Wireless Syndicate, Ltd., owners of the Lepel patents, and the Compagnie Générale Radiotelegraphie, the French company exploiting the Rochefort spark system. Mr. V. Poulsen has appealed against the decision of the Comptroller-General to grant a patent to Baron von Lepel for hi disc discharger. The stations to be erected for the Australian Government at Sydney and Fremantle are to be on the Telefunken system. (Page 578.)

In his Presidential Address to the Engineering Section of the British Association last week, Prof. Dalby, dealing with our railway system, pointed to the low percentage which locomotive expenses bear to the

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whole cost of working. A comparison of working expenses on steam and electric lines showed the latter to be about two-thirds of the former per train-mile, although it was admitted that the two conditions are not strictly comparable. The possibility of extending the South London single-phase line to Brighton was mentioned. In a lecture before the Engineering Section on Monday, Mr. Philip Dawson described the South London single-phase railway. Figures were given of the life of the commutators, and acceleration. After eight months' working the trolley wires show no appreciable wear, in spite of the fact that the height of these in one or two places drops suddenly from over 20 ft. to less than 10 ft. Mr. E. W. Cowan dealt with electricity tariffs before the Economic Science and Statistics Section, and condemned the practice of attempting to fix the charge for every part of a supply according to the cost of production. A discussion on the neglect of science by industry and commerce in the Chemistry Section produced some conflicting views on the part of educational experts and engineers, one speaker expressing the opinion that the greatest ignorance of the value of science applied to industry was to be found in the electrical and chemical industries. Mr. H. E. Wimperis described, in the Engineering Section, an accelerometer for the measurement of road resistances, which he has applied in connection with acceleration and retardation on London electric railways. In the same section Prof. A. Schwartz described a machine for measuring the hysteresis of india-rubber, and in the Mathematical Section a method of obviating the use of platinum for leading-in wires of electric incandescent lamps was explained by Dr. Sands. (Page 579.)

A SHORT article relates to the competition between electricity and gas for street lighting. (Page 581.)

AMONG the specifications published by the Patent Office on Thursday last was one by V. Colin and M. Jeance for an oscillation generator for wireless telephony, in which the arc is struck between copper and carbon electrodes in a gas or liquid.—The Felten and Guilleaume-Lahmeyerwerke A.-G. protect the insertion of devices in lamp bulbs which will indicate how long the lamp has burned, and thus afford a check on complaints.—An appeal has been lodged against the decision to grant C. H. Weber a patent for a process of preventing the oxidation of tungsten powder.—On appeal, a patent has been granted to W. Schwarz for an exhaust steam accumulator in which the steam is brought into intimate contact with the water by breaking up the latter. (Page 582.)

A LETTER from Mr. Frank Broadbent contains further criticism of the rule that only corporate members of the Institution of Civil Engineers shall be admitted to the newly-formed Association of Consulting Engineers. (Page 583.)

THE Aberdeen Electrical Engineer recommends reducing the charge for heating from 1½d. to 1d. per unit. —A motion calling upon the Bexley Tramways Manager to resign has not been carried by the Council.—Sunderland Corporation are to institute a Sales Department on the lines of Marylebone and West Ham.—Coventry and Barrow Corporations contemplate purchasing the local Tramway Companies.—The question of gas *v.* electricity for street lighting is attracting much attention in Harrogate.—Overcrowding on the Plymouth tramways is being inquired into by the Board of Trade. (Page 584.)

Dartford Corporation propose to borrow £11,000, and the Potchefstroom (S.A.) Municipality £20,000. The Transvaal Gold Mining Estates, Ltd., require a large power plant, and transformers are required at Dublin. An electrical installation is to be erected at the Buenos Aires Customs House at a cost of £22,000. A loan of £22,268 is required at Stalybridge. (Page 585.)

ARRANGEMENTS FOR THE WEEK

SATURDAY, SEPTEMBER 10TH.

Mining Institute of Scotland.

9 a.m. Annual Excursion to Broxburn. Inspection of electrical installation at Broxburn Oil Works.

TUESDAY, SEPTEMBER 13TH.

National Electrical Manufacturers' Association.

2.30 p.m. Committee meeting at Balfour House, Finsbury Pavement, London.

WEDNESDAY, SEPTEMBER 14TH.

Institution of Mining Engineers.

11 a.m. Annual general meeting at University College, Nottingham. Among the Papers to be read is "Progress in the Use of Exhaust-Steam Power," by J. Burns.

Institute of Metals.

Meeting at the Engineering and Machinery Exhibition at Olympia.

SATURDAY, SEPTEMBER 17TH.

Institute of Marine Engineers.

Meeting at Engineering and Machinery Exhibition, Olympia.

AMALGAMATION OF THE A.E.G. AND THE LAHMEYER COMPANIES

AN official communication issued by the Allgemeine Elektricitäts-Gesellschaft announces that the Felten & Guilleaume Lahmeyerwerke A.-G. has disposed of the electrical machinery works at Frankfort-on-Main to the A.E.G. in return for an issue of A.E.G. shares. The works will be made over to the A.E.G. in the form of a company with a share capital of £500,000, and reserves of £150,000, which will take over the buildings and plant. The Felten & Guilleaume Co. (which will drop the name of Lahmeyer from its title) will devote itself exclusively to cable and wire manufacture, as before the amalgamation with the Lahmeyer Co.

The A.E.G. has only consented to take over the works under the provision that shares to the value of 32 million marks (£1,600,000) of the Felten & Guilleaume Co. (out of the total of 55 million marks) are made over to it, and the Bank für elektrische Unternehmungen, Zürich, conjointly. As stated in our notice of the exchange of shares between the Elektricitäts-A.-G. and the Zürich Bank (ELECTRICAL ENGINEERING, August 11th, 1910, p. 523), the A.E.G. holds the controlling interests in this Bank, so that the A.E.G. will in future also have the controlling influence over the Felten & Guilleaume Co. itself, and its cable manufacture at the Mülheim Works.

A general meeting of the A.E.G. company will be called on October 15th, and an increase of the capital by 30 million marks, to bring it up to 150 million marks (£6,500,000), will be proposed. The new shares will be applied as follows:—One-third to the purchase of the Frankfort works, and the remaining to the acquisition of 16 million marks of shares of the Felten & Guilleaume Co., which, with the 16 million marks recently acquired by the Zürich Bank, make up the total of 32 million marks controlled by the A.E.G. At the meeting of the Felten & Guilleaume Co. on the same day, the conversion of the Frankfort works into an independent company, and the transfer of its shares to the A.E.G., will be proposed, as well as the change of name of the Mülheim undertaking to the Felten & Guilleaume Carlswerk A.-G.

At present it is premature to forecast the alterations that will be made in the corresponding companies in this country. A few weeks ago, Mr. R. R. Todd, who has hitherto managed the Lahmeyer Electrical Co.'s cable department, made arrangements with the firm that he would start business on his own account, retaining the agency for Felten & Guilleaume cables, and possibly taking up other agencies. No arrangements have yet been made with regard to the working of the A.E.G. Electric Co., the Lahmeyer Electrical Co., and the Electrical Co. under the new conditions.

Bonus System at Aberdeen.—Mr. J. A. Bell, City Electrical Engineer at Aberdeen, has reported to his committee in favour of instituting a bonus system for the electricity works staff. He regards such a system as having an important bearing upon reducing the works costs.

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Electric Cooking.

The illustration below shows a new pattern of electric oven which is being introduced by Bertram Thomas (Worsley Street, Hulme, Manchester). An important feature of the oven is a special interior construction inducing a true circulation of air, which ensures a uniform heating of the contents and results in a higher economy. The resistance wire heating elements are fixed under a horizontal metal sheet, which is extended up the back of the oven to within a few inches of the top. The narrow passage between this vertical sheet and the back of the oven induces a continuous circulation of the air, which passes down over the contents of the oven, and returns to the heating elements through apertures in the front of the horizontal metal sheet. This circulation of the air prevents the lower portion of the oven from getting unduly



Gray's Patent Oven.
(Bertram Thomas.)

hot, and ensures a thorough and uniform heating of the whole oven. Other novel features are a small incandescent lamp inside and a window, the provision of which renders it unnecessary to open the door of the oven until cooking is completed. A thermometer shows the interior temperature, which can be regulated to suit the particular class of food being cooked. Double walls of sheet metal, with fibrous insulators, are provided, to reduce the loss of heat by radiation. We have been supplied with the following particulars as to working and cost. Tests made in a customer's house on an oven measuring 17 ins. by 18 ins., by 19½ ins. inside, and taking 10 amperes at 230 volts, showed that the temperature was raised from cold to 350° Fahr. in 25 minutes. For meat, the temperature should be from 360° to 370° Fahr., while the highest temperature necessary is not more than 375° Fahr. The usual procedure is to heat the oven up with 2000 watts for half an hour, when the temperature will be some 360° Fahr. The food is then placed in the oven, and the heating units placed in series by switching over the double-pole throw-over switch. The oven then consumes some 500 watts, which is usually sufficient to maintain the required cooking temperature. Thus at 1d. per unit, the heating up costs 1d. and the cooking ½d. per hour. We understand that the oven retains its heat so well that after the current has been switched off altogether, pies, cakes and bread, &c., could be cooked without supplying further heat. The oven on which the above test was made is installed in a pantry adjoining living rooms, in a position where it would have been quite impossible to install a gas oven. One of these ovens can be seen in daily operation in the electric kitchen of Oetzmann & Co.'s "week-end cottage" in the grounds of the Japan-British Exhibition, London. It is exhibited there together with a patented distributing board for domestic apparatus. The board can be fastened on a dresser or table, and contains all the switches and plugs. The flexible wires to the various apparatus are kept taut by a system of pulleys and counterweights behind the board.

The General Electric Co., Ltd. (71 Queen Victoria Street, London), have brought out a new pattern of heavy cast-iron cooking range, in the design of which the company have had the co-operation of Mr. Holmes, of the Marylebone Electricity Supply sales department. As shown in our illustration, it is similar to a gas cooker in appearance, and is of equally substantial construction, being built almost entirely of cast iron and weighing some 5 cwt. It is 36 in. in height by 21 in. wide by 20 in. deep. The oven has an inside measurement of 20 in. by 16 in. by 15 in. A heavy lagging is provided, and the interior sheet-metal lining is enamelled to facilitate cleaning. For the same purpose, the side supports of the shelves and the shelves themselves are removeable. The bars or rods of the latter run from back to front in order that dishes may not catch in them and tilt up. There are two heating elements of the Archer pattern, one on each side. Each consists of a helix of spiral resistance wire fixed to china supports on a Stellite plate. This is protected inside by a sheet of perforated metal, and is attached to the heavily lagged round cast-iron plate seen in the illustration. The whole can be easily removed and the element repaired or replaced in a few minutes. The connections are arranged so that parts or all of both elements are on at the same time, and the two switches provide three heats, corresponding to 800, 1,600, and 2,400 watts respectively. Although the wires run at a bright red heat, they do not readily oxidise, and are stated to have a very long life. The top plate contains a 1,000-watt grill, consisting of a rectangular heating element mounted face downwards, so that the heat is thrown down direct on to the meat or toast on the grill. At the back are two hot plates, consuming 800 and 1,000 watts respectively. In these the heating element consists of resistance wire wound zig-zag, and embedded in an enamel coating on the underside of the plate. Lagging is provided under the heating element in these, and above in the case of the grill. Food can be kept hot or plates warmed in the space between the top plate and the oven. The switches are of the Hart rotary quick break pattern. Though the total capacity of the range is some 6 kw., the maximum demand



Cooking Range.
(General Electric Co.)

is said to be not often more than 2·5 kw. Ordinary kitchen utensils can be employed, but a special set of light saucepans, kettles, steamers, etc., is supplied at a low cost in tin or copper. We understand that the General Electric Co. have already sold between 40 and 50 of these ranges. The Marylebone Electricity Supply Department has purchased 24, and lets them out on hire to consumers at 7s. 6d. per quarter in order to encourage electric cooking. The company will shortly introduce a modified pattern with the switches and an indicating lamp on a separate board.

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Lamps, Fittings, Switches, and Accessories.

The WARDLE ENGINEERING CO., LTD. (196 Deangate, Manchester) are developing several new designs of fittings, in addition to their now familiar "Streetlite." The "Beatark" fitting (see opposite page) is designed for cases in which wide diffusion of light is required, rather than concentrated deflection. It consists of a curved reflector of polished aluminium heavily lacquered, or of white enamelled metal, covered by a spun zinc top. Provision for the lampholder is made inside the fitting, so that only the lamp projects. This fitting is supplied in diameters of 12 ins. upwards for single lamps, or in diameters from 18 ins. upwards for groups of five or seven lamps; the larger type has been designed with the assistance of Mr. Cameron Gibson, the electrical engineer of Nuneaton, and the fitting also meets the present tendency to eliminate globes. A pattern of the "Streetlite" is also now made with a spun metal reflector instead of a globe. Another illustration shows a "converted" arc lamp. We also illustrate two internal fittings made by the same company. The "Deflectorlite" is a form of cluster fitting which will frequently be found convenient, either as a ceiling fitting or suspended by tubing or a chain in warehouses, docks, &c. The size illustrated can take up to twelve 50-c.p. lamps. This fitting is of zinc or aluminium enamelled green on the top, and either white or polished and lacquered underneath. The "Drawlite" is an inverted fitting for drawing offices, &c., 24 ins. in diameter and of enamelled zinc. A lampholder at the bottom is intended for an independent lamp for use when the indirect lighting is not required, or for a plug adapter. A feature of all these fittings is their moderate price.

A new line of switches has been introduced by the GENERAL ELECTRIC CO., LTD. (71 Queen Victoria Street, London), under the name of "Salford" Type Ironclad Switchgear. This gear is manufactured at Witton, and comprises two- and three-pole switches in iron boxes, with or without fuses. Special ammeters and voltmeters in cast iron cases can be attached direct to the switch-cases. The gear, either in its separate parts or combined, is made in three sizes, for 60, 100, and 200 amperes, the switches and switch fuses are supplied either two- or three-pole, the fuses are made single-pole only, and the switches and fuses are also made in 15, 30, and 60 ampere sizes. All the gear is suitable for 500-volt circuits, and the cases are watertight and fool-proof, the covers being interlocked with the switch. As can be seen from the illustrations, the gear has a substantial appearance. One of our illustrations shows a two-pole 100-ampere switch combined with fuses. These are of the porcelain expulsion type, and are boxed in with fire-resisting insulating partitions. Our top illustration is of a 50-ampere switch fuse with an ammeter attachment. Another illustration shows a convenient ironclad fuse-box, with carrier fuse, which is used where separate switches and fuses are preferred.

Among other novelties placed on the market by the General Electric Co. are various patterns of reflectors for small Osram lamps fitted with double-ended lamp holders, as shown in the illustrations. These are adapted for either series or parallel wiring. One of the fittings illustrated is a simple brass bracket for two 17-watt lamps, suitable for office desk lighting, and the other is a strip reflector for shop lighting.

JOHN DUGDILL & CO. (Failsworth, near Manchester) have introduced a new pattern of dining-room pendant with joints giving facilities for raising and lowering the fitting and moving it laterally in all directions. This enables the position of the lamps to be altered to suit the position of the dining table when extended or moved out of the normal position. As shown in the illustrations, the fitting has three Dugdill patent joints, by which it is held firmly in any position without either counterweights or springs. The position can be instantly altered in any direction, but the fitting is quite rigid, and retains the new position. Three lampholders are provided in the stock pattern, which is supplied ready wired. Its normal length is 3 ft. 6 in., but it extends a further 1 ft. 6 in. The finish is polished or bronzed brass, oxidised brass, oxidised copper or silver, or gilt, as required.

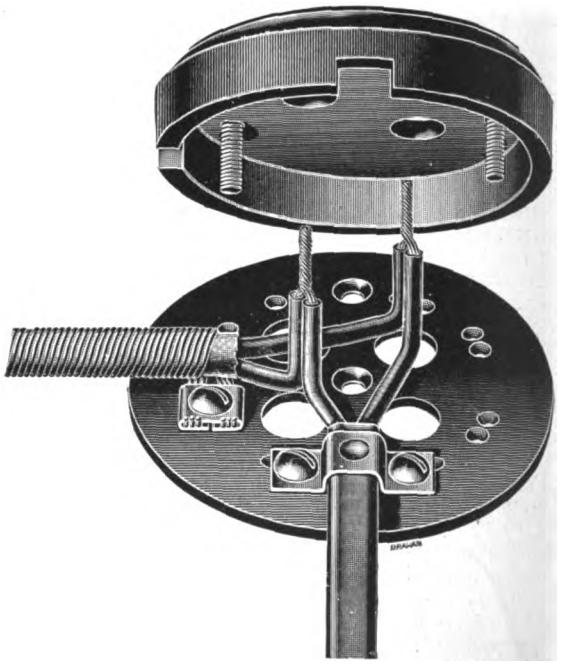
A complete list is now to hand of the Tungsten lamps made by the IMPERIAL LAMP WORKS (BRIMSDOWN), LTD. (Kingsway House, Kingsway, London, W.C.), at their works in Brimsdown, Middlesex. The filaments are produced by the colloidal process. The following are some of the standard sizes: 200—260 volts: 32 watts, 22·5 British candle-power; 40 watts, 28·5 c.p.; 55 watts, 45 c.p.; and 90 watts, 72 c.p. 100—135 volts: 17 watts, 14·5 c.p.; 25 watts, 22·5 c.p.; 32 watts, 28·5 c.p.; 55 watts, 45 c.p.; 80 watts, 67·5 c.p. 150-155 volts: 25 watts, 22·5 c.p.; 32 watts, 28·5 c.p.; 55 watts, 45 c.p. Other sizes for from 25 volts to 80 volts, and candle lamps for 25, 33, 50, 66—80, and 100—135 volts are listed. High candle-power lamps of 100 to 1,000 c.p. and special train-lighting lamps of 5 to 24 c.p. at 16, 22, and 24 volts are also listed.

Arc Lamps.

The BRITISH THOMSON-HOUSTON CO., LTD. (Rugby) have issued a leaflet describing a new improved pattern of enclosed lamp under the name of the "B.T.-H. Intensified Arc Lamp." This lamp embodies many novel features, including an entirely new mechanism permitting the use of carbons of small diameter. With such carbons the arc varies less in candle-power than with carbons of larger diameter, and the carbon tips, as well as the crater, become a source of light. In order to maintain a reasonably long life, two positive carbons, each about one-quarter inch diameter, are used, and these are brought into abutment, and the arc thereby maintained at a predetermined position in relation to the reflector. This arrangement obviates the necessity of regulating mechanism for the upper carbon. Under normal conditions, these lamps burn 50 to 60 hours on one trimming. The lower negative carbon is actuated by the mechanism which regulates the arc. Among the special advantages claimed are a white light suitable for matching colours, a focusing arc, and steady operation. The lamps are designed to burn singly with 100-125-volts, two in series with 200-250 volts, or five in series with 500 volts, on continuous current circuits only. The efficiency of a 5-ampere lamp with single enclosing globe and reflector is stated to be 1·5 watt per mean hemispherical candle-power and 1·04 watt per maximum candle-power, including loss in resistance for 110-volt circuit. The maximum c.p. is at 60° to 70° below the horizontal.

Wiring System.

A cheap system of wiring, introduced by S. W. MARTYN & Co. (11 Pratt Street, Camden Town, N.W.), under the name "M.P." wiring system, has several good points. Twin rubber-insulated wire, either lead-covered or armoured,



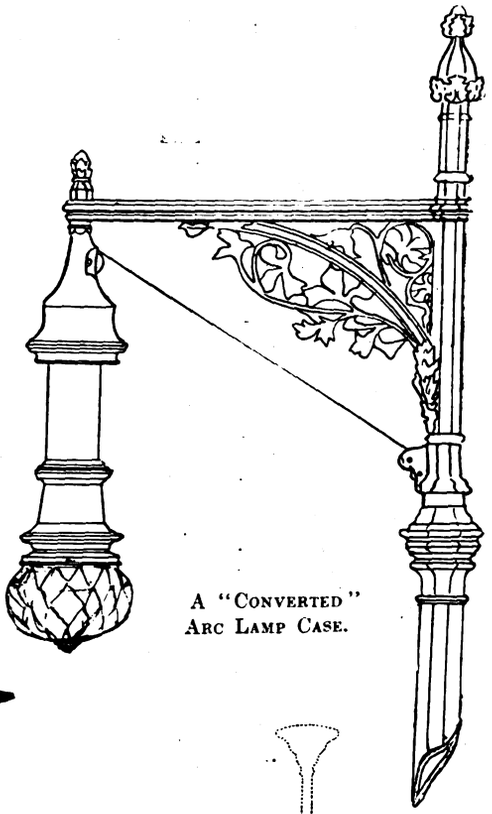
BONDING PLATE FOR M.P. WIRING SYSTEM.

is employed. In the armoured variety galvanised iron wire is lapped round the pair of insulated conductors with a short lay. The two varieties are seen in our illustration of the bonding plate. This plate is the important feature of the system, and serves as a metal back plate to the recessed wooden blocks which carry the switches and any other fittings. It can be used for side entry (as in the illustration), or for back entry by bringing the cables through one or more of the four holes at the back. There are three counter-sunk holes for fixing it to the wall, and eight pairs of tapped holes for screwing down the brass clips which hold the cables. One of each of the two patterns of these clips is seen in the illustration. In the case of the lead-covered cable, the

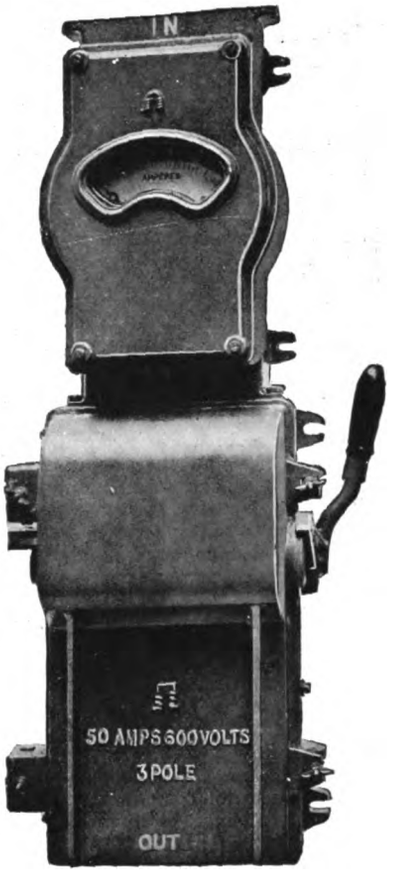
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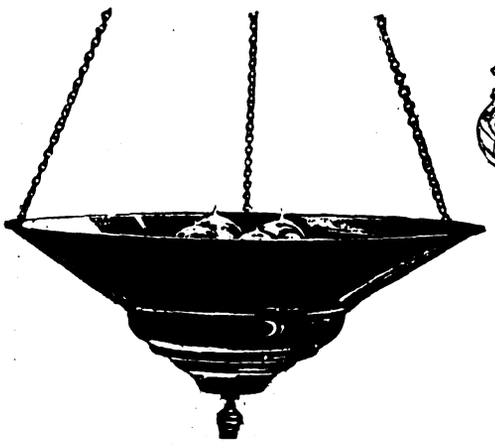
ONE-LAMP "BEETARK."



A "CONVERTED" ARC LAMP CASE.



IRON-CLAD SWITCH AND FUSES WITH AMMETER ATTACHMENT.



THE "DRAWLITE."
(Wardle Engineering Co., Ltd.)

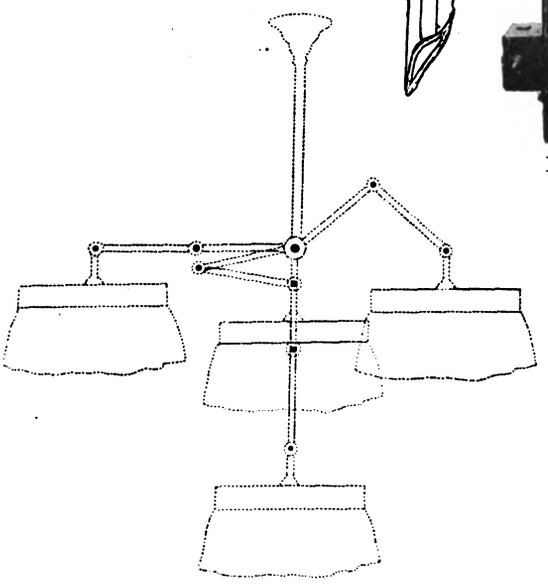
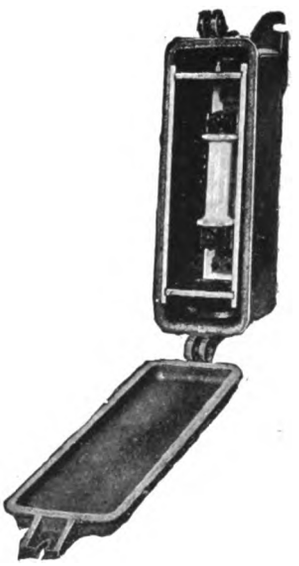
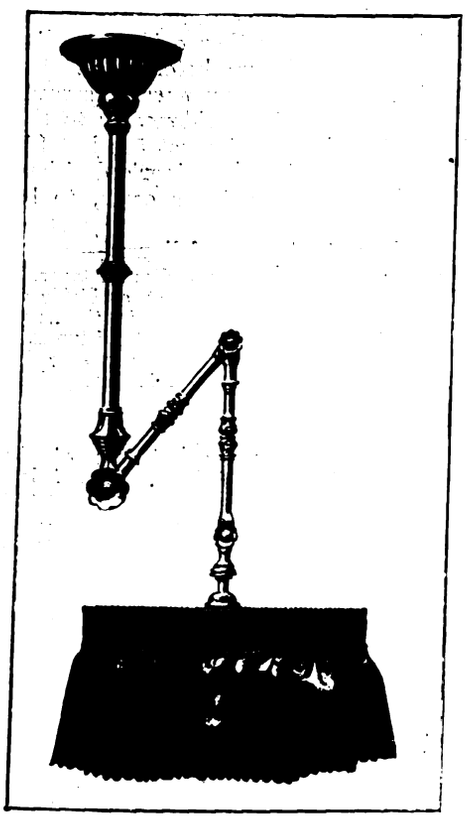


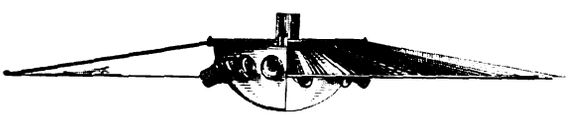
DIAGRAM OF ADJUSTABLE DINING-ROOM PENDANT.



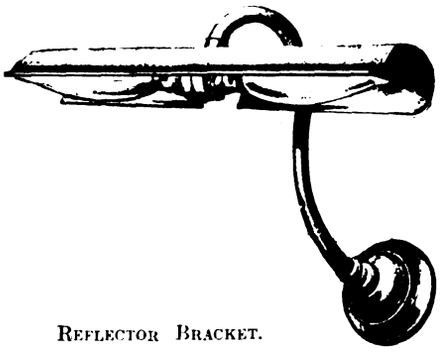
IRON-CLAD CARRIER FUSE.



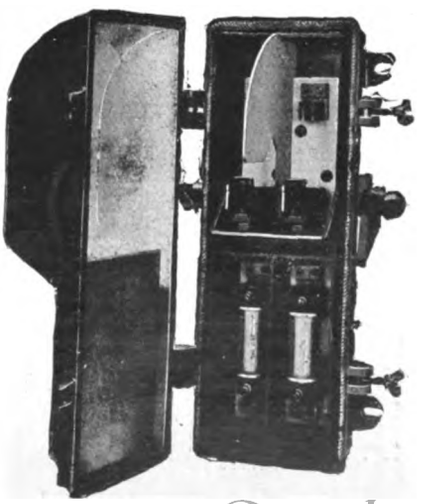
ADJUSTABLE DINING-ROOM PENDANT.
(John Dugdill & Co.)



"DEFLECTORLITE."
(Wardle Engineering Co., Ltd.)



REFLECTOR BRACKET.
(General Electric Co., Ltd.)



IRON-CLAD SWITCH AND FUSES.
(General Electric Co., Ltd.)



STRIP REFLECTOR.
(General Electric Co., Ltd.)

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hole at the top facilitates soldering to improve the bonding; the clip for the armoured cable is a spring washer into which the ends of the galvanised wire are fitted. With back entry, the lead-covered cable is bonded to the plate with two spring washers in a similar way, the lead sheathing of the cable being split into two flat strips for the purpose. The wood block is screwed down to the back plate by a pair of metal screws into any two diagonal holes not required for the bonding clips of the cables. A simple and effective method is also employed for bonding the cables at the distributing boards. Mr. Martyn has also introduced a plug in which a small block of wood is placed between the terminals within the cover of the plug, and is thus forced against the flex inside when the cover is screwed down, so that it acts as an effective cord grip. The switches are fitted with a simple but ingenious device for earthing the covers to the metal back plate. In the specimens of cable shown to us, the pursuit of economy has been carried rather too far, as the rubber insulation is of a distinctly inferior grade. We understand, however, that, in the case of the lead-covered cable at any rate, there will be no difficulty in supplying material of practically any quality. Even with the best cable, the system should be a cheap method of wiring, and a considerable saving in labour costs should be possible. Messrs. S. W. Martyn & Co. have prepared a pamphlet describing and illustrating the system very clearly, and offer to supply copies of it to any of our readers who may apply for it.

Iron and Steel Institute Autumn Meeting.—The autumn meeting of the Iron and Steel Institute will be held at Buxton from September 26th to 30th. The following are among the papers which have been offered for reading:—"On Electric Steel Refining," by Dr. F. Campbell; "On the Preparation of Magnetic Oxides of Iron from Aqueous Solutions," by S. Hilpert; "On the Utilisation of Electric Power in the Iron and Steel Industry," by J. Elink Schuurman. On Monday evening, September 26th, His Grace the Duke of Devonshire will hold a reception and concert in the Pavilion, and on Tuesday morning, when the reading of papers and discussions will be commenced, the Chairman of the Urban District Council will accord the Institute an official welcome. The Institute dinner will be held on Wednesday, September 28th, at 8.30 p.m., at the Palace Hotel.

South African Institute of Engineers.—The *Transactions* of this Institution for June, 1910, contains a Paper by G. A. Webb on the subject of the earthing of armoured cables and electrical machinery and switchgear with especial reference to mining practice. The discussions of this and other Papers dealing with underground winding plant at the New Modderfontein Co.'s gold mine, maintenance of electrical plant in a gold mine, rotary converters and protective devices, are also included.

Canadian Pacific Railway.—According to *Electrical World*, the Canadian Pacific Railway Co. is considering plans for the electrification of a portion of its old steam line to Prescott and the formation of an electric railway belt line around Ottawa in connection with the Hull Electric Railway, controlled by the Canadian Pacific Railway, for the purpose of creating at Ottawa a large industrial area for manufacturing sites.

Electric Traction in Paris.—It is stated that the French Government has allotted a large sum for the electrical equipment of the St. Lazare Station and the suburban lines about Paris. This is stated to have been found necessary owing to the congestion due to the increasing traffic. It is expected that the capacity of the terminal stations will be increased by some 33 per cent. by substituting electric for steam operation.

New Aluminium Alloy.—According to the *Times*, Messrs. Vickers, Sons, and Maxim's have succeeded in producing an aluminium alloy as strong as steel, and only slightly heavier than aluminium. It can be rolled, drawn, and forged, and is less corrodable than other aluminium alloys. The firm have taken out patents for this alloy, which they call "Duralumin," and will, it is said, manufacture it in large quantities at Birmingham. It is expected to be on the market in October.

Scottish Exhibition, Glasgow, 1911.—An exhibition of National History, Art, and Industry will be held in Kelvingrove Park, Glasgow, from May to October next year. A large hall will be set apart for engineering, scientific, and industrial exhibits, and a special building to be called the Kelvin Hall will be devoted to electrical apparatus and machinery. The "Lord Kelvin Electrical and Engineering Committee," with Prof. Andrew Gray and Mr. J. G. Gray as conveners, will be responsible for this section. Electricity supply at 250-volt and 500-volt D.C. will be available. Further particulars and space-application forms can be obtained from the Manager, Mr. W. H. Knight, 190 West George Street, Glasgow.

THE MANUFACTURE OF METAL FILAMENTS

Important Patent Decision

LAST week's Official Journal of Patents contains the brief announcement that the grant has been allowed of patent No. 15,021/1906. This unobtrusive notice, however, actually makes public the result of a decision with regard to metal filament lamp patents that may have far-reaching importance.

The patent in question was applied for on July 6th, 1906, by the Consortium für Elektrochemische Industrie Ges., of Nuremberg; the date of the corresponding German application was July 5th 1905. The process covered is that of heating the formed tungsten filament to a temperature close upon its melting point before it is employed in a lamp, in order to drive off any impurities and to render it denser. This may be accomplished by external heating or by passing a current through the mounted filament before sealing the bulb.

On acceptance and publication of the specification in February, 1907, the grant of a patent was opposed by Drs. A. Just and F. Hanaman, and by the Deutsche Gasglühlicht A.-G. (Auergesellschaft). The former claimed that the invention was covered by their patent, No. 23,889 of 1904, and the latter put forward six patents, including the above, as anticipating the invention. In his decision granting the patent (dated July 25th, 1907) the Chief Examiner, Mr. H. Hatfield, acting for the Comptroller, considered each of these patents separately. He concluded that though the raising of metal filaments to a white heat, or some 1,400° C., for various purposes, was covered, there was no suggestion of the employment of a temperature near 2,800° C., the melting point of tungsten, and that the subjection of the tungsten filament to such a high temperature before sealing the bulb constituted an invention.

Both opposing parties appealed to the Law Officer from this decision, and the matter came before the Solicitor-General, Sir S. T. Evans, on May 21st, 1908. The hearing was adjourned for further evidence to be filed, and the case was brought up before Sir Rufus Isaacs on April 28th, 1910. Judgment was reserved, and leave was given to file further evidence as to the melting point of tungsten, but on August 5th last Sir Rufus Isaacs affirmed the Chief Examiner's decision, dismissing the appeal with ten guineas costs, to be paid by the appellants.

The two claims of the patent are as follows:—

(1) A process for producing incandescent bodies of tungsten which consists in heating the said body almost as highly as its melting-point previous to its being employed in the lamp.

(2) A process for producing incandescent filaments of tungsten which consists in heating the said filament almost to its melting-point by means of electricity before it is employed in the lamp.

Obituary.—Mr. W. Anderson, Managing Director of the Dublin United Tramways Co., died on Wednesday of last week in Dublin. He was manager of the company for many years before his appointment as managing director in 1896.

Rubber Exhibition, 1911.—The second International Rubber and Allied Trades Exhibition will be held at the Royal Agricultural Hall, London, from June 24th to July 11th, 1911. The exhibits will illustrate the cultivation, preparation, and various uses of rubber, and the manufacturers' section will include electrical goods manufactured partly or wholly of rubber, gutta-percha, balata, asbestos, vulcanite, or ebonite. The German manufacturers are supporting the exhibition, and French and Dutch Committees are also preparing exhibits. Applications for space and further particulars should be made to A. Staines Manders, organising manager, 75 Chancery Lane, London, W.C.

Theft of Electric Lamps.—At Marlborough Street Police Court on Thursday last two counter-assistants were charged with stealing lamps, &c., to the value of £12 from their employers, the General Electric Co. (Queen Victoria Street), and two electricians and another were charged with receiving these, knowing them to be stolen property. It appeared that a systematic arrangement of stealing and receiving had been carried on for several weeks. Various sentences of imprisonment were passed on all the prisoners, with the exception of one of the assistants, who was placed under the Probation Act for three years.

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THE MUNICIPAL WIRING BILL

WE have already published in our issue of August 18th a list of towns which had undertaken to give their support to the Bill to be promoted next session for giving Local Authorities power to wire houses for electric light and power, and to hire and sell fittings, &c. A few more towns have expressed themselves in favour of the Bill, and at the time of going to press the position is as follows.

The following towns have promised financial support:—

Barnes, Barrow, Blackpool, Bolton, Bradford, Bristol, Cardiff, Coventry, Croydon, Devonport, Dewsbury, Doncaster, Eastbourne, Eccles, Edinburgh, Gillingham, Glasgow, Govan, Greenock, Hastings, Ilkeston, Ilford, Londonderry, Lincoln, Maidstone, Middlesbrough, Peterborough, Portsmouth, Rochdale, St. Helens, St. Marylebone, Sheffield, Taunton, Walsall, West Ham, Wimbledon, Wigan, Wolverhampton.

The following will give their "moral" but not financial support:—

Birkenhead, Bray, Broughty Ferry, Bury, Canterbury, Colne, Dartford, Exeter, Falkirk, Fulham, Hackney, Halifax, Loughborough, Shipley, Southend-on-Sea, Warrington, West Bromwich.

The following towns have expressed themselves in favour of the proposal:—

Brighton, Carlisle, Darlington, Keighley, Swindon.

The following towns have decided to take no action:

Aberdeen, Batley, Epsom, Farnworth, Grimsby, Hammersmith, Ipswich, Liverpool, Salford, Southwark, Sutton Coldfield, Tunbridge Wells.

In Derby the matter is being considered again. Hull has decided not to support the wiring clause, but to support the clause relating to stand-by supply and supply by unauthorised undertakers; and Mansfield are taking no action as they are among those towns who already possess the necessary powers to do wiring.

It must be noted that a large number of the Borough Electrical Engineers and Committees who are in favour of the Bill being passed, have yet absolutely no intention of carrying out house wiring in competition with local contractors. They appear, however, to consider it important to be in a position to do wiring work themselves in exceptional circumstances, and they consider that they will have a freer hand in canvassing and be in a better position when they approach new consumers if they are competent to do house wiring themselves if need be. Moreover, many regard it advisable to hold their wiring powers *in terrorem* over the heads of the wiring contractors to keep them up to the mark, not only in canvassing for new consumers and pushing the use of electric cooking, heating, and power, but also as regards the general technical efficiency of the actual wiring work done.

Even Mr. A. H. Seabrook, of Marylebone, takes up the position that so long as the work is done properly, he does not care a bit who carries it out. One of Mr. Seabrook's points, however, is that unless his department at any rate supervises the installation or has it carried out to their specification, there is a danger of insufficient copper being placed in it, so that there may be subsequent difficulty in encouraging the consumer to go in for electricity largely for heating and cooking. Upon receipt of information with regard to new buildings being erected or alterations being carried out, the Marylebone Borough Council immediately writes the owner, pointing out to him the advantages of electricity supply, the cheapness of electric light with the new metal filament lamps, and the rapid strides in public favour which are being made by electric heating and cooking. He invites the owner to inspect the Borough Council's showrooms, and offers to supply him with apparatus on hire, hire-purchase, or approval, adding that arrangements can also be made for supplying the wiring installation on rental system if required.

It would be interesting to know how many wiring contractors are equally energetic; we publish in each issue of ELECTRICAL ENGINEERING a list of important additions and alterations which are projected all over the country, and yet it is surprising how few electrical contractors there are who act immediately upon this information.

As an instance of towns having wiring powers and yet encouraging the local contractors rather than organising a wiring department themselves, we may take that of Bristol. In this town a hire-purchase system of installation is offered by the Corporation, and the contractors themselves canvass for it to some extent. The work is in all cases done through a contractor, and the Corporation does no wiring work at all.

Other towns also constantly send out to the contractors in the district valuable information with regard to prospective work, and realise to the full that the interests of the contractors and the Electricity Supply Department are to a large extent identical.

MOTOR AND DYNAMO BREAKDOWNS

THE annual report of Mr. Michael Longridge, chief engineer of the British Engine, Boiler, and Electrical Insurance Co., Ltd., contains the usual statistics relating to breakdowns of machinery in 1909, details of unusual failures, and reports of trials carried out by the company. After complaining of the neglect of attendance to small gas engines, which results in a very large percentage of breakdowns with this class of engine, Mr. Longridge gives a number of typical instances of failures of steam and gas engines, and these are followed by statistics of electrical breakdowns. The electrical machines insured increased in number, as compared with 1908, by 9·8 per cent., but the breakdowns actually decreased by 4·1 per cent., and the cost of the repairs by 9·5 per cent. The rates of breakdown among the machines insured were: D.C. generators, 1 in 17·2; alternators, 1 in 17·5; D.C. motors, 1 in 8·2; A.C. motors, 1 in 9·5; starters and controllers, 1 in 25. With these may be compared the rate of breakdown with steam engines and turbines, which was 1 in 10·2, and with gas and oil engines 1 in 10·4.

Of the breakdowns of dynamos, 40 per cent. were due to failure of the rotating armature or rotor, and the same part was responsible for 37 per cent. of the failures of motors. Commutators and slip rings caused 29 per cent. of the dynamo failures and 27 per cent. of the motor failures. Stationary coils as D.C. field coils or A.C. armatures accounted for 12 per cent. of the dynamo and 20 per cent. of motor failures. Three per cent. of the dynamo and four per cent. of the motor accidents were due to brush-gear and terminals. Mechanical failures were 16 per cent. in the case of dynamos and 12 per cent. in the case of motors. Of the failures of starters and controllers, 52 per cent. were caused by the resistance coils, 9 per cent. by the contacts, 21 per cent. by the relays and release coils, and 18 per cent. by mechanical failures. Over 85 per cent. of the machines insured are motors. The breakdowns of the D.C. motors are mostly due to armature or commutator failures, while failure of the starter coils accounted for half of the breakdowns of A.C. motors.

A curious fact brought out by the tables is the large increase in the number of cases where the primary cause of the damage resulting in a breakdown is unascertained. The figures are 35 and 43 per cent. for dynamos and motors respectively, as against 23 and 26 per cent. as the average for the seven years previous to 1908. The cases of accidental damage, overloading, and deterioration due to age have decreased, while those accounted for by bad work or design have increased slightly. Dirt and neglect account for 20 and 26 per cent. of the 1909 breakdowns for dynamos and motors respectively. Almost exactly similar tendencies are shown in the corresponding figures for starters and controllers.

Among the descriptions of typical breakdowns appended is the case of a dynamo in which a short-circuit of some commutator bars was caused after two years running by a ferrule from the handle of a file, which must have been dropped in when the machine was made. In another case, a fault between some armature coils and the cast-iron drum for supporting them was caused by the blood from three mice which had crept into the armature and had been thrown out against the coils by centrifugal force. A case of an induction motor is cited in which much trouble was caused by the rotor being forced into contact with the starter, when running only, by the pressure exerted by gear, the bearings having been worn considerably. Piercing of the shields over the stator windings so as to allow inspection of the gap is recommended. Another breakdown with an 11,000-volt induction motor was found to be due to the destruction of the insulation by nitric acid formed by decomposition of the air by brush

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discharges. As the presence of moisture is necessary for the formation of acid, adequate protection can be obtained by enclosing the conductors in waterproof tubes and sealing them at the ends to prevent the egress of air or moisture. Finally, Mr. Longridge emphasises the importance of refraining from touching high-tension apparatus for some ten minutes after disconnection from the supply, so as to allow the electrostatic charge to leak away. Discharging to earth before touching is recommended. The rest of the report deals with boiler accidents and trials of steam engines. A report of a test on a 500-kw. exhaust-steam turbo-generator is included.

THE WIRING CONTRACTOR'S POINT OF VIEW

MANY consumers will doubtless be consulting their wiring contractors with regard to a circular letter which has been issued by the Metropolitan Electric Supply Co. This company, which supplies large shops and houses at 100 volts, has been hard hit by the reduction in output due to the extended use of metal filament lamps, and has notified its consumers that the price of current for lighting will be increased from 5½d. to 6d. per unit to those consumers who are not prepared to avail themselves of the company's new "Contract" tariff. The "Contract" tariff is the fixing of a minimum annual charge, depending on the size and nature of the installation. The consumer is to pay this in quarterly instalments, and it entitles him to twopenny units up to this minimum, after which 1d. per unit only is charged. As a definite "quotation" of the minimum charge will be made to each consumer applying for particulars, it will be possible to calculate from the previous year's consumption whether the acceptance of the new tariff or the payment of 6d. per unit will be the more economical, but it must be borne in mind that if the two totals are not very divergent the acceptance of the contract rate would enable the consumer to employ electricity for heating and cooking or to increase his consumption in other ways at a small cost. It is obvious that for the same cost three times the number of units can be consumed at 2d. as at 6d. If a consumer uses, or estimates that he will use, 400 lighting units per annum, and the quotation for the minimum annual charge is £12, it is true that he would save £2 on the sixpenny tariff, but he could have an additional 1,040 units for the extra £2, and it would probably pay him to accept the "Contract" offer and to use electricity largely for heating and cooking. By the way, a useful rough and ready short cut for forecasting the probable consumption of new consumers is to multiply the candle-power of each lamp by the number of hours it will be burnt per diem at this time of the year; on adding up the number of candle-power-hours per diem of the whole installation and dividing by three an approximate estimate of the number of units that will be consumed per annum may be arrived at.

An article in another column deals with the central station man's point of view of the present controversy relating to municipal wiring powers. Although there is no doubt that the proposed Bill will be fought tooth and nail by the Contractors' Association—and rightly so—yet individual contractors should remember that there are two sides to every question. Whether the local authorities obtain wiring powers or not, there is no doubt that the wiring firms can obtain much assistance from the electricity supply department, and that the energetic wiring contractor with a good connection, and doing first-class work, is always regarded as a friend to the supply undertaking. If a condition of almost personal hostility between the contractor and the central station engineer is worked up to, it is the contractor who stakes most, and must be prepared to lose most if the Bill is passed by Parliament. The contractor should remember that a large number of the municipal electrical engineers have no intention at present of putting their wiring powers into force if they obtain them, and although the contractors as a body are quite right to fight the Bill stubbornly in Parliament, little is to be gained by the creation of unpleasantness locally. If the Bill is passed, and every wiring contractor went out "on strike," the supply authorities could soon take over their work; if the Bill does not pass, the wiring contractor, who has abused the municipal electrical engineer and has damned the electricity committee and the whole system of municipal trading, will be in no better position than the one who has gone on working peacefully and has paid his subscription to his association, upon whom he relies to carry on the opposition tactfully and systematically. Local assistance can be afforded by petitioning the members of Parliament for the division, but not by accusing the borough electrical engineer of incompetence and ignorance, and his committee of unfairness and harsh dealing.

The Leicester Corporation is setting a good example to the wiring contractor in the pleasant process of "burying the hatchet." According to the *Electrical Contractor*, the Corporation is accepting the decision of the law courts in the proper spirit, and, recognising that it is to the benefit of all concerned that the wiring of consumers' houses should be proceeded with without intermission, is doing all in its power to assist the wiring contractors. The latter, on their side, have offered to relieve the Corporation of the stock of fittings and wiring material it holds, and a schedule is to be drawn up to assist this process.

WIRELESS TELEGRAPHY

WITHIN the last few weeks, an amalgamation of interests has been effected between the Anglo-German Wireless Syndicate, Ltd., the new company holding the British rights of the Lepel patents, and the Compagnie Générale Radiotelegraphie, the French company who have for some years exploited the Rochefort spark system of wireless telegraphy. By this arrangement the French company will hold the rights of the Lepel patents in France.

Our readers may have noticed in the Patent Record of ELECTRICAL ENGINEERING, August 25th, that the Comptroller-General granted patents, in spite of opposition, to both Baron E. von Lepel and the Gesellschaft für Drahtlose Telegraphie (the owners of the Telefunken system) for transmitters comprising in each case metal plates separated by a ring of paper. We understand that the Gesellschaft für Drahtlose Telegraphie have only obtained their patent (which covers certain special details) on condition that a specific reference is inserted to the Lepel patent, which is of earlier date. As is announced in our Patent Record this week, the decision of the Comptroller to grant the Lepel patent is to be appealed against. The appellant in this case is not the Telefunken company, but Mr. Valdemar Poulsen, who holds that the non-arcing property of the Lepel transmitter is due not, as claimed by the inventor, to the short gap and rapid cooling of the air, but to the presence of hydrogen in the gap produced by the burning of the paper. One of Poulsen's patents covers the use of hydrogen for this purpose.

It appears that the Federal Cabinet of Australia have now definitely decided to place a contract with the Australian Wireless, Ltd., for two stations at a cost of £6,150, this sum not to include land and buildings. These stations are to be at Sydney and Fremantle. The original quotation of this company was £4,150 for stations on the sea coast, but the Admiralty and Defence Department have required that the Sydney station be placed 15 miles inland, for which the contractors are obtaining an extra £2,000, increasing their power plant about 50 per cent., and employing two towers instead of one. The antenna is to be supported on two wooden towers 275 ft. high. These towers will be about 16 ft. square at the base, tapering to 8 ft. at a height of 225 feet, the last 50 ft. consisting of a pole. The earth will consist of a network of copper wires buried in the ground and covering 30 acres. Petrol engines will be employed, and 30-40-kw. generators. The "Telefunken" system is being adopted, and the stations are to be completed in 52 weeks. The guarantee is for a minimum distance of 1,250 miles during day-time.

According to the *Review of the River Plate*, the Compañia Marconi de Telegrafia Sin Hilos report a profit of $65,105 on the past year's working.

It has been stated that the Bill introduced by Sir Edward Sassoon for the compulsory installation of wireless apparatus on all vessels carrying over 50 persons may be proceeded with next year. At a meeting of the North of England Steamship Owners' Association at Newcastle last week, however, the Bill was reported to have been withdrawn by its promoters.

Wireless telegraphy has again played an important part in the saving of life at sea. The *Mauretania* on Friday last received a message from the liner *Devonian* giving brief particulars of the burning of the *Westpoint* in mid-ocean, and as the result of this information the *Mauretania* was enabled to pick up a small boat containing some of the survivors.

Telegraph and Telephone Congress.—On Monday the second International Telegraph and Telephone Congress, at which twenty-two nations are officially represented, was opened at the Sorbonne, Paris, by M. Millerand, Minister of Public Works.

Electric Power in Ontario.—According to the *Times*, the 120,000-volt transmission line of the Ontario Hydro-electric Commission for the supply of power in Toronto from Niagara Falls was worked at full pressure as far as Dundas on Thursday last, and will be in operation delivering power to Toronto on October 1st.

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ELECTRICAL ENGINEERING PAPERS AND DISCUSSIONS AT THE B.A. MEETING

(By Our Special Correspondent)

A NUMBER of electrical engineering subjects were discussed at the meeting of the British Association for the Advancement of Science, held at Sheffield from August 31st to September 7th, although the chief interest was centred in the joint discussion on "Mechanical Flight" by the engineering and mathematical sections, and the account given by Sir J. J. Thomson of the progress of his investigations to ascertain the nature of positive electricity.

ELECTRIC TRACTION.

Electric traction was dealt with by Prof. W. E. DALBY during the course of his presidential address to Section G (Engineering) on Thursday, and by Mr. Philip Dawson in a lantern lecture on the Electrification of the L. B. & S. C. Rly. on Monday.

Professor Dalby's address was entitled "British Railways: Some Facts and a Few Problems." He commenced with some figures to illustrate the large part that railways play in our national life. The capital invested in the railway companies of the United Kingdom is nearly twice the amount of the national debt; the gross income of the companies is within measurable distance of the national income; and to produce this income every inhabitant of the British Islands would have to pay annually £3 per head; over six hundred thousand people are employed by the railway companies; and about eight million tons of coal are burnt annually in the fire-boxes of the locomotives. In 1908 the total paid-up capital of the railway companies was 1,310 millions, and the gross receipts amounted to 120 millions. The net revenue, after deducting the working expenditure, was 43½ millions, corresponding to 3·32 per cent. of the total paid-up capital. At the end of 1908 there were 23,205 miles of line in operation, corresponding to 53,669 miles of single track, including sidings, and 1,278 millions of passengers (exclusive of season-ticket holders) and 491 million tons of goods were carried. In 1907 nearly 515 million tons of goods were carried.

Professor Dalby then analysed the costs, and showed that out of the total working costs (averaged from 1905 to 1908) of 41·68 pence per train mile, locomotive power represented only 12·07 pence per train-mile. He pointed out that if the whole of the locomotive power could be obtained for nothing the average dividend would only be increased by 1¼ per cent., although dividends on the ordinary stock would be increased by about three times this amount. To increase the number of passengers carried is therefore far more important than locomotive efficiency, and therefore on suburban lines the speed of the journey, and the necessity of rapid acceleration of the train after each stop is of supreme importance. An acceleration of thirty miles per hour in thirty seconds is considerably below what may be applied to a passenger without fear of complaint, but it is just about as much as a steam locomotive can do with a train of reasonable weight. But with electric traction the limitations imposed on the steam locomotive by the construction-gauge and by the strength of the permanent way are swept away. The equivalent of the boiler power of a dozen locomotives can be instantaneously applied to the wheels of the electric train, and every axle in the train may become a driving axle. Thus the whole weight of the stock, including the paying load, may be utilised for tractive purposes.

Since December 18, 1890, when the City and South London Railway was opened for traffic, electric traction on the railways of this country has been gradually extended, and at the end of 1908 there were in the United Kingdom 204 miles of equivalent single track worked solely by electricity and 200 miles worked mainly by electricity, corresponding to 138 miles of line open for traffic. Of this 102 miles belong to the tube railways of London and 201 miles to the older system formed by the District and the Metropolitan Railways and their extensions. The total number of passengers carried (exclusive of season tickets) on the 138 miles of electrical track during the year 1908 was nearly 342 millions, being roughly one-third of the total number of passengers carried on all the railways of England and Wales during the same period. The average cost of working this traffic is 22·3d. per train-mile. This figure includes the service of the lifts. The charges work out as follows, in pence per train-mile: Locomotive power 8·40, repairs and renewals of carriages and wagons 1·50, maintenance of permanent way 2·40, traffic expenses 5·22, general charges 1·52, rates and taxes 2·36, Government duty 0·088, compensation 0·116, legal and miscellaneous 0·75. The corresponding total receipts were 38·65d. per train-mile. The working expenses are thus 58 per cent. of the total receipts. Comparing this with the figures for the whole of the lines in England and Wales, it is seen that the cost for locomotive power on the electric railways is about two-thirds of the cost on steam lines per train-mile, the cost for repairs and renewals of carriages and wagons about one-half, and the cost for traffic expenses about one-half. The two kinds of working are not, however, strictly comparable, as all the conditions of traffic in the two cases are different, and the length of the electric lines is relatively so small that the problems which arise out of the transmission of electric power over long distances are excluded. [Those of our readers who desire to study these statistics further can obtain the corresponding figures for 1909 in a "Blue Book" just issued by the Board of Trade.—Ed. *E.E.*]

Professor Dalby then outlined the various systems of electric traction employed, and pointed out, in connection with the H.T. single-phase system used on the Lancaster, Morecambe, and Heysham branch of the Midland Railway and on one of the suburban sections of the London, Brighton, and South Coast Railway, that it has not only shown itself to be quite suitable for dealing with a stopping traffic where quick acceleration is the dominating condition, but it contains the germ of practicable long-distance electrification. The near future, he said, may see the extension of the system to the line between London and Brighton, giving a frequent non-stop service which would bring Brighton in point of time nearer than the suburbs on opposite sides of London are to one another.

The concluding part of the address dealt briefly with power signalling and automatic signalling.

THE SOUTH LONDON SINGLE-PHASE RAILWAY.

Before Section G on Monday, Mr. PHILIP DAWSON described the main features of the South London Elevated Electric Railway. The general characteristics of this line and some details have already been described in our columns (ELECTRICAL ENGINEERING, Vol. V, 1909, pp. 132 and 307). Mr. Dawson said that several objections had been made to the single-phase system. The principal ones were that the single-phase motor gave a low acceleration, was heavier, and had a lower efficiency, involving a greater energy consumption per ton mile, and also that repairs and maintenance were heavier. Experience on the South London Elevated Electric Railway, however, had proved that the acceleration was quite as good as that of the District line and Underground lines in London generally, and that it was a good deal better than that obtained on some other continuous-current systems. This, he said, depended upon the capacity of the generating plant, and was independent of the system adopted. The total extra weight over that for a continuous-current equipment for a complete train did not exceed 10 per cent., and he thought it would probably be found to be nearer 5 per cent. The energy consumption per ton mile was less with single-phase than with continuous-current, being 70 to 80 watt hours per ton mile in the former case, as compared with from 100 to 125 in the latter. There was nothing to give him any reason to think there would be any considerable increase under this head.

In describing a few technical details, Mr. Dawson mentioned that the commutators of the motors had run 50,000 miles without repair. The power factor of the whole system was about 80 per cent. The bows on the cars were controlled by compressed air. The working part of the bow was a grooved aluminium strip filled with grease, and after eight months' use the trolley wires did not show the slightest wear. The aluminium strips ran 15,000 miles before renewing; the cost of renewal was 6s. 8d. Special attention was drawn to the great differences in the height of the trolley wires, this varying from 21 ft. 6 in. to about 10 ft. No

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trouble had been experienced with any of the transformers on the trains, although the circuit was made and broken 800 times per day. Double insulators were used for the first time on any railway, and they had been tested up to 14 tons stress, the maximum working stress being one ton. Electrically they had been tested up to 65,000 volts, and some to 70,000 volts. Even at this pressure the insulators did not break down, but merely sparked over. Some interesting photographs were shown of the erection of the overhead structure whilst the steam-train service was being continued. Ordinarily collapsible ladders were used, but as the work progressed the men would often cling to the overhead wires while the ladders were drawn away to let a train pass. Various forms of suspension were illustrated, the most important departure from standard practice being at Denmark Hill, where there is only 1½ inches clearance between the bow and the coach roof. The catenary wires were, he continued, 12-strand mild steel 0·088 in. diameter, tested to a strain of 10,000 lbs. Every insulator was working in compression. The insulators had horizontal spindles, so that they were cleaned by the rain running off them. By experiment it had been found possible to replace an insulator in three minutes.

With regard to the drop in the return circuit, continued Mr. Dawson, which the Board of Trade had limited to 20 volts, he believed that it was down to 12 or 15 volts. In the main distributing stations at Denmark Hill all the connections were worked by means of signal levers, as the railway staff which had to do the work were familiar with these. An interesting portion of the repair-shed equipment was a petrol electric coach on the auto-mixte system, which is used for inspection purposes and for supplying current for lighting during inspection and on breakdowns, also for testing purposes. In order to reduce the current bill, a sign had been placed at every spot where the motorman should cut off the current before entering a station. It had been found that any failure to do this sent the consumption up by 5 or 10 per cent., and as the current bill ran into many thousands of pounds, it was an important matter that this regulation should be observed. In conclusion, Mr. Dawson pointed out that although the conditions of the line were as bad as they possibly could be, there being rising gradients out of every station, the acceleration was over one mile per hour per second. Further, since the line had been opened there had not been the slightest trouble with the equipment either mechanically or electrically. He did not intend this short review to be a contribution to the question of single-phase *versus* continuous-current traction. No one could say that one system or the other was the best. It depended entirely on the conditions. As to energy consumption of the train, there was very little to choose between the two. But the energy consumption at the power station was a totally different matter, because additional losses occurred in transformation with the continuous-current system.

Dr. SILVANUS P. THOMPSON congratulated Mr. Dawson on the fine piece of work for which he had been responsible, especially in view of the prejudice which still existed against the single-phase system. The end of the single-phase system had not yet come. Only quite recently he was looking at the drawings of a 2,000-h.p. single-phase locomotive. For long-distance work there were obvious advantages in this system.

Sir WILLIAM WHITE and Mr. DUGALD CLERK also congratulated Mr. Dawson, who, in a brief reply, mentioned that, with the exception of the construction under the low bridges, the whole of the equipment was working as originally designed. At Victoria Station, however, the overhead constructional details had had to be reconstructed three times.

THE PRICE OF ELECTRICITY.

A Paper on this subject by Mr. EDWARD W. COWAN was presented to the section dealing with "Economic Science and Statistics" on Thursday. The author contended that electrical engineers were wrong in assuming as a fundamental principle that electricity must not be sold to one class of consumers at a lower percentage profit than to another class. He maintained that a system of attempting to price every part of a supply according to the cost of producing it was scientifically faulty; in fixing a price, Demand, he said, should be the predominating influence. A great potential demand for electricity for power and heat uses, for instance, awaited the sufficient lowering of prices. He had estimated that electricity at three units a penny would compare favourably, for heating, with coal at 15s. to £1 per ton burnt in open hearths. Apparently, therefore, his ideal system would be to supply electricity for power and heating at this price, and to increase the price for lighting sufficiently to make the aggregate income cover the total cost of production, profit, &c., if this price would not be higher than that for which the consumer could obtain his light by other means. An interesting appendix to the Paper reviewed the legal aspect of the question, and gave the opinion, which the author said was endorsed by Mr. Sydney Morse, that "classified" tariffs—after the manner of railway rates—are not illegal.

Mr. S. L. PEARCE (Chief Electrical Engineer to the Manchester Corporation), who opened the discussion, said that he personally was in accord with the abstract principles put forward by Mr. Cowan, but the great difficulty was to translate them into a scientific tariff. Economically, electrical engineers were on unassailable ground in adopting the cost of production as the basis of their charges, but it was a matter for argument as to whether this method enabled the most to be got out of their undertaking. He held the view that some remission might be made in the standing charges to certain classes of consumers whom it was desirable to get on the mains. For instance, seven or eight years ago extension plant was put down costing £8 to £10 per kw., while to-day it could be put down for about £3 per kw., and it would not be fair if the power consumer who had been the means of introducing this extra load, should not have some remission as regards the fixed charge.

Mr. W. B. WOODHOUSE (Chief Engineer to the Yorkshire Electric Power Co.) thought most people would agree that the principle of equal profits from all consumers might quite reasonably and fairly be supported. There were limitations to the policy of charging what an article would fetch. All electric supply undertakings had certain monopolistic privileges. Although the electrical industry suffered from more restrictions than any other, any abuse of the few privileges it now possessed in the way of extorting unreasonable profits from any one class of consumer, might lead to further restrictions.

Mr. S. J. WATSON (Chief Electrical Engineer, Bury) pointed out that if they charged any particular portion of the supply at "by-product" prices, there was a danger of the "by-product" supply becoming the principal production, and this would lead to disastrous results. He did not see any possibility of the principle of charging the same prices to persons using electricity under the same conditions, being departed from.

Mr. A. J. CRIDGE (Assistant Electrical Engineer, Sheffield Electricity Department) expressed disagreement with the author on some points, and

PROFESSOR ASHLEY was surprised that electrical engineers should regard the principles underlying the paper as open to discussion. Electricity supply, he said, was precisely on all fours with railway charges, and, as an economic fact, they must all accept the principle of charging what the traffic will bear.

NEGLECT OF SCIENCE BY COMMERCE AND INDUSTRY.

On Monday, Section B (Chemistry) and Section L (Educational Science) held a joint meeting to discuss the question of the neglect of science by commerce and industry. Mr. R. BLAIR, who opened the debate, had prepared a lengthy paper, in which he referred to the fact that the engineering industry appreciated as much as, if not more than, most others, the training given in the technical colleges; and, thanks to the relations between the principals and the heads of engineering firms in the neighbourhood, the colleges had no difficulty in placing all their best students into works at the end of their training.

One of the main defects of college training was neglect of the question of cost in design and the commercial side generally. All engineering firms existed for the purpose of making a profit, and modern conditions made it essential that all technical students should fully realise the importance of economical design and cheap upkeep. Employers wanted men who could in their designs give the most for the money. It was quite insufficient to teach design on physical principles alone. Methods of production, ease of repair, depreciation, and even conditions of transit in large machines, should all be taught in connection with effective design.

On the other hand, in order that heads of firms should more fully appreciate the need for science in business, he recommended special courses in technical training for them. The present comparative indifference on the part of business men toward science in relation to their businesses, was due to the conflict of interests of the various trades unions, the unsatisfactory state of the law regarding employers, and other difficulties, and nothing short of a far-reaching Parliamentary scheme was likely, as far as his experience went, to alter the situation materially.

He deplored the lack of application of scientific principles to canvassing the various markets of the world, a matter to which attention is being called repeatedly by British Consuls abroad. Another suggestion which the speaker made was that consultative committees should be attached to all facul-

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ties or departments, such committees to be advisory, and to be composed of commercial leaders and business experts of the highest reputation. Probably this was the best way of enlisting the sympathy of industrial and commercial men.

Subsequent speakers included Sir W. Tilden, Dr. H. T. Bovey, F.R.S., late principal of the Imperial College of Technology; Dr. E. H. Griffiths, of Cardiff, Sir William White, Mr. J. E. Stead, F.R.S., and Prof. E. H. Armstrong. Sir W. Tilden thought the greatest ignorance on the part of employers in relation to science was to be found in the electrical and chemical industries. He supported this statement by a reference to the exceedingly low salaries frequently offered to fully qualified men. He also criticised the Government in this connection, and said it was impossible to find an official, from a Cabinet Minister downwards, holding a superior administrative position, who had received an education in which physical science had formed any substantial part. The measure of Parliamentary sentiment in favour of science was to be found in the moderate grants made for this purpose. The Imperial College of Science was quite inadequately endowed. Dr. H. T. Bovey said the only means of securing the universal application of science to industry, was by the organisation and centralisation of technical education. In America it was a *sine quâ non* for a young engineer to have received a diploma in some technical institution of repute before he could obtain employment. Sir William White and other speakers differed from the view that England was behind other countries in the application of science to industry. Principal Griffiths deprecated abuse of the industrial leaders. There were faults on both sides, and the cause of the present unsatisfactory state of affairs was the absence of means of communication between those working in the universities and commercial men. If the universities could not provide the type of men required in business, they must put their house in order. The need for co-operation was supported by other speakers. Sir William White suggested that a laboratory should be attached to all commercial undertakings, a policy which had led to some remarkable results in the steel industry.

OTHER PAPERS AND REPORTS.

On Thursday, the Committee on *Electrical Standards* presented a report upon the experiments that had been made since last year for improving the construction of practical standards for electrical measurements.

On Monday, Mr. H. E. Wimperis described *an accelerometer for the measurement of road resistance*, invented by him and constructed by Messrs. Elliott Bros. The instrument consists of a brass box about four inches across, containing a copper disc mounted on a vertical pivot and "damped" in its motions by a permanent magnet. The centre of gravity of the disc is purposely removed from the axis so that when the box moves forward, one side of the disc tends to lag behind, thus partially winding up a coiled spring and actuating a pointer which moves over a scale. To render the reading unaffected by any accelerations at right angles to the direction of motion, a second parallel axis is fitted, which is geared to the first one, and has attached to it masses having the same mass moment as the disc itself. Couples about these two axes add up in the direction of motion, but neutralise one another in any direction at right angles. The accelerometer therefore reads in one of the three directions of space only, and is not affected by even violent movements in the other two directions. With this instrument the author has measured the road resistance of various classes of road and has obtained figures varying from 50 to 210 lbs. per ton. On main line railways the resistance is usually from 12 to 30 lbs. per ton, depending on the speed. He has also measured the acceleration of practically all the London electric railways with his instrument. The acceleration on the London, Brighton and South Coast single-phase line was 1·9 ft. per second per second, which was identical with the figures given by Mr. Dawson. The braking retardation was found to be 5·8 ft. per second per second, which was about twice that of the Great Northern, Piccadilly & Brompton Railway, which had about the same acceleration. The main use to which the instrument has been put hitherto, however, is in connection with motor-cars.

Another Paper read on Monday, to which more discussion might have been devoted with advantage, was by Dr. H. J. S. Sand, of Nottingham University, on *a new method of hermetically sealing iron wire into glass*. The glass is fused round the iron wire, and while it is still hot a small piece of heated steel tube surrounding the wire is pushed a few millimetres into the glass. After cooling, the steel tube is soldered to the wire. The vacuum tight seal is produced between the glass and the inner surface of the steel tube, which on cooling becomes slightly stretched, and at the same time compresses the glass. He pointed to the great possibilities of this method in connection with electric lamp manufacture, and the saving which would be effected by obviating the use of platinum. It is to be regretted that this Paper was presented in Section A (Mathematics and Physics) instead of Section G (Engineering).

On Tuesday, before Section G, Prof. Silvanus P. Thompson gave a short Paper on *Electro-mechanics*, in which he dealt mathematically with the laws governing electromagnetic apparatus, and pointed out some of the relations between them.

Before Section A on Tuesday, Dr. Charles Chree opened a discussion on *atmospheric electricity*, and dealt principally with the potential gradient existing in the atmosphere, mentioning incidentally the influence of an electric field on the growth of plants, and phenomena of thunderstorms, &c. In the discussion Sir Oliver Lodge referred to the experiments in connection with *electricity in agriculture*, in which he is interested, and mentioned that it had been found that no electricity should be given to the plants in bright sunshiny weather. In dull weather the application of positive electricity had been found to give an increase in the output of the crops of 30 per cent. In one experiment, however, a field of beans, when positively electrified, had been found to give a smaller crop than usual. He had tried to induce the farmer to repeat the experiment with negative electricity, but he would not.

Another Paper on Tuesday was one by Professor Ernest Wilson and W. H. Wilson, on *a new method for producing high tension discharges*. Energy is taken from an alternating or continuous current source and stored in a magnetic field by an inductance; it is then permitted to surge into a condenser, which forms with the inductance a low frequency oscillatory circuit. When the energy is accumulated in the condenser the latter is mechanically bridged across the primary winding of an induction coil, with which it forms a high frequency oscillatory circuit. The energy is then transmitted by the secondary winding of the induction coil to the work circuit, and can be of an oscillatory or uni-directional character according to the purpose in view. The apparatus is intended for radio-telegraphy and X-ray work.

On Wednesday, Prof. Alfred Schwartz described a machine for measuring the hysteresis of *india rubber*, and the application of this test to the determination of various grades of rubber, of the quantity of rubber in a given mixing, of the degree of vulcanisation, and the deterioration due to age or high temperature.

THE STREET LIGHTING IN WESTMINSTER

WE regret to see that the correspondence with regard to the street lighting contracts in Westminster is being continued in the London daily papers, and that the controversy has been extended to the provincial Press also. Statements are still being made by chairmen of gas companies at general meetings and by gas advocates on every possible occasion, giving a one-sided version, and in most cases a misleading one, of the circumstances. We have before us a pile of letters and reports of statements of this character, and the replies of representatives of the electric lighting interests, but we refrain from publishing them. The facts of the case are simple. Sixty-six out of a total of 1,055 electric street lamps in Westminster will be replaced with gas lamps for the next five years at a price practically the same as that for which the electric lighting has been supplied with the arc lamps that are being displaced, and against the wishes of the residents in the street in question. Figures have been published, and their accuracy, we believe, has not been disproved, showing that the gas company will be supplying the new lighting at considerable loss. Moreover, certain conditions of the specification and local circumstances prevented the electricity supply companies concerned from tendering for the whole of the area at the same price as that which had been charged for these 66 lamps, and instead of electricity displacing gas, as is being done elsewhere, the gas interests recovered a little lost ground. These are the plain facts regarding the "victory" for gas that has been proclaimed so loudly all over the country.

In the meantime, as was shown in the article published in our issue of August 25th, electric lighting is rapidly superseding gas for street lighting elsewhere, and not only is the lighting more satisfactory and constant, but it is also cheaper. Figures of actual costs which we published in that article prove this indisputably. The advantage is apparent even for side-street lighting, for which electricity was certainly severely handicapped before the advent of the metal filament lamp. In Marylebone, Hampstead, and Shoreditch gas will soon be displaced entirely by electric lighting in the streets. Our article giving descriptive details of these three street lighting systems—which are typical—is being reprinted in pamphlet form, and we have no doubt that its circulation over the whole country will soon lay the Westminster bogey.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Sept. 1st, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

18,436/09. **Wireless Telephony.** V. COLIN and M. JEANCE (Paris). This specification describes an oscillation generator consisting of several arcs in series, each struck between a water-cooled positive electrode of copper and a carbon electrode some 1 to 5 mm. in diameter. The arcs are enclosed in a chamber in which some insulating gas or liquid is circulated. A variable-voltage D.-C. dynamo supplies current to the generator. An intermediate resonance circuit is employed, and a number of telephones connected in series are connected across that coil of the second oscillation transformer, which is in the aerial circuit. Three figures.

18,590/09. **Storage Batteries.** P. MARINO (London). The lead supports of positive plates are protected from peroxidation by coating them with a composition consisting of a solution of gutta-percha or celluloid to which powdered antimony or graphite or both, have been added. The composition conducts equally as well as lead, and does not crack on bending the lead. Further, it does not cause local action.

24,950/09. **Reflectors for Tubular Lamps.** A. W. BEUTELL (London). The wires are laid along an open metal channel or conduit, which is closed by means of the reflector or a separate cover. The double-ended lampholders are fixed to the wire conduit at suitable intervals. Other constructional details are covered. Nine figures.

2,432/10. **Metal Filament Lamps.** FELTEN & GUILLEAUME-LAHMEYERWERKE A.-G. In order to ascertain whether the complaints of consumers that lamps have broken down after a short period of burning are justified, a substance that is chemically affected by the light, heat, or current is placed in the bulb. The lighting of the lamp will then produce discolouration or some other indication of its proper working. The insertion of checking devices of different degrees of sensitiveness for recording the duration of the passage of current through a lamp, is also covered by this patent. One figure.

6,668/10. **Protective Devices.** BRITISH THOMSON-HOUSTON Co. and E. B. WEDMORE. This patent covers the use of leakage devices in various parts of a distribution system so arranged and set that those controlling sections remote from the source of supply will operate without affecting the supply to the other sections. One figure.

8,409/10. **Ventilation of D.-C. Machines.** SIEMENS BROS. DYNAMO WORKS and W. PARKER. Efficient ventilation of the field coils is secured by an arrangement of guide plates in conjunction with a fan of equal or less diameter than the armature, which causes currents of air to flow axially between the coils. One figure.

Opposition to Grant of Patents

15,021/06. **Tungsten Filaments.** CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE GES. On appeal to the Law Officer, the grant of this patent has been allowed. It covers the process of raising tungsten filaments to a temperature nearly as high as the melting point previous to insertion into the bulbs. See also page 576 of this issue.

3,881/08. **Exhaust Steam Plant.** W. SCHWARZ. On appeal to the Law Officer, this patent has been granted. It covers a heat accumulator with a series of chambers in which water is circulated, and into which the exhaust steam is passed. The water is broken up into drops, so that intimate contact with the steam is ensured.

17,349/08. **Wireless Telegraphy.** E. VON LEPEL. An appeal has been lodged against the decision of the Comptroller granting this patent. It covers the disc discharger of the Lepel system. (See ELECTRICAL ENGINEERING, Vol. V., pp. 434 and 1086.)

8,104/08. **Filaments of Refractory Oxides.** G. MICHAUD and E. DELASSON. As the result of an appeal to the Law Officer, the decision of the Comptroller allowing the grant of this patent has been upheld. (See ELECTRICAL ENGINEERING, November 18th, 1909, p. 976.)

16,528/09. **Tungsten Filaments.** C. H. WEBER. The decision of the Comptroller to grant this patent is to be appealed against. The patent covers a process for preventing the oxidation of tungsten powder. (See ELECTRICAL ENGINEERING, January 6th, 1910, p. 16.)

Application for Restoration of Patent

14,851/06. **Telephone Exchanges.** KJÖBENHAVNS TELEFON-AKTIESELSKAB. Aktiebolaget L. M. Ericsson & Co. have applied for the restoration of this patent, covering apparatus for the automatic distribution of the operating service in telephone exchanges, which expired in June, 1909, owing to non-payment of the renewal fee. Opposition must be entered at the Patent Office on or before October 31st next.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: HIRST and ANGOLD, 29,068/09; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*), 7,821/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BUTLER and GIBBINGS [Cable boxes] 20,067/09.

Dynamos, Motors, and Transformers: SMITH, GREEN and GLOVER [Induction motors] 5,985/10.

Electric Ignition: SIMS MAGNETO Co. (High-tension magnetos) 15,380/09; L. DUTHEIL, R. CHALMERS ET CIE. [Sparking plugs] 1,130/10; BRIGGS, 2,438/10; ZAHRINGER, 10,820/10.

Heating and Cooking: LAKE (*Parker-Clark Electric Co., U.S.A.*) [Heating units] 18,954/09.

Incandescent Lamps: TURQUAND [Battery lamps] 18,756/09; LAKE (*Parker-Clark Eltctric Co., U.S.A.*) [Filaments] 18,954/09; STEVENSON [Boxes for packing metal filament lamps] 26,873/09.

Instruments and Meters: JOHNSON and BILLINGTON [Meters] 16,332/09; FARRAND [Prepayment meters] 19,660/09; BRITISH THOMSON-HOUSTON Co. and D'ARCY [Meters] 6,667/09.

Switchgear, Fuses, and Fittings: HAMER [Lift control] 18,555/09; MEDWAY and SCOTT [Automatic switchgear for remote control of motors] 18,675/09; COWPER-COLES [Reflectors] 19,037/09; MURPHY [Rectifier] 19,030/09 and 3,410/10; BUTLER and GIBBINGS [Conduit couplings] 20,067/09; SHEWARD [Lamp-holder] 26,048/09; WYNNE [Switch] 28,429/09; HIRST and WHITE [Bell pushes] 28,557/09; NEUDÖRFFER [Switch boxes] 5,835/10; ADAMS MANUFACTURING Co. (*Cutler Hammer Manufacturing Co.*) [Switches] 6,160/10 and 6,363/10; BERG [Time-switch] 9,590/10.

Telephony and Telegraphy: LAKE (*Electric Press Bulletin Co.*) [Telegraph bulletin printers] 23,324/09; LEON and LEWIS [Telephone transmitters] 26,779/09; KAJIURA [Duplex telegraphy] 8,141/10.

Traction: LAKE (*Bour*) [Block signalling] 22,319/09; SOC. IN ACCOMANDITA PER L'UTILIZZAZIONE DELLE INVENZIONI ING. BEER [Block signalling] 26,487/09; JONES and INTERCHANGEABLE BRAKE BLOCK Co. [Brake blocks] 26,526/09.

Miscellaneous: VIRY [Apparatus for controlling movements from a distance] 18,847/09; COWPER-COLES [Smoke combustion in furnaces] 20,021/09 and 20,557/09; FAIRWEATHER (*Electric Shoe Polisher Co.*) [Shoe brushing machine] 21,005/09; DESSAUER [Radiography] 23,455/09; GAEDE [Vacuum pump] 27,457/09; BLUM [Electric vaporizer] 2,286/10; HINDEMANN [Illuminated signs] 4,096/10; GRATH and DREXLER [Coin-freed bell alarm] 8,827/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrochemistry: SOC. L'AIR LIQUIDE [Fixation of nitrogen and oxygen at high temperatures] 18,475/10.

Switchgear, &c.: SIEMENS-SCHUCKERTWERKE GES. [Fuses] 18,528/10; WEISSMANN [Lamp-holder] 18,738/10; BEIGE [Lamp-holder] 19,033/10.

Miscellaneous: ALLGEMEINE ELEKTRICITÄTS-GES. [Centrifugal compressors] 17,474/10; KOVATCH [Coal-cutters] 18,135/10.

The following amended Specifications can now be obtained.

MARKS (*Chicago Oil Co.*) [Induction coils] 318/09; CROOKELL [Lamp-shade attachment device] 3,195/09.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: BRITISH THOMSON-HOUSTON Co. (*W. C. Fish, U.S.A.*) [Lamp with two arcs in series] 11,078/02.

Distribution Systems, &c.: G. S. ELLIS and A. M. TAYLOR [Automatic control of storage batteries in distribution systems] 10,495/05.

Dynamos, &c.: BRITISH THOMSON-HOUSTON Co. (*W. M. Dey, U.S.A.*) [Motor-control system for ship-steering gear] 10,275/01; P. M. BOUCHEROT [Reciprocating electric motor] 10,299/05; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Compounding of alternators] 10,555/05.

Instruments, &c.: M. KALLMANN [Iron-wire resistances for testing instruments] 10,202/05; J. M. TOURTEL [Prepayment electricity meter] 10,509/05.

Switchgear, &c.: O. L. PEARD [Fuse-box] 11,404/02; M. KALLMANN [Iron-wire resistances for relays, &c.] 10,202/05.

Telephony, &c.: W. S. STELJES [Printing telegraphs] 11,278/98; P. A. LORRAIN and A. DENNERY [Poles and insulator supports] 9,279/00.

Traction: B. MAGRINI [Tramcar roof] 11,203/02; R. THAYER [Trolley vehicles with storage batteries] 11,264/04.

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CORRESPONDENCE

THE ASSOCIATION OF CONSULTING ENGINEERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Whilst I am in entire sympathy with any movement which has for its object the raising of the status of the consulting profession, I am somewhat doubtful as to the ability of the proposed association to accomplish all that might be desired. My experience tends to confirm the opinions expressed by Mr. Boot in your last issue, and I fear that an association of consulting engineers, whose members are necessarily members of the Institution of Civil Engineers, will be of little or no assistance to the general body of professional engineers who confine their attention to consulting practice.

Membership of the "Civils" is no guarantee of professional integrity, and one is in continual competition with such members who pose both as consulting engineers, and agents or engineers to machinery insurance companies. In the latter connection I may say that I have in my possession a letter addressed to some of my clients by a corporate member of the I.C.E. offering, as chief engineer of a large insurance company, to draw up specifications for electric power work and to supervise its erection for a stated fee, whilst travellers of the same company regularly call on me asking me to recommend clients to insure their machinery with the company they represent.

Similarly, one finds oneself in competition with members of the Institution of Civil Engineers, who on one day act as consulting engineers for public institutions, and on another call as representatives of manufacturing companies to discuss quotations for engineering appliances intended for clients whom later on they will directly approach in one capacity or another.

It is clear, then, that membership of the Institution of Civil Engineers does not carry with it the white certificate of a blameless professional life, and it is therefore difficult to fully appreciate the motive in limiting the membership of the proposed Association to members of the "Civils," as this limitation has the appearance of casting a stigma not only on professional engineers who are not members of that body, but also on the institutions to which they have the honour to belong.

Moreover, the existence of the proposed, or any other, Association will not prevent men who have not the professional instinct from acting unprofessionally, seeing that it is impossible to penalise them in any way; hence the benefits to be conferred by membership must be in other directions than in protecting them against unfair competition.

It therefore behoves those consulting engineers who are yet outside the pale to consider whether or not it is worth while to join the "Civils" in order to qualify for and obtain the advantages of membership of the proposed Association of Consulting Engineers; and, on the other hand, it is for the Council of the "Civils" to consider whether this is quite the most desirable method of recruiting their ranks.

Yours, etc.,

FRANK BROADBENT, M.I.E.E.

4, Queen Street Place, London, E.C.,
September 5th, 1910.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

GAS ENGINES.—A complete new catalogue of gas engines, comprising seven sections, published in March and June of this year, has been issued by Messrs. Crossley Bros., Ltd. (Openshaw, Manchester). The first section contains a number of interesting photographs of the works at Openshaw, with notes on the work of the various departments. Small gas engines of from 1½ to 28 b.h.p. are dealt with in the second section, which includes brief illustrated descriptions of their constructional details, and some particulars of lighting sets with direct-coupled dynamos. Section three describes engines of from 30 to 80 b.h.p., suitable for both town and producer gas, while section four deals with suction gas engines of from 80 to 150 b.h.p., fitted with an improved system of low-tension magneto ignition. This, and all the other sections, are illustrated with very clear photographs and drawings. Section five deals with large single-cylinder engines of from 175 to 200 b.h.p., for mill and factory driving. An extra heavy flywheel is provided for electric lighting work. Two-cylinder engines of 150 to 300 b.h.p., for working off blast furnace, coke oven, suction or pressure gas, are described in section six, and four-cylinder vertical engines, also suitable for working with waste gases, in section seven. These last are specially adapted for electric generating stations and mill driving.

ENAMEL-INSULATED WIRE.—A leaflet from the Allgemeine Elektricitäts-Gesellschaft (Berlin) contains an article on the advantages of enamel-insulated wire for field bobbins and the coils of instruments, arc lamps, &c. Enamel-insulated wire with an outer covering of cotton or silk has been introduced for ignition apparatus.

ELECTRICALLY DRIVEN ROLLING MILLS.—A booklet from the Allgemeine Elektricitäts-Gesellschaft gives a long list with a few particulars in each case of electrically driven non-reversing rolling mills with A.E.G. equipment. Some 20 photographs illustrating typical installations are reproduced.

MOTORS AND DYNAMOS.—A 32-page illustrated list from the Adnil Electric Co., Ltd. (Adnil Building, Artillery Lane, London, E.C.), gives particulars and prices of standard continuous-current motors of from 3 to 68 h.p. output, and dynamos of from 2·5 to 48 kw. capacity. Some general technical information with regard to the construction and design of these mechines is included. Motor-generators, back-geared motors, metallic and liquid starters, and flexible couplings are also listed.

WIRING FITTINGS.—Messrs. Loxley & Co. (Cabinet Chambers, Basinghall Street, Leeds) have sent us a copy of a new leaflet describing the V.B. cleat ceiling roses for surface wiring. Only one screw is required to fix this rose, and no jointing or looping-in is necessary. It is especially suitable for temporary work. A description of the ceiling rose appeared in ELECTRICAL ENGINEERING of December 2nd, 1909 (Vol. V., p. 1028).

GAS ENGINES.—A booklet from the Key Engineering Co., Ltd. (Trafford Park, Manchester) contains an illustrated description of the constructional details of the latest type of double-acting four-cycle gas engine of the pattern developed by Messrs. Ehrhardt & Sehmer, of Saarbrucken. This is an abbreviated and partially rewritten translation by Mr. Leonard Andrews of an article in *Stahl & Eisen*. Engines of this description are now being built by Galloways, Ltd., of Manchester.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

MOTOR STARTERS.—Messrs. Wm. Geipel & Co. (St. Thomas Street, London, S.E.) have issued a new illustrated catalogue of motor starters and panels, rheostats, &c. Special features are the renewable contacts and contact brushes. The resistances are made up of renewable units of wire spirals on hard asbestos tubes. No soldered joints are used. Among the special rheostats listed are interlocked theatre dimmers, and other apparatus fitted with the Ward-Leonard interchangeable resistance units.

TELEPHONES.—A booklet issued by the Western Electric Co., Ltd. (North Woolwich, London), primarily intended for the use of contractors and electricians, contains concise particulars of telephone apparatus and accessories suitable for private installations. We reviewed the company's full catalogue in our last issue.

ELECTRIC BELLS.—Messrs. Gent & Co., Ltd., Leicester, have issued a new catalogue of electric bells, &c.

DRILLS.—A leaflet from the A.E.G. Electric Co., Ltd. (121 Charing Cross Road, London, W.C.), illustrates a portable electric drill for holes up to 2 in. diameter.

CANDLE FITTINGS.—The Kingolite Co. (164 Wardour Street, London, W.) have sent us a list of the Kingolite fittings for carbon or metal-filament lamps. These are provided with a screw flange at the bottom for keeping the translucent candle cylinder perpendicular and rigid.

ELECTRICAL SUPPLIES.—A complete revised trade catalogue is being issued by Drake & Gorham, Ltd. (66 Victoria Street, Westminster, London, S.W.). This is divided into nine sections. The first covers Osram, Tantalum, and carbon filament lamps of all shapes and sizes. The second is devoted to arc lamps, and includes the new "Butt" flame lamp. A section on cables and flexibles is followed by a list of switchboards, switchgear, lighting accessories, and bells. A good illustration is given of a well-designed porcelain fuse carrier for distribution boards. In the section on heating and cooking apparatus, the latest Bastian heaters, as well as the Gray patent oven (described in this issue) are listed. Auto-transformers, two-part insulators for obviating binding wire, and the new D.G. continuity clips for ensuring efficient bonding of wiring conduit, are also listed. The last section is devoted to lighting fittings, and includes a large number of artistic designs and several patterns of weather-proof lanterns for outdoor use. Among the last-named is a cast-iron fitting taking six 100 c.p. Osram lamps.

STEEL CONDUIT AND POSTS.—An illustrated list is to hand from John Spencer, Ltd. (Globe Works, Wednesbury, Staffs.). This covers all manner of iron and steel piping, water-, steam- and gas-pipe fittings, wiring conduit, tramway trolley-wire poles, and arc-lamp standards. The illustrations of the last-named include a 65-foot, three-lamp standard erected at Bournemouth.

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LOCAL NOTES

ABERDEEN: *Electricity Department Report.*—Mr. J. A. Bell, the Borough Electrical Engineer, has presented his annual report. The adoption of a flat rate of charging has proved successful. Hiring out heating apparatus has increased the connections to the equivalent of 11,368 33-watt lamps—nearly double last year's figure. He recommends that the price of energy for heating be reduced from 1½d. to 1d. per unit. The total number of units sold for all purposes during the year was 5,430,065, including 90,442 for the tramways. Motors representing 387 h.p. have been added to the mains, and there are 181 new consumers, and mains corresponding to 3·6 additiona miles of frontage have been laid. Mr. Bell points out that there are only four tramways in the Kingdom supplied with electricity from joint stations at a cheaper rate than at Aberdeen.

AUSTRALIA: *Perth Tramway Employees' Strike.*—Reference to this strike was made in our last issue. Advices from Perth now state that the secretary of the Tramway Employees' Union has been sentenced to a fine of £50 or two months' hard labour for a breach of the Arbitration and Conciliation Act by aiding and abetting the strike. Two other executive officers of the Union have been sentenced to a fine of £10 or three weeks' hard labour.

BARROW: *Tramway Purchase.*—The Council are considering the advisability of exercising their option to purchase the local tramway undertaking from the British Electric Traction Co.

BERMUDA: *Proposed Electric Railway.*—It is stated that a Canadian company is endeavouring to obtain powers to build 30 miles of an electric railway at an estimated cost of £200,000, to connect all parts of Bermuda, and it is further stated that all equipment for the line is to be purchased in the United States. Here is evidently a case where either the National Electrical Manufacturers' Association or the Electrical Committee should bring pressure to bear upon the Bermuda Government, either directly or through the Home Government, to refuse the concession unless British material is to be bought.

BEXLEY HEATH: *The Tramway Management.*—At last week's meeting of the Bexley Heath Urban District Council two motions were on the agenda paper to the effect that the tramway manager should be given notice or be asked to resign, and another that an entire change in the working and management of the tramways was necessary. An amendment was passed, however, giving instructions for the immediate preparation of the financial statement for the year ended March 31st. 1910, with a view to its being considered by the Council at an early date.

BOMBAY: *Electricity Supply.*—"After full investigation of the many conditions which differentiate an Oriental from a European city," the directors of the Bombay Electric Supply and Tramways Co. have decided to comply with the strong views expressed by the municipality and by a large majority of consumers, and offer to abandon the present maximum demand tariff, and to substitute a flat rate tariff. The new tariff proposed, which has to be accepted by the municipality, is a charge of 5d. per unit for all purposes, with a cumulative discount of 3 per cent. upon each completed 250 units consumed monthly, the aggregate discount not to exceed 45 per cent.

BRADFORD: *Trackless Trolley System.*—At last week's meeting of the Tramways Committee, a sub-committee was formed to carry into effect the provisions of the Bradford Parliamentary Bill with regard to omnibuses on the trackless trolley system.

Tramway Accounts.—Mr. C. J. Spencer, general manager of the Bradford Tramways, has presented his report. The total working expenses per car mile come out to 7·149d. and the income 10·777d. Only one item of the expenses has increased since last year—namely, that of cleaning, salting, and sanding the track, which has been increased owing to the cost of keeping the track open for traffic during snowstorms. All the other items of expenditure are less, and the total expenses represent a saving of ·072d. per car mile over last year. The power expenses were 2·073d. per car mile. The revenue of the parcels department continues to increase, and 675,719 parcels were handled. The net profit on the year's working was £32,365, of which £20,000 is allocated to the relief of city rates, and the balance is transferred to reserve and renewals account. Six new Mountain and Gibson trucks put into service during the year have been fitted with a new type of track brake, using cast-iron shoes of the type recommended by the Municipal Tramways Association. Eight automatic electric track point controllers made by a local firm have been erected, and are working well. The mechanical device for the operation of the cars over two gauges has given very little trouble in actual operation once the initial difficulties were overcome.

CAPE TOWN: *Electric Light and Power.—The African World and Cape-Cairo Express* refers to the replacement of the four public electric supply plants at Cape Town by supply from one central power-house owned by the Corporation, which was carried out last year. The estimate of the power which the Government would have to buy was 1,500,000 units per annum, which is sold at 1½d. per unit, and the actual consumption from July 1st, 1909, to July 30th, 1910, came out within 1,000 units of this figure. The Government has still on hand a quantity of its old plant which it desires to sell.

COVENTRY: *Electric Tramways.*—An agitation is going on in favour of purchasing the Coventry Tramway Company's undertaking. The Corporation have until February in which to give the statutory notice.

GOVAN: *Electricity Supply Accounts.*—The burgh electrical engineer, Mr. T. C. Parsons, has submitted his report and accounts for the year ended May 15th. The coal costs come out to 0·198d. per unit sold, and the works and distribution costs to 0·477d. per unit sold. The total working costs, including management, are 0·813d., and the total, including interest and sinking fund, 1·461d. per unit sold. Compared with other stations of a similar size—*i.e.*, with an output of 3,000,000 units per annum or less, there are only eight with better total costs, two with better works costs, and only one with better coal costs. The average price obtained per unit sold was 1·61d. The total number of units sold was 2,624,684—an increase of 268,317 over last year. Of these 1,602,029 were sold for power. The units sold for lighting show an increase of about 36,000 over last year, the figures for which were about 2,000 below the previous year, presumably due to metal filament lamps. Interesting tables are given showing the percentage revenue from various sources, from which it appears that 38 per cent. of the revenue is for power, and if the revenue for lighting engineering works, etc., be added to this, the total received from the power consumers comes out to 55 per cent. Another interesting table gives the class of consumers connected to the mains. There are 142 power consumers, 442 domestic houses are lighted, 259 shops and offices, 58 licensed premises, and 46 engineering works and factories. Schools, churches, and public buildings bring the total to 986. Yet another table gives the total h.p. in motors on hire to the various trades.

GREENOCK: *Street Lighting.*—The price for street lighting is to be reduced from £18 to £15 per lamp.

HARROGATE: *Street Lighting.*—Considerable interest is being aroused through the chairman of the Gas Company's criticism of the Council for lighting part of its streets electrically, and not accepting an offer by the gas company, which he contends was more advantageous to the Corporation. The matter is being commented on at length in the local press.

NOTTINGHAM: *Tramways.*—The laying of about two miles of new line is being proceeded with, and interlacing track is being adopted on a short portion of the route.

PLYMOUTH: *Tramways.*—There have been serious complaints of overcrowding, and the Board of Trade has taken the matter up.—The Borough Surveyor, Electrical Engineer, and Tramways Manager have submitted a report on the relative costs of the ordinary trolley system and the trackless trolley system on a proposed new route.

PRESTON: *Tramways.*—The Preston municipal accounts, which have been issued by the borough auditors with their report, show that although 45,000 fewer passengers were carried by the tramways than during last year there was a profit balance of about £4,000, which was carried to reserve fund.

SALFORD: *Trams.*—The annual report of the general manager of the Salford Tramways, Mr. G. W. Holford, shows a net profit balance of about £19,000, £17,000 of which it is proposed to allocate to relief of rates, and the balance to depreciation and renewals fund. The number of units used per car mile was 1·63, and the average traffic receipts per car mile 10·09d. The average car miles per day is 113 per car:

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the average car hours per day 15·25, and the average working expenses per car mile 4·464d. excluding power and 6·459d. including power.

SOUTH AFRICA: *Bulawayo.*—The introduction of Osram lamps for public lighting is said to have saved the Corporation over £2,000 per annum.

SUNDERLAND: *Proposed Sales Department.*—A sub-committee of the Electricity Committee has been appointed to report on a scheme for the establishment of a show-room and sales department, staffed by a sales manager, two canvassers, an installation inspector, a prime cost clerk, and a typist.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

AUSTRIA.—The communal authority of Smischow have decided to proceed with the construction of an electric tramway at an estimated cost of £42,000.

BUENOS AIRES.—Messrs. Zacarías Marioni y Hermano are to erect an electrical installation for the custom house, at a cost of about £22,000.

COBHAM (Surrey).—Competitive tenders for street lighting are being asked from the Gas Company and the Woking Electricity Company. The present oil lamp standards could be converted.

DARTFORD.—Application is to be made to the Local Government Board by the Urban District Council for sanction to borrow £11,000. A sum of £10,000 is required for plant and buildings, and £1,000 for mains.

DUBLIN.—The Lighting Committee have issued their quarterly report. They are continuing their policy of postponing any extension work not urgently required. To meet the winter load, however, eight new 100-k.w. transformers and two spares, and four 50-k.w. transformers, will be wanted, the expenditure for which has already been sanctioned by the Local Government Board in connection with the anticipated extension of mains.

DURBAN.—Tenders are invited by September 28th for an elevated jet condenser and piping, switchboard, rotary convertors, cables, and transformers. Tenders to Messrs. Webster, Steel & Co., 5, East India Avenue, Leadenhall Street, London.

EGYPT.—The *Board of Trade Journal* states that tenders are invited for the supply and installation of machinery, &c., for establishing an electric light system in the town of Beni-Souef. Tenders, on stamped paper (obtainable from Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Westminster, S.W.), to be addressed to "M. le Directeur de la Section des Municipalités et Commissions Locales, Ministère de l'Intérieur," Cairo, by noon on October 31st. Specifications, drawings, &c., may be obtained at the same address on payment of 200 piastres (£2 1s.). A deposit of 2 per cent. of the value of the offer is required with each tender. Contractors must have a responsible agent in Egypt.

GRASSINGTON.—A scheme for the lighting of the streets by the Grassington Electric Supply Co. at £15 a year has been approved by the Parish Council.

LA PLATA.—A company has been formed to take up a concession granted to Mr. A. Lemousin for an electric light and power house in the city of La Plata. The River Plate Electricity Co. is already established there. Messrs. J. G. White and Co. are engaged on a contract for a new station for them and for placing a large portion of the overhead mains underground.

SOUTH AFRICA: *Potchefstroom.*—A Government inquiry is being held on the proposal of the Potchefstroom Municipality to adopt an electric lighting scheme at an outlay of £20,000.

STALYBRIDGE.—An inquiry has been held into a loan of £22,268 for electrical extensions. During the inquiry it was announced that the total loss on the electricity and tramways undertakings of the joint board during the seven years of its existence, amounted to £81,000.

TRANSVAAL.—The Transvaal Gold Mining Estates, Ltd., are about to purchase a large power plant.

URUGUAY.—The Municipal authorities of Tacuarembó invite tenders for an electricity supply works at St. Fructuoso. Tenders to be received at the Secretaria de la Intendencia Municipal de Tacuarembó, Tacuarembó, by September 30th.

WALTHAMSTOW.—Tenders are invited by September 9th for a storage battery at the electricity works.

MISCELLANEOUS

BILBAO.—The Compañía del Tranvía de Bilbao has been granted a concession for constructing a tramway line.

MANCHESTER.—The Waterworks Committee require an electric derrick crane. Tenders to the Town Hall by September 12th.

NEWCASTLE.—Extensions of the Newcastle Corporation tramways have been decided upon.

RETFORD.—Criminal Lunatic Asylum about to be erected near Retford. A light railway to connect with the G.C.R. is contemplated. Home Office.

RUSSIA.—Messrs. S. Pearson and Son, Ltd., of 10, Victoria Street, S.W., have commenced a survey of the coast route from Sevastopol to Alushta for the purpose of building a narrow-gauge single track electric railway, which, it is stated, will be financed entirely by British capital.

SANTA FE.—The municipal authorities called for tenders for the electrification of the tramways about a year ago. All the tenders received were rejected, and fresh tenders were invited. These fresh tenders have just been received, and it is stated that none of them are as advantageous to the Corporation as the previous one. The *Review of the River Plate* states that the delays are due to the fact that the Council do not call any proper technical advice.

SOUTH AFRICA: *Cape Town.*—It is proposed to equip the Cape Town docks with an electric travelling crane and other modern improvements.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

PROVINCES.

BURY.—New County Court to be erected. H.M. Office of Works.

CAMBUSLANG.—A constabulary station at corner of Church and Mansions Streets. County of Lanard Standing Joint Committee.

CHAPEL-EN-LE-FRITH (DERBYSHIRE).—Theatre. Frank Edwards.

DEVONPORT.—New Methodist Church, Keyham.

DUBLIN.—New Fire Brigade Station. City Architect.

FINCHLEY.—Proposed "Brent Garden Village." P. W. Home, Church End, Finchley, architect.

GODALMING.—New pumping station buildings at Ockford. J. H. Norris, Borough Surveyor.

GRAYS (ESSEX).—Electric theatre.

LEICESTER.—Primitive Methodist Church, Humberstone Road.

LETCHWORTH.—Extensions to Printing Works of the Letchworth Printers, Ltd. Edgar Simmons, Architect.

MOSSLEY.—New Drill Hall for the West Riding of Yorkshire County Association. W. Cooper, 4 Kirkgate Buildings, Huddersfield.

NELSON.—Cottage Hospital.

NELSON (GLAMORGAN).—Police station at Nelson. T. M. Franklen, Clerk to the Glamorgan County Council, Cardiff.

STORNOWAY.—Roman Catholic Church. Alex Macdonald, architect. Ross & Mackenzie, builders, Stornoway.

TODMORDEN.—£300 is to be spent for the electric lighting of the Town Hall by electricity.

WESTCLIFF-ON-SEA.—New St. Saviour's Church.

WEYBRIDGE.—Congregational Church Manse.

In a discussion at the British Association on Tuesday, Prof. H. E. Armstrong, F.R.S., said he did not want to use electricity in his house, but was being forced to do so by the bad quality of modern gas. Prof. Armstrong's address is 55 Granville Park, Lewisham, London, S.E.

Industrial Education.—The proposed "National Industrial Education League" for promoting the establishment of a system of industrial training for the children of the labouring class, and a consequent extension of school life, is gaining considerable support. We have received a booklet containing a list of the supporters of the scheme, including Members of Parliament and of the London County Council, Trades and Labour Councils, Trades Unions, and Educational Associations. A National Conference on the supject will shortly be held at the Guildhall, London. Further particulars can be obtained from Mr. R. Applegarth, 49 Craig's Court House, Charing Cross, S.W.



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TENDERS RECEIVED AND ACCEPTED

BOURNEMOUTH.—Considerable discussion took place at the Town Council meeting on Tuesday in reference to a recommendation by the Tramways Committee that a tender of Messrs. W. Griffiths & Co., at £2,904, for a supply of Belgian tramway rails should be accepted. An amendment was moved in favour of the acceptance of the tender by a Leeds firm at £3,299 on the ground that this tender was for English rails. The Tramway Manager, in reply to questions, said it was generally known that Belgian rails were superior to English. On the amendment being put, 5 voted for it and 19 against.

DUBLIN.—The tender of the A. E. G. Electric Co., Manchester branch, has been accepted for the electric light installation of the South Dublin Union Workhouse, at the sum of £2,587 4s., and £250 for five years' maintenance. This tender was £500 less than the tender of any Irish firm. Only six tenders were received in response to the Union's advertisement. [The advertisement was not inserted by the Union in our paper.]

SOUTH AFRICA: *Transvaal.*—The order for the electrical equipment for the new air-compressor station of the New Modderfontein Gold Mining Co., Ltd., has been placed with the British Westinghouse Electric and Manufacturing Co., Ltd., Maschester, and includes a number of 1,000-b.h.p. three-phase motors.

CAPE TOWN.—Messrs. Veritys, Ltd., London, have secured the contract for electric light fittings for the Parliament Buildings, Cape Town.

DELAGOA BAY.—An order for a battery and "Entz" booster equipment has been placed with the Chloride Electrical Storage Co., Ltd., by the Delagoa Bay Port and Railway Council.

JOHANNESBURG.—The municipality have placed a contract with Messrs. Siemens Bros. & Co. for the supply of 2,277 A.C. meters, and with the A.E.G. Electric Co., of South Africa, for 88 D.C. meters.

THE D.P. Battery Co., Ltd., have just concluded contracts for the supply of their batteries to the District Councils of St. Annes-on-Sea, Naas (Kildare), the Chorlton Board of Guardians, and for a number of private installations. The maintenance of these batteries for terms of years has been undertaken by the company. They have also secured orders for three batteries for South Africa for mining and other purposes.

THE Foster Arc Lamp & Engineering Co., Ltd., inform us that their "Q" type lamp was selected for the illumination of the People's Palace in the Mile End Road. Messrs. H. J. Cash & Co., Ltd., were the contractors.

APPOINTMENTS AND PERSONAL NOTES

The War Office has appointed Capt. G. Thorp, Royal Engineers, to be instructor in the Schools of Electric Lighting of the Regular Forces.

Mr. A. J. Howard has been appointed Borough Electrical Engineer to Taunton. Mr. Howard was at one time Chief Assistant at the Taunton Electricity Works. The short list included Mr. A. W. Clay, Deputy Electrical Engineer of Accrington, Mr. W. J. Sowter, Engineer at Bray, and Mr. W. F. Stamp, Deputy Engineer at Devonport. The salary commences at £200 per annum, with half the pupil fees.

On Friday Mr. J. W. Fraser was the recipient of a handsome writing-case, subscribed for by the employees of the London County Council Tramways power house at Greenwich, upon his leaving the department to take up a Government appointment.

Mr. Ashton Bremner, who has relinquished the post of Chief Engineer to the Burslem Council owing to the undertaking being absorbed in the new County Borough of Stoke, has been presented with a travelling bag by the employees.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

British Insulated & Helsby Cables.—Interim dividend announced of 4 per cent. actual for the half-year.

Aberdeen Suburban Tramways Co.—At the half-yearly meeting on Thursday it was announced that there was a satisfactory increase in traffic. A 2½ per cent. dividend is being paid, and mortgages are being paid off to the extent of £1,500 during the half-year, and £2,500 subsequently, leaving the outstanding mortgages at £4,000.

Jarrow & District Electric Traction Co., Ltd.—Particulars of £20,000 debentures, created August 5rd, 1910, have been filed.

United Electric Car Co.—Dividend of 2½ per cent. declared for the year ended June 30th.

Vera Cruz Electric Light, Power & Traction.—The accounts for 1909 show that the deficit of £4,600 shown on the previous year's working has been converted into a credit balance of £2,000. The accounts were adopted at the third ordinary general meeting of the company last week.

Canadian General Electric Co.—Quarterly dividend of 1¾ per cent. to September 30th on the common stock, a half-yearly dividend of 3½ per cent. for the half-year to September 30th at the rate of 7 per cent. per annum on the preference stock.

Metropolitan Electric Tramways.—For the thirty-three weeks to August the gross traffic receipts show an increase of £42,000. compared with the same period for last year. If this rate of increase is continued throughout the present financial year, the company point out that it will be possible to pay 6 per cent. on the ordinary shares, as against 5 per cent. in 1909, and 4½ per cent. in the two previous years.

MISCELLANEOUS BUSINESS NOTES

PRICE OF COPPER.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 5s. to £58 15s. per ton (last week, £58 5s. to £58 15s.).

LIQUIDATIONS.—Official notice has been given of the release of W. Allnutt, liquidator of the Empire Electric Light & Power Co., Ltd.

CHANGE OF ADDRESS.—The British Central Electrical Co. have moved to 84 Hatton Garden, London, E.C.

SWITCHBOARD FOR SALE.—A 160-ampere battery switchboard is for sale. See advertisement on another page of this issue.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"General Foundry Practice." By Wm. Roxburgh. (London: Constable & Co.) 10s. 6d. net; by post in U.K., 10s. 11d.; abroad, 11s. 3d.

The Mining Institute of Scotland. List of Members, August, 1910. (Hamilton: J. Barrowman, Sec.)

"The Application of Arc Lamps to Practical Purposes." By Justus Eck. (London: Rentell & C., Ltd.) 2s. 6d. net, by post in United Kingdom, 2s. 9d.; abroad, 2s. 10d.

"Electric Motors." By H. M. Hobart. Second Edition. (London: Whittaker & Co.) 18s. net. By post in U.K., 18s. 6d.; abroad, 19s. 4d.

"Construction and Working of Internal Combustion Engines" By R. E. Mathot. Translated from the French by W. A. Tookey. (London: Constable & Co., Ltd.) 24s. net. By post in U.K., 24s. 6d.; abroad, 25s 3d.

"British Standard Specification for Portland Cement." Engineering Standards Committee's Report No. 12. Revised edition. (London: Crosby Lockwood & Son.) 5s. net. By post in United Kingdom or abroad, 5s. 2d.

"Power and its Transmission," by Thomas A. Smith. (London: E. & F. N. Spon.) 2s. net; by post in U.K. or abroad, 2s. 2d.

NEW COMPANIES

W. H. SAYER & CO., 10 New Street, Bishopsgate Street, London. Capital £500. Electrical and mechanical export merchants.

GEORGE HILL & CO., 12 Cornbrook Park Road, Manchester. Capital £4,000. To take over the existing business of electrical engineers, &c.

W. V. WAITE & CO.—Registered by Jordan & Sons, 116 Chancery Lane, London. Capital £1,000. Electrical, consulting, and general engineers, &c.

UNITED LIGHTING & MAINTENANCE CO., 35 Cock Lane, Snow Hill, London. Capital £2,000. To take over the business of electrical engineers, &c., now carried on at the above address.

Telegraph Traffic.—It is stated that a closer working arrangement between the Anglo-American Telegraph Co. and the American Telephone & Telegraph Co. has been successfully effected.



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ELECTRICAL ENGINEERING

No. 194 [Vol. VI., No. 37] THURSDAY, SEPTEMBER 15, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

Mr. V. A. H. McCowen, until lately Borough Electrical Engineer to the Salford Corporation, and previously for thirteen years in a similar position in Belfast, died last week. We have also to record the death of Mr. W. Finlay, last year's President of the Electrical Contractors' Association. (Page 588.)

The date of the Electrical Exhibition at Olympia in 1911 has been definitely fixed. (Page 588.)

The new line of the London County Council Tramways from Woolwich to Eltham, has been for the most part equipped on the double trolley system, to avoid possibility of interference with the magnetic instruments at Greenwich Observatory. (Page 589.)

An illustrated article describes a new sealing-in machine for metal filament lamps. (Page 590.)

We describe the most recent developments of the Lepel system of wireless telegraphy, including an integrating device for intensifying the received signals, and a method of transmitting a number of different musical notes in rapid succession. The equipments of a commercial station in Jamaica, and the experimental station at Slough, are also described. (Page 591.)

The electrical appliances exhibited at the Dental Exhibition included several patterns of drilling "engines," small resistance furnaces, projectors and mouth lamps, water-heaters and sterilisers. Automatic electrically-driven air-compressors, used in conjunction with atomisers, and electrically-heated hot-air syringes, and some novel root-drying and cautery instruments, were exhibited. (Page 592.)

A letter which is being sent by the Electric Supply Publicity Committee to the principal papers throughout the country, calls attention to the great increase of electric street lighting in London, in order to dispel the false impression that London, instead of continuing an electrically-lighted city, is about to return to gas. (Page 593.)

The leader and two other members of a gang which has been successfully making compensation claims for bogus accidents on tramcars for some years, have been convicted. (Page 593.)

A letter from Mr. E. W. Cowan refers to the purport of his Paper read before the British Association. (Page 593.)

Among the Specifications published by the Patent Office on Thursday last was one by M. T. Medway and M. D. Scott for a means of preventing the reversal of the armature current of a motor before the armature has come to rest. The main switch is held open by a solenoid supplied with current generated by the motor.—A silicon-carbide filament, which incandesces in the open air without oxidising, is covered by the Parker-Clarke Electric Co. of America.—H. Hirst and A. E. Angold protect a flame arc lamp with converging carbons, one of which is supported on a slow-burning carbon, actuated so as to feed upwards as it is consumed by the heat.—An appeal has been lodged against the decision of the Comptroller to grant two patents to

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J. Howden & Co. for exhaust steam accumulator plant.—A patent by R. J. Grindle relating to accumulator plates, consisting of rolled up strips of corrugated lead, expires to-morrow, after a life of fourteen years. (Page 594.)

AN article deals with the question, "What is 'Association' Cable?" (Page 595.)

AN arbitration was commenced in London on Monday to settle a difference between the Torquay Tramways Co. and the Torquay Corporation with regard to the system of electric traction to be adopted on the Torbay Road route. The Board of Trade have refused to sanction the Dolter system after October 1st on any of the lines in Torquay, and with regard to all the lines except the Torbay Road, the Company are advised that they have powers to use the overhead system, although the Corporation disagree with this view. The arbitration, however, has special reference to the Torbay route, which is protected by certain clauses in the Company's Act. The Company asked to be relieved from the obligation to use the Dolter system, and have produced many facts and figures to prove that it has been both a technical and commercial failure. (Page 595.)

BELFAST Corporation are installing arc lamps in two streets experimentally.—A poll is being taken in Torquay on the question of tramways.—Competition between the Manchester Corporation Electricity and Gas Departments was deprecated at the last Council meeting. (Page 596.)

ACCRINGTON Corporation propose an expenditure of £16,000; Burnley, £1,800; Colwyn Bay, £23,000; Dublin, £3,150; Stockport, £7,000; and West Bromwich, £11,386. Edinburgh Corporation require turbo-generators and condensing plant. Warrington Corporation have been granted a loan of £6,000. (Page 597.)

ARRANGEMENTS FOR THE WEEK

SATURDAY, SEPTEMBER 17TH.

Institute of Marine Engineers.

3 p.m. Visit to the Engineering and Machinery Exhibition, Olympia.

7 p.m. Paper to be read:—"Electro-Magnetic Transmission for Main Marine Propulsion," by Jules Lecoche.

WEDNESDAY, SEPTEMBER 21ST.

Municipal Tramways Association.

10.30 a.m. Annual Conference at Bradford. (1) Presidential Address by Mr. C. J. Spencer, President. (2) "The First Decade of Municipal Tramway Working," by Alderman S. Flint (Leicester). (3) "The Comparative Durability of Brake Shoes and Tyres," by J. W. Dawson (Assistant Engineer, Bradford Tramways).

Society of Engineers.

Visit to Engineering and Machinery Exhibition, Olympia.

THURSDAY, SEPTEMBER 22ND.

Municipal Tramways Association.

10.30 a.m. Annual Conference at Bradford. (1) "Tramways in Relation to Town Planning," by A. Baker (General Manager, Birmingham Tramways). (2) "Lubrication of Car Bearings," Report prepared by Messrs. E. Cross, R. L. Acland, P. J. Pringle, and T. R. Smith.

7 p.m. Association dinner at Great Northern Victoria Hotel.

FRIDAY, SEPTEMBER 23RD.

Municipal Tramways Association.

10 a.m. Annual Conference at Bradford. Business meeting.

SATURDAY, SEPTEMBER 24TH.

Association of Engineers in Charge.

5.15 p.m. Visit to Engineering and Machinery Exhibition, Olympia.

7.45 p.m. Lecture on "Wireless Telegraphy: its Maritime Importance," by G. Langler Bullocke (by special permission of Mr. Marconi).

International Congress of Radiology and Electricity.—An international congress, at which papers on radiology and physical electrical phenomena will be read, was opened at the Brussels Exhibition on Tuesday. Sir J. Thomson, who, with Prof. E. Rutherford, of Manchester University, was to have represented his Majesty's Government at the Congress, is unable, through private business, to accompany his colleague, and Prof. Rutherford will act alone as delegate for Great Britain.

OBITUARY

VICTOR A. H. MCCOWEN.

IT is with the deepest regret and a feeling of personal loss that we record the death, on Thursday, of Mr. V. A. H. McCowen, who was for many years Borough Electrical Engineer of Belfast, and more recently Borough Electrical Engineer of Salford.

Mr. McCowen has been associated with the electricity supply industry since the earliest days. He was one of the engineers with J. E. H. Gordon & Co., and was chiefly employed in the erection of the Crystal Palace District Electric Supply Co.'s station, one of the first designed on the "Oxford" H. T. continuous-current system. In 1894 he was appointed Borough Electrical Engineer at Belfast, while the station there (a gas-engine station to the designs of Sir A. B. W. Kennedy) was under construction, and between leaving Gordon's and taking up this appointment, he was connected with the Killarney Electric Supply Co., whose station was designed and erected by him. During the thirteen years he was at Belfast, the undertaking developed to one of considerable magnitude, and the gas engine plant was entirely displaced by steam plant in load. The steam station at Belfast was entirely designed by Mr. McCowen, and it is interesting to note that he showed great foresight in this, arranging the lay-out with a view to subsequent extensions, and the ultimate supply of a tramway load. He left Belfast in 1907 to take up the position of Borough Electrical Engineer to the Salford Corporation, in succession to Mr. C. D. Taite. The South Lancashire climate suited neither his health nor that of his wife, and shortly after his wife's death he became ill, and about a year ago had to obtain leave of absence for a long period. A few months ago, after a prolonged stay at Bath, his condition had only improved slightly, and he felt obliged to tender his resignation at Salford. Although of a retiring disposition, Mr. McCowen had many friends in the electrical world, particularly in municipal electrical engineering circles, who will deplore his loss.

At Monday's meeting of the Belfast Corporation, Alderman Finnigan, in moving a resolution of sympathy with the relatives of Mr. M'Cowen, said their late electrical engineer was a thorough gentleman in all his ways, and when Belfast lost his services Salford made a great gain. From several reasons, first of all the death of his wife, and then the extreme pressure of work in consequence of the re-arrangement of the Salford station, his health broke down, and his friends, who knew and appreciated his worth, mourned his early demise. Councillor Irvine seconded the resolution, which was passed in silence, the members of the council standing.

WILLIAM FINLAY, JUN.

We regret to record the sudden death on Wednesday evening, the 7th inst., at the house of his father, Councillor Finlay, at 77 Great King Street, Edinburgh, of Mr. W. Finlay, jun., of the firm of W. Finlay & Co., electrical engineers and contractors, of 27 Frederick Street, Edinburgh. The cause of death was a block on one of the arteries of the brain, which caused heart failure 26 hours after the first symptom. Mr. Finlay was well known in electrical circles in Edinburgh. He was president of the Electrical Contractors' Association last year, and it will be remembered that although in bad health at the time he was able to take the chair during part of the annual meeting of the Association at Edinburgh last June. He was 38 years of age, and leaves a widow and two young children.

ELECTRICAL EXHIBITION AT OLYMPIA, 1911

IT has now been definitely decided to hold an Electrical Exhibition at Olympia, London, from September 23rd to October 21st, 1911. The Exhibition will be promoted by the National Electrical Manufacturers' Association, and arrangements are being made as regards the business management and organisation with International Trade Exhibitions, Ltd. (Broad Street House, E.C.), on similar lines to those which proved so markedly successful in the case of the Manchester Electrical Exhibition, 1908. The preliminary arrangements are nearly complete, and it is hoped that invitations for applications for space will be made in the course of a few weeks.

Electric Railway Exhibition in Russia.—Programmes, &c., in connection with the Electric Railway Exhibition, which is to be held in St. Petersburg, from April to July, 1911, may be seen at the Commercial Intelligence Branch of the Board of Trade, Basinghall Street, London, E.C.

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THE WOOLWICH-ELTHAM LINE OF THE L.C.C. TRAMWAYS

A Double Trolley System

THE tramway line from Beresford Square, Woolwich, to Eltham, which was opened for traffic by the London County Council at the end of July, has been obliged to be equipped with an insulated return circuit on account of the risk that earth return currents might cause disturbance of certain instruments at Greenwich Observatory, within three miles of which the major portion of the line is situated. The traffic is not sufficiently dense to warrant the expense of installing the conduit system, so it was decided to equip the line on the double trolley system, with both positive and negative overhead wires for each track.

The total length of the line is five miles of track, and the whole is double track except the loops near the Woolwich end, where the up and down lines follow different routes. A portion of these loops are outside the three-mile radius from the Observatory, so that the ordinary single positive trolley wire and earth return can be used. As we shall see, the cars are equipped so that they can run either on the single or double trolley system, for, in addition to the loops mentioned above, the cars have to traverse a length of single trolley line to the car shed at Abbey Wood. They are also arranged so that plough carriers can easily be added in case of future through running on the conduit lines yet to be constructed from Greenwich to Woolwich, and so that they can be used on any other line on any of the three systems should occasion arise.

At present there is no through running, the cars running only between the Eltham terminus and the Woolwich loop. The overhead construction is considerably simplified by the fact that there are no junctions or crossings, and, indeed, the difficulties that junctions would introduce when two overhead wires of opposite polarity are to be considered would be formidable. The whole construction is span wire with side poles; the same standard fittings are used as in the Council's other overhead work. On the double track portion, as shown in Fig. 1, the four wires, two for each track, are arranged with the negatives together in the centre with no strain insulator between them, but there is the usual double insulation provided by the insulated hangers and globe strain insulators between the positive and negative, and between the outer wires and the posts. The positive and negative wires are everywhere 3 ft. 6 in. apart, and the centres of the pairs over double track are 8 ft. 6 in. apart. The feeding points are, of course, rather more noticeable than usual, owing to the fact that four cables have to be brought up instead of two. There are no special arrangements where the double construction changes to single; the

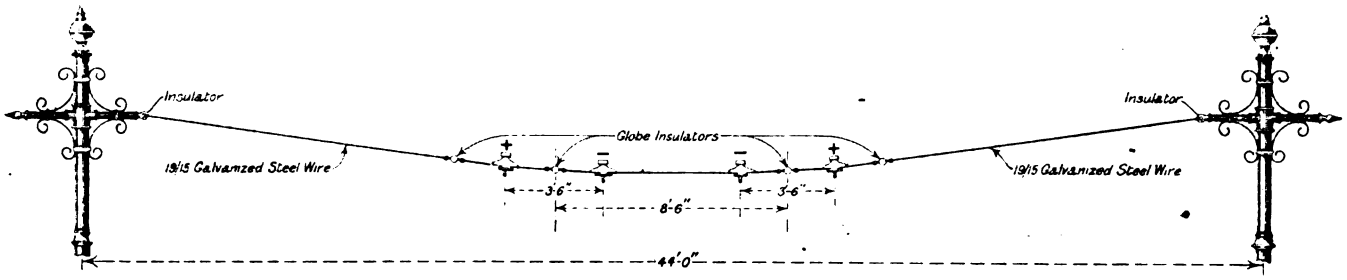


FIG. 1.—ARRANGEMENT OF SPAN WIRES AND INSULATORS ON DOUBLE-TRACK.

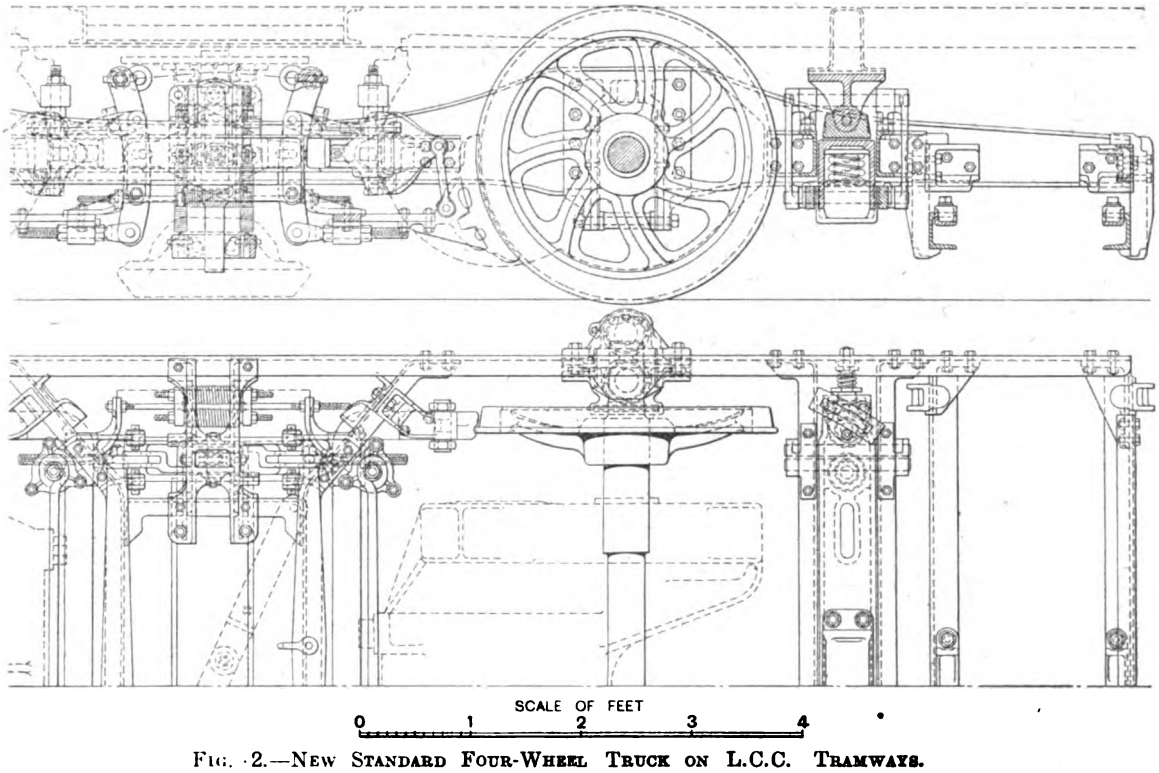


FIG. 2.—NEW STANDARD FOUR-WHEEL TRUCK ON L.C.C. TRAMWAYS.

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negative wire simply stops, and the positive is brought over the centre of the track. In one place the line passes under a bridge where there is not much clearance, and here the usual inverted wooden troughs are used, and these, at the request of the railway company, are provided with an earthed metal strip at the back, in case of surface leakage.

The cars are all of the four-wheel, rigid truck, double-decked type with top covers, and are interesting as being the first to be put into service with the new pattern of four-wheeled, pressed steel sided truck which the Department have now standardised for all future four-wheeled cars. A drawing of this truck is given in Fig. 2. Its chief peculiarity is that the car body is supported on moving bolsters at each end of exactly the same pattern as those used on bogie cars, and this, with the long wheel base, gives remarkably easy riding, especially on entering curves. It will be

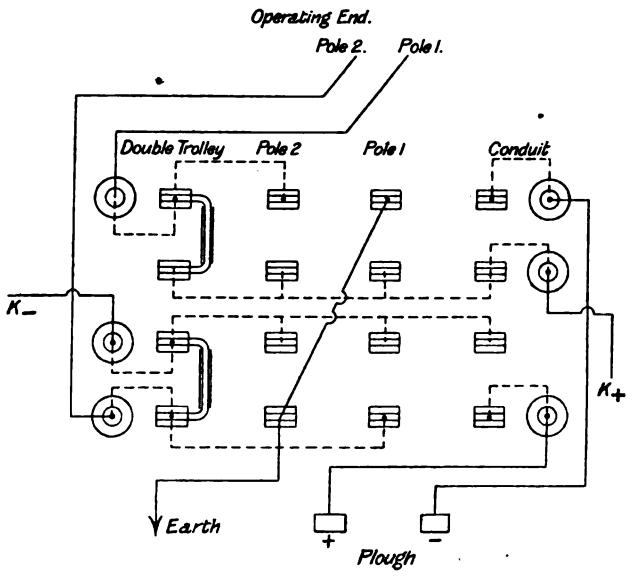


FIG. 3.—DIAGRAM OF CONNECTIONS OF CHANGE-OVER SWITCH.

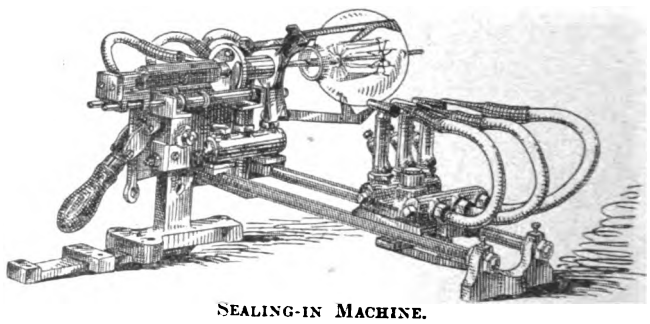
noticed that the brake gear, which is the standard electromagnetic track brake developed by the Council, is in the centre, and that only one shoe on each side is provided instead of two, as on the earlier four-wheeled cars. The space for the plough is at either end instead of in the centre. The whole arrangement is extremely rigid, and has far fewer parts than the older design, and besides giving noticeably better riding, is of distinctly neater appearance. It is interesting to note the extent to which standardisation is carried even in the construction of the bodies. These cars have bodies similar in every detail to the longer bodies on the bogie cars, but with one section, so to speak, omitted, and one window less. Thus all the woodwork, window glasses, fittings, &c., are absolutely interchangeable. It may also be mentioned that on all the cars throughout the system only one size of motor is employed, and, indeed, it is usually found that where the cars are lighter the gradients are heavier, so that about the same power is required.

The trolley poles and bases are absolutely standard, the only difference being that each car carries two side by side. When entering a section where single wire working is practised, all that has to be done is to haul down one trolley pole and put over a special switch, which leaves one or other trolley pole connected, and puts the wheel return connection in circuit. This change-over switch has also another position to provide for conduit working. It is practically the only part of the equipment which has had to be specially designed, and a diagram of connections is given in Fig. 3. The switch itself is of the barrel type, like a small controller, and is placed at one end of the car under the stairway. It is arranged to be actuated by the controller handle, which has to be removed from the controller for the purpose. This ensures stopping the car before switching over, and makes it impossible for it to be put over without knowledge of the driver.

In conclusion, we wish to express our thanks to Mr. A. L. C. Fell (Chief Officer of Tramways to the London County Council), under whose designs the work has been carried out, for putting drawings at our disposal and for other kind help in the preparation of this article.

SEALING-IN MACHINE FOR THE MANUFACTURE OF METAL FILAMENT LAMPS

THE illustration below shows an apparatus introduced by the Foster Arc Lamp & Engineering Co., Ltd. (Morden Road, Wimbledon, London), for effecting the sealing-in of filament carriers into the bulbs of incandescent lamps. It is stated that a few days' practice with this machine enables an unskilled but intelligent worker to make good lamps of the highest finish, and that the risk of filament breakage is reduced to a minimum. The machine consists of a frame with three claws to grip the lamp bulb, and a spindle to hold the filament carrier true and central. An axial extension of the frame rests on two rotating pulleys, which by



SEALING-IN MACHINE.

friction impart a rotary motion to the whole frame. By means of the handle on the left, the frame is lowered so as to bring the friction pulleys into contact with one another, and the lamp bulb into the flame. The small trigger under the handle enables the bulb to be given a horizontal axial movement in and out of the flame. When the frame is lifted again, it operates a valve and automatically lowers the gas. An American blow-pipe with three flames on either side is provided. The two lower pulleys are driven by an endless band (not shown in the illustration) which passes over a shaft under the bench. We understand that this machine is employed in the works of the Foster Arc Lamp & Engineering Co. for the manufacture of their "Foster" metal filament lamps.

Association of Mining Electrical Engineers: Visit to Ferndale Collieries.—The South Wales branch of this institution will visit the collieries of Messrs. D. Davis & Son, Ltd., Tylorstown, Ferndale, on Saturday, September 24th. Members should leave by the following trains: Cardiff, Queen Street, 2.20 p.m.; Newport, G.W.R., 1.34 p.m.; Swansea, High Street, 12 p.m; Pontypridd Junction T.V.R., 2.52 p.m. After the visit, a meeting will be held at the Jubilee Hotel, Tylorstown, Mr. S. F. Walker in the chair. Members desiring to attend should notify their local secretary before September 19th.

Telephones on Trains.—With further reference to the experiments in train telephony described in ELECTRICAL ENGINEERING, August 4th, p. 513, we now learn that the company owning Mr. H. von Kramer's patents, Railophones, Ltd. (21 Wood End Road, Erdington, Birmingham), have definitely contracted to instal the system on the London, Brighton & South Coast Railway's line for a distance of 30 miles in the middle of the route between London and Brighton, and to equip the "Southern Belle" with the necessary apparatus. The equipment is to be complete early next month. The telephone apparatus on the train will consist of a "Peel-Connor" local battery set with a special transmitter, and will be installed in a sound-proof box in the usual way. The inducing coil will be wound on a large horizontal frame suspended from the carriage, and two insulated live wires will be laid along the two rails for a distance of 30 miles. We understand that Railophones, Ltd., are negotiating with other railway companies in England and Scotland with a view to installing further equipments.

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THE LEPEL SYSTEM OF WIRELESS TELEGRAPHY

THROUGH the courtesy of Baron von Lepel, we were enabled recently to inspect the wireless station which has been erected at Slough for experimental purposes by the Anglo-German Wireless Syndicate, Ltd. (1 Cecil Chambers (West), Strand, London, W.C.), the new company owning the rights of the Lepel patents. At the same time Baron von Lepel kindly explained the latest developments of his system, and also gave us particulars of the commercial station recently installed in Jamaica for the Direct West Indian Cable Co.

The Lepel system has already been described in an article by Mr. C. C. F. Monckton in ELECTRICAL ENGINEERING, May 13th, 1909, p. 434. Fig. 1 illustrates the latest arrangements. The discharger, *A*, comprising two metal discs separated by a ring of thin paper, and provided with water-cooling, is connected through choking coils, *G*, direct to a direct-current supply at about 500 volts. The positive disc of the discharger is of copper, and the negative, delta metal. A resistance, *R*, is provided, and the switch, *S*, is the sending-key. Although this key is in the primary circuit, and breaks from 2 to 5 kw. at 500 volts, D.C., destructive sparking or arcing is prevented by means of a delicately adjusted resistance and condenser connected across the contacts. A condenser, *B*, and the two-turn primary, *C*, of the Tesla transformer complete the oscillation circuit. In parallel with the discharger are sometimes a second inductance, *H*, and a variable capacity, *F*, the function of which will be explained later. These, however, are not necessary for ordinary work. The spark rate is from 10,000 to 30,000 per second. The formation of an arc is prevented by the rapid cooling of the gap, due to the continual travelling of the spark all over the surfaces of the electrodes, and the water-cooling. Oscillatory currents rising up to 60 amperes are produced in the primary circuit, and these are transformed up in the coil, *D*, of the transformer, which is connected with the antenna as shown.

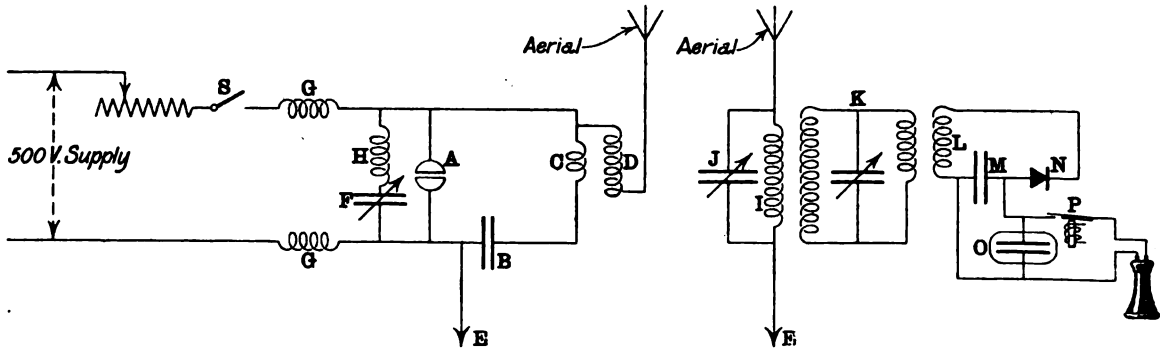


FIG. 1.—DIAGRAM OF CONNECTIONS FOR TRANSMITTING AND RECEIVING CIRCUITS.

Whereas the primary circuit is very highly damped owing to the rapid cooling of the gap, the secondary circuit is only very slightly damped, in spite of very close coupling with the primary, since the quenched spark enables the secondary to swing freely after each excitation from the primary circuit, and give out a continuous train of pure waves of one period only.

The receiving circuit comprises the antenna oscillating circuit, *I*, *J*, an intermediate tuning circuit, *K*, and the detector circuit. A graphite galena thermo-electric detector is employed, and the diagram of Fig. 1 shows this in use with a recently devised integrating device for producing loud signals. A gold-wire interrupter, *P*, operated in the same manner as an ordinary electric trembler or bell, alternately opens and closes the telephone circuit. In parallel with the telephone and the interrupter is an electrolytic condenser, *O*, of 5-mf. capacity, and this stores up the feeble continuous current from the detector and discharges through the telephone every time the interrupter closes the circuit. The "note" heard is there-

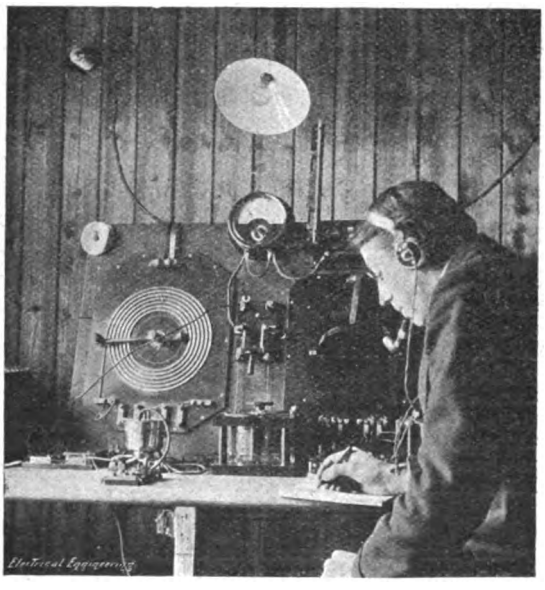


FIG. 2.—INTERIOR OF SLOUGH STATION.

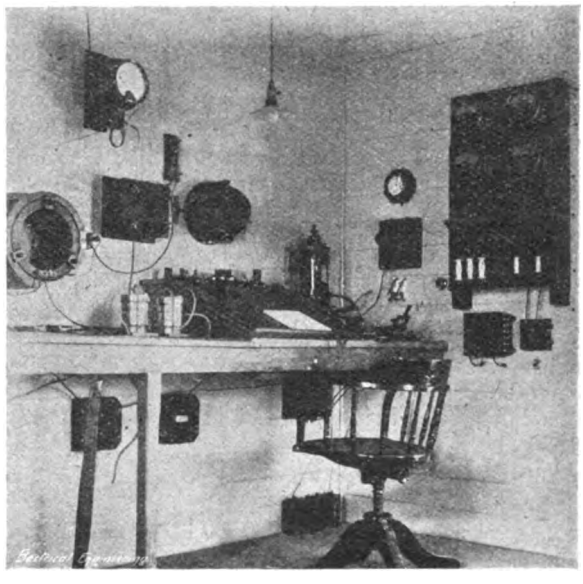


FIG. 3.—INTERIOR OF JAMAICA STATION.

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fore not the high note of the transmitter, but the "buzz" of the interrupter. Where the signals are sufficiently distinct to be heard without the integrator, the musical note of the spark is heard.

An interesting recent addition to the system is a means of instantly altering the "note" of the transmitter over a wide range, thus allowing simple tunes or bugle calls to be transmitted. The auxiliary inductance, H, and the variable capacity, F, shunted across the discharger and already referred to are used for this purpose. This capacity, F, consists of eight condensers connected in parallel with eight corresponding keys so interconnected that the second key puts in two condensers, the third key three, and so on. The result of thus connecting an oscillatory circuit of a different period in shunt with the discharger circuit is to cause the successive amplitudes of the primary wave train to alternately swell and diminish with a period equal to that of the auxiliary oscillatory circuit. As the period of the primary oscillations is made higher than that of the highest note audible, the periodic surgings caused by the auxiliary circuit produce a pure musical note. Eight different notes can be obtained in quick succession by depressing the keys, and the octave can be varied by altering the inductance. In this manner tunes are played at the transmitting station, and we had the pleasure of listening with a portable receiving set to a variety of well-known melodies played at the Slough station. For receiving musical notes, the electrolytic capacity in the detector circuit is removed and the interrupter short-circuited.

Fig. 2 shows Mr. B. Binyon, the engineer, at the Slough experimental station receiving a message This station can communicate with Paris and Brussels with its 2-kw. continuous-current equipment. For communication with Brunswick, Germany, a 5-kw. equipment utilising alternating current at 1,500 volts, 300 cycles per second, and a discharger consisting of six Lepel gaps in series, is employed. The aerial mast is 212 ft. high.

The station at Jamaica has two masts, 160 and 120 ft. high respectively, placed 260 ft. apart. The antenna is of the inverted "L" type, arranged to be slightly directive in a north-easterly direction. The generating plant consists of gas-engine sets, and the power employed in transmission is from 2·5 to 3 kw. The interior of the operating room is illustrated in Fig. 3. To the left of the desk can be seen the two single-gap dischargers connected in series, and still further to the left is the oscillation transformer. A regular commercial service is carried on with ships up to 900 miles, but communication has been successfully established with New York harbour, a distance of over 1,500 miles. The station is in frequent communication with the shore stations at Colon (600 miles), Santiago-de-Cuba, and Guantanamo, the two latter stations being in Cuba, some 200 miles distant.

New Electrically-driven Cotton Mill.—A large cotton mill especially designed for electric drive is being erected in Yorkshire. Messrs. Wright & Wood, Ltd. (Century Works, Halifax), who have secured the contract for the motors, have sent us the following particulars of the equipment:—Power to the amount of some 1,000 h.p. will be obtained from the three-phase distribution system of the Yorkshire Electric Power Co. Fifty 15-h.p. 400-volt three-phase motors running at 970 r.p.m. will be installed. These will be of the squirrel-cage type, with delta-wound stators, and will each have a three-pole oil switch fixed to the top of the shell. Each motor will drive a single ring-frame through a clutch, and will be started up by switching direct on to the supply. They are designed to take from five to six times the full load current momentarily at starting. When the full speed is reached the clutch will be thrown in by the operator. Separate cables are run from a plug near each motor to the main switchboard, so that each motor can be separately metered if necessary. We understand that seven or eight manufacturers were invited to submit sample machines to the specifications of the consulting engineer, and that these were tested for efficiency, power factor, temperature rise, starting torque, etc., before placing the order.

ELECTRICAL APPLIANCES IN DENTISTRY

THE Dental Exhibition, held last week at the Royal Horticultural Hall, was a striking testimony to the manner in which electrical appliances are becoming essential adjuncts to the equipment of dental surgeries. A large variety of "electric engines" were to be seen, a favourite pattern being that in which the motor, enclosed in a metal sphere, is suspended by a heavy flexible cable with a counterweight over pulleys fixed to a long wall bracket. The power is transmitted to the tool by a rotary flexible steel cable or a cord and pulley drive. A neat foot-controller for reversing and varying the speed of the motor, and provided with foot levers at opposite diameters so as to be readily operated from either side of the chair, is provided. All the electric lathe motors exhibited appeared to be of American make, the usual size being ⅛ h.p. at from 1,000 to 3,000 r.p.m. Two or three patterns of electric furnaces for the firing of enamels and gum bodies, and the baking of in-lays, were represented. These consist of a small muffle from one to three inches wide, and of about equal depth, wound externally with resistance wire. Electrical pyrometers are used for ensuring the right temperature being employed. Various designs of electric dental projectors were exhibited, including adaptations of the "Telschow" and the "Dunn" lamp, which throws light on to the instrument table as well as concentrating a beam on to the patient's mouth. Hand-mirrors with a bull's-eye lamp let into the mirror for enabling patients to inspect the work, and improved mouth lamps for the inspection of cavities, were also shown.

A number of appliances already described in these columns were to be seen adapted to the special requirements of dental work. Such were the "Fuller" geysers fitted to fountain spittoons, "Prometheus" water heaters adapted as instrument sterilising tanks, electric hot-water jugs, kettles, foot-warmers, compo heaters, &c. Electrically heated instrument tables for keeping the instruments warm, and thus avoiding the shock to the patient of the cold metal, electric annealers for annealing gold plates, &c., and various patterns of cautery instruments were also to be seen. An interesting novelty was a root dryer comprising a long silver point, hollow at its thick end, and containing an electric heating spiral. This instrument is inserted into root canals for drying and sterilising the tissues. Several compressed air plants for use with atomisers and hot air syringes were exhibited. A small motor-driven compressor is employed in conjunction with an air reservoir, and an automatic device which starts the compresser directly the pressure falls below 40 lbs. per sq. in., and stops it when the pressure reaches 80 lbs. The air is used for atomising antiseptic or anæsthetic solutions with which to spray the mouth, and to remove foreign matter from cavities. The hot-air syringe consists of a small spiral heater supplied with current at 4 volts, and enclosed in a glass cylinder through which the compressed air is forced. It is constructed with an air space between the heating cylinder and the outer perforated sheet, so as to prevent the external parts getting hot. A nozzle fine enough to enter a nerve canal is provided. The switch is fixed on the instrument and the air valve is opened on switching on the current. This instrument is used for relieving pain and drying cavities and root canals.

Most of the above instruments and apparatus were exhibited by The Dental Manufacturing Co., Ltd., who showed some fine examples of surgery switchboards. Messrs. Claudius Ash, Sons & Co., Ltd., had an extensive exhibit of electrical apparatus, and other firms showing electrical appliances were Arnold Biber, Cottrell & Co., and the Midland Dental Manufacturing Co., Ltd.

Battery Exit Lamps for Theatres.—According to the *Electrical World* (New York) an arrangement of exit lamps has been adopted at the Olympic Theatre, Chicago, in which each lamp is lighted from its own set of independent storage cells. The cells are, however, connected to a series circuit, so that they can be charged when required from the ordinary supply. Each exit sign contains a second lamp, which is switched in automatically if the filament of the first fails.

Interpole Tramway Motors.—As the result of a circular letter sent out by the Verein Deutscher Strassenbahn-und Kleinbahn Verwaltungen to tramway and light railway engineers, some 28 undertakings reported having carried out experiments with interpole motors. Four undertakings which only recently commenced working have adopted interpole motors exclusively. The reports show that the chief advantage in their use is the absence of sparking, and the consequent lessened attention to the commutators and longer life of both commutators and brushes.

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ELECTRICITY v. GAS FOR STREET LIGHTING

IN view of the attention that has been drawn in various quarters to the activities of the gas interests in the competition between electricity and gas for street lighting in London, the Electrical Supply Publicity Committee are sending the following letter to all the principal papers throughout the country, in the interest of supply undertakers generally, and in response to numerous inquiries received by the Committee.

[COPY.]

LIGHTING OF LONDON.

A most misleading impression has recently been created by certain paragraphs appearing in the Press under the above heading. The impression given was that London, instead of continuing an electrically-lighted city, as at present, was about to revert to gas. I need hardly say that nothing is further from the truth. The case, however, presents an interesting example of how easily an erroneous impression can be set afloat. The facts are as follows:—One of the twenty-nine London authorities, influenced by conditions which were purely local, decided to alter a few of their numerous electric lamps to gas lighting. The number of the lamps involved is quite small compared with the total number of lamps in the borough in question, and is altogether negligible in comparison with the total electric lighting of London. The whole case, in fact, is simply a local matter, confined to one authority only, and is quite undeserving of this wide publicity were it not for these incorrect rumours which have given rise to so much misunderstanding. For corroboration of the facts, reference need only be made to the official statistics of the London County Council, where it will be seen that the use of electric street lighting has more than doubled in half a dozen years, and that only ten out of the twenty-nine London authorities are wholly without electric street lighting. As to the relative cost of electricity *versus* gas for street lighting, I need only mention that in St. Marylebone the saving effected last year was £1,500 in respect of a portion of their area only, and that this has encouraged them to convert the whole of the remaining gas lamps to electric light, which will bring the saving up to £2,600 per annum. Further, the boroughs of Hampstead and Shoreditch—already extensively electrically lighted—are extending electric lamps practically throughout the whole of their areas.

Thanking you for your courtesy in giving publicity to these facts,

I am, your truly,

H. B. RENWICK,
Chairman of the Electric Supply Publicity Committee.

Full particulars of the methods which are being adopted in Marylebone, Hampstead, and Shoreditch were given in an illustrated article on page 547 of ELECTRICAL ENGINEERING of August 25th.

BOGUS TRAMWAY ACCIDENTS

AT the Old Bailey, on September 9th, three men, named Weller, Smith, and Hodder, were sentenced to six, four, and one month imprisonment respectively with hard labour for making compensation claims for bogus tramway and other accidents. The prosecution was at the instance of the British Electrical Federation. The prisoners were part of a gang which has been perpetrating these fraudulent claims for the past five or six years. The leader, Weller, has a permanent injury to his right wrist, and with this asset has been able to obtain considerable sums of money from tramway companies, insurance companies, and others.

So far as the tramway companies' claims are concerned, Weller's method was to board a car and, after allowing the other passengers to alight, on the car reaching its destination, to break away a piece of the wood slatting or beading which is nailed across the top deck, and then to pretend to fall. Having informed the conductor that he had met with an accident through falling over the defective slatting, his name and address would be taken, and in due time his claim would be received for compensation. In the meantime, he would go to a hospital, and obtain from the hall porter a form recording the injury. Weller also arranged with the other prisoners to give their names and addresses as his own, and before the company on whom he claimed sent their representative to interview the claimants, Weller had bandaged their right arms in correct hospital fashion and provided them with the hospital form. As the sum claimed was usually small, varying from £2 to £15, it was an easy matter for the frauds to be successful. In the case of the Metropolitan Tramway Co. they had a report from the conductor of the car, and also a detailed report from an inspector who happened to be on the car at the time of the alleged accident, and the company's representative saw the prisoner Hodder bandaged up. The whole case appeared to be genuine, and a prompt settlement was made in order to avoid legal proceedings.

The fraud was discovered in the following manner:—Weller, writing in the name of Smith, informed the Metropolitan Tramways that he had met with an accident and intimated a claim for compensation. A report had in the meantime been received from the conductor of the tramcar, and these documents were forwarded to the department which deals with all the claims received by the companies belonging to the British Electrical Federation, who have a mutual accident fund. In response to a letter, Weller called at the Federation offices and was interrogated about the accident; he produced the hospital form describing his injury, and it was then noticed that the date had been altered. He was told to come back again, and in the meantime inquiries were made which proved that the certificate had been issued previous to its date, and had been used in connection with another bogus accident. When Weller appeared at the Federation offices the next day he was arrested, and on being searched documents were found in his possession which led to the arrest of Hodder and Smith.

CORRESPONDENCE

THE PRICE OF ELECTRICITY.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Will you allow me to correct an evident misunderstanding occurring in your report of my paper at the B.A. meeting?

Your account says "apparently, therefore, his ideal system would be to supply electricity for power and heating at this price, and to increase the price for lighting sufficiently, &c."

Correctly put, my ideal is "to supply electricity for power and heating at prices which are not unnecessarily restricted by an assumed cost of supplying electricity for these purposes, which separate cost is, as I have tried to demonstrate in the paper, unascertainable; but to offer the supply at prices which are profitable having regard to their effect upon the relation of mean price to mean cost, and then to apply the increased profit to *decreasing*—not increasing (as you put it)—the price to other consumers, or in such a way as may result in the greatest benefit to the undertaking considered as a whole."

Your comment shows that the writer of it is influenced by the misunderstanding which it was the main object of my paper to dispel.

I am, Sir, yours, &c.,

4 Queen Victoria Street, E.C. E. W. COWAN.
September 12th, 1910.

The Association of Consulting Engineers.—Will the "old subscriber" who has written us on this subject over the signature of "Anon" kindly send us his name and address?

New Sub-Stations and Extensions for the Newcastle and Durham Electric Supply Co.'s Systems.—Owing to the increasing demand for electric power at Messrs. R. & W. Hawthorn Leslie & Co.'s engineering works at Walker, the sub-station of the Newcastle-upon-Tyne Electric Supply Co. at Walker has been extended. It now consists of three transformer chambers 29 ft. by 21 ft. by 14 ft. high. This sub-station is built inside a larger building and is for reducing the pressure from 5,500 volts to 440 volts. The total capacity is now 2,000 h.p., there being three 700 h.p. oil-cooled transformers. The high-tension switchgear is of the Brown, Boveri "Grid" type, supplied by Messrs. Richardsons, Westgarth & Co., Ltd., and consists of two feeder panels, each of 2,500 kw. rated capacity, and three transformer panels each of 1,000 kw. capacity, while one extension panel is allowed for. The low-tension switchgear is of the Reyrolle "Ironclad" type, with three transformer panels each of 1,000 kw. capacity. There is also a small 30-volt battery used for the tripping coils of the protective gear. The new installation was put into service on August 17th. To cope with the demand for light and power at the Co-operative Stores, at Seaton Delaval, the Newcastle-upon-Tyne Electric Supply Co. has just ordered a new sub-station of 150 h.p. capacity. The power will be transmitted from the Carville generating station by means of the main pole line of the Company running north, the feeder to the sub-station being taken off the pole line serving the East Holywell and Seghill Collieries. The switchgear will be of the Reyrolle "Ironclad" type. Another interesting installation is that being made by the County of Durham Electric Power Distribution Co., Ltd., for the Silksworth Co-operative Society. The sub-station is being built inside an existing building. The power comes overhead from Carville, at a pressure of 20,000 volts, as far as Ryhope, where it is transformed down to 2,750 volts and transmitted by underground cable to Silksworth. Here it is transformed down to 440 volts.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Sept. 8th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

18,675/09. **Motor Control.** M. T. MEDWAY and M. D. SCOTT (Purley). This specification describes a system of control for motors, the object of which is to render it impossible to reverse the armature current until the motor has come to rest. This is effected by a solenoid supplied with current by the motor when rotating by momentum, and acting as a dynamo after the main circuit has been broken, which holds open the main switch. When the armature comes to rest it no longer generates, and the solenoid permits the closing of the switch. One figure.

18,954/09. **Lamp Filaments.** H. W. LAKE (*Parker-Clarke Electric Co., U.S.A.*) This specification covers a strong filament which can be used at a very high temperature as a lighting or heating body in the open air. A core or filament of carbon is flashed in a vessel containing a mixture of hydrogen and benzol and silicon tetrachloride. The gases are decomposed, and the filament is covered with a skin of silicon-dicarbide (SiC_2). Any desired thickness of skin may be formed. Such filaments are said to incandesce in the open air without oxidising.

19,037/09. **Reflectors.** S. O. COWPER-COLES (London). Parabolic and other reflectors for searchlights, motor lamps, etc., are prepared by depositing a film of gold on a glass surface. A backing of silver is deposited over the gold to protect it. By regulating the thickness of the gold film, a variety of shades are obtained, and the light does not dazzle.

20,067/09. **Conduit Junction Boxes.** R. BUTLER and A. H. GIBBINGS (Liverpool). Junction boxes, elbows, etc., for metal conduit are constructed in two halves connected by screws, and have at the necks outwardly tapering recesses into which the flayed out ends of the conduit fit tightly. When the box or elbow is screwed up the conduit is held rigid and cannot move longitudinally. Two figures.

29,068/09. **Arc Lamp.** H. HIRST and A. E. ANGOLD (General Electric Co.). This is a flame arc lamp with two converging flame carbons, one of which rests on another short, hard carbon. The arc is normally struck between the two upper electrodes, but the supporting carbon is slowly consumed by the heat due to the arc, and is fed upwards by lever mechanism to keep the arc in the same position. The unsupported carbon is mechanically connected with the supported carbon, and feeds down at the same rate by gravity. This specification covers the lever mechanism acting on the supporting or abutment carbon, and operated by side pressure from the carbon holder as the carbon feeds down. Two figures.

5,985/10. **Induction Motor.** W. I. SMITH, J. D. GREEN, and A. W. GLOVER (Leeds). The rotor is built upon a sleeve and can rotate round the shaft. One plate of a cone friction clutch is attached to one end-plate of the rotor or itself forms an end-plate, and the other plate is mounted so as to rotate with the shaft but to slide axially along it. The two plates are normally pressed into contact by a helical spring on the shaft, but are held apart by means of a lever when the motor is started up. On the rotor attaining full speed, the lever is gradually released. One figure.

6,667/10. **Meter.** BRITISH THOMSON-HOUSTON CO. and C. R. D'ARCY. In meters of the induction type, the magnet system is constructed with an E-shaped potential core connected to the U-shaped current core at a point below the current coils, so as to avoid the use of the meter casing as a path for that part of the potential flux which does not cut the driving disc. Two figures.

7,821/10. **Searchlights.** SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens-Schuckertwerke Ges.*). For heavy current arc lamps, a permanently excited electric motor is geared to the electrode holders and is controlled by relays, so that it varies the position of the carbons according to the condition of the arc. The motor armature is short-circuited when the arc is normal. A main relay switch actuates one of two auxiliary relays which starts up the motor in the required direction. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: SCHUER, 13,728/09; MOUNT AND BECK FLAME LAMP, LTD., 19,387/09; MCBRIDE, 28,555/09; SIEMENS-SCHUCKERTWERKE GES. [Searchlights] 8,411/10.

Dynamos, Motors, Transformers: BAMBRIDGE [Driving mechanism for motors] 19,496/09; BARBOUR [Homopolar machines] 21,179/09; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [Prevention of sparking in frequency transformers] 23,291/09; FYNN [A.-C. motors] 30,208/09; W. A. STEVENS, LTD., and LAMBERT [Brush-holders] 30,331/09; FELTEN & GUILLEAUME-LAHMEYERWERKE A.-G. and COLLISCHONN [Petrol-electric driving mechanism] 4,681/10; SIEMENS BROS. DYNAMO WORKS and LYDALL (*Siemens-Schuckertwerke Ges.*) [A.-C. commutator motors] 7,266/10; A.-G. BROWN, BOVERI & CIE. [Train lighting dynamo] 13,502/10.

Electric Ignition: HIGGS, 28,453/09; BATT, 28,818/09; ALLISON (*Noyes*) [Magneto] 14,315/10.

Electrometallurgy and Electrochemistry: MULACEK and HATLANEK [Induction smelting furnaces] 672/10.

Storage Batteries: HUBBELL, 29,240/09.

Switchgear, Fuses and Fittings: BRACKENSIECK [Automatic sign switch] 16,885/09; KIRWAN and QUANEY [Circuit-breakers] 21,343/09 and 26,088/09; HOSGOOD [Plug and socket] 25,719/09; BENJAMIN [Lamp fittings] 27,208/09; DICKER (*Benjamin Electric Manufacturing Co.*) [Portable lamps] 3,977/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Motor controllers] 6,867/10; PODSZUS [Vapour apparatus] 14,857/10.

Telephony and Telegraphy: GRAHAM [Signalling] 23,747/09; SIEMENS BROS. & Co. and DIESELHORST [Pupin coils for submarine cables] 26,250/09; SIEMENS & HALSKE A.-G. [Semi-automatic telephone exchanges] 6,964/10; GRAHAM [Telephone transmitters] 8,024/10 and [Telephone systems] 10,577/10; FESSENDEN [Variable transformers] 11,903/10.

Traction: HARDINGHAM (*Le Feuvre*) [Vacuum brakes] 5,379/10.

Miscellaneous: ECKERSLEY and CRESWICK [Coal-cutters] 22,432/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Refractory insulating materials] 23,351/09; WILLIAMS [Coal-cutters] 26,299/09; BAMBERGER [Electric organ mechanism] 27,175/09; FALK [Electric clocks] 27,355/09; HURD [Coal-cutters] 4,491/10; CLARKE, CHAPMAN & Co. and COOKSON [Brake mechanism for hoisting machinery] 6,349/10; REINEKING [Short-circuit detectors] 7,322/10; KLEIN [Electrical warp stop-motions for looms] 11,761/10; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [Vacuum cleaning apparatus] 11,901/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Incandescent Lamps: ARSEM [Filaments] 19,030/10; A.E.G. UNION ELEKTRICITÄTS-GES. [Manufacture of tungsten filaments] 19,095/10.

Instruments, &c.: DUNOYER [Measurement of intensity and variations of magnetic fields] 17,624/10.

The following amended Specification can now be obtained.

HIBBERD [Prepayment meters] 8,438/08.

Opposition to Grant of Patents

25,231-2/07. **Exhaust Steam Accumulators.** J. HOWDEN & Co., LTD., and W. H. OWEN. An appeal has been lodged against the decision of the Comptroller to grant these patents. (See ELECTRICAL ENGINEERING, Sept. 1st, 1910, p. 564.)

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

20,505, of September 16th, 1896. **Storage Battery Plates.** H. IMRAY (*R. J. Grindle, Dieppe*). In plates comprising several ridged strips of lead rolled up and held in a frame, the strips have a central longitudinal ridge to improve the conductivity.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. E. ANGOLD, A. W. HILL, and SIR HIRAM MAXIM ELECTRICAL & ENGINEERING CO. [Enclosed lamp] 12,101/03.

Distribution Systems, &c.: E. S. MOORE and W. G. STRANG [Booster connections] 10,639/05.

Dynamos, &c.: H. LAKE (*General Electric Co., U.S.A.*) [Insulation of H.-T. transformer coils] 11,851/02, and [Turbo-alternator rotor construction] 12,080/02; L. KRIÉGER and COMPAGNIE PARISIENNE DES VOITURES ELECTRIQUES (Procédés Kriéger) [Dynamo-motor combinations for electric cars] 25,171-2/05.

Electrometallurgy, &c.: E. STASSANO [Electric furnace and iron alloys] 11,604/98; S. O. COWPER-COLES [Electrodeposition apparatus] 9,731/00; M. OTTO [Ozone sterilizer] 11,928/04; D. FULLER [Dry cell] 11,040/05.

Incandescent Lamps: D. J. O'BRIEN [Straight filament lamp] 11,439/04.

Storage Batteries: C. GOULD [Machine for grooving plates] 11,070/99.

Switchgear, &c.: M. A. CODD [Cable connectors] 11,012/05.

Traction: G. GIBBS [Motor trucks] 9,413/00.

Miscellaneous: D. ABERCROMBIE [Lamp for rifle] 11,700/04; D. D. PLUNKET [Coal conveyor] 11,877/04; A. J. BOULT (*Cöln-Müssner Bergwerks Akt.-Verein*) [Use of arc in manufacture of metal ware] 10,655/05.

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WHAT IS "ASSOCIATION" CABLE?

THE Cable Makers' Association have published in the advertisement columns of a few technical papers a full-size reproduction of their label, with a notice to warn buyers of "Association Grade" cable to see that they get it. In an interview with the Secretary of the Association, we were informed that the advertisement is actually published to protect the Association against imitation of their label, and that particular importance has been attached to the announcement appearing in the journals read by architects, as the wiring contractors already know of the existence of the Association.

The label, which is probably known to the majority of our readers, or at any rate to that portion of them who have to do with house wiring, is buff coloured, and measures about $5\frac{3}{4}$ ins. long by $3\frac{3}{8}$ ins. wide. It bears the words "Association Cable, made in accordance with the standards of the Cable Makers' Association, of which we are members," with spaces for the guaranteed insulation resistance, the length, size, "megohm" grade, and class, and the name of the maker. The Secretary of the Association did not respond to our request for information as to whether it was the label of any particular non-Association firm that had called for the issue of this notice. We do not remember having met any inferior cable labelled to pass off as C.M.A. material, but we must admit that there are many makes of foreign cable that do not come under our observation in ordinary circumstances. A British maker outside the Association supplies a cable with a pink label marked "C.M.X. Made in accordance with the Standards of the Cable Makers' Association and Engineering Standard Committee," but in this case we are convinced that there is no desire to pass off as an Association firm, and the samples of the cable in question which we have seen appear to be, at all events as good as, if not better than, samples of C.M.A. cable of the same "megohm grade."

We cannot but think that the Cable Makers' Association would be well advised to be less reticent than they are as to the actual quality of cable to which the magic word "Association" is attached, and also if they advertised a list of those makers who form the Association, and a list (possibly a shorter one), of those who do not make any other vulcanised rubber cable than "Association Cable." Of greater utility still to the expert buyer and user, however, would be a clear statement indicating the quality of this "Association" cable, and the specification to which it is made. The consulting engineer or contractor has, it is true, a sort of implied guarantee that the "Association" cable made by all its members is of equal quality, but he has no guarantee that the cable he buys as "Association" cable to-day contains the same proportion of Para rubber as that which he bought a year or five years ago. The Association, so the Secretary informs us, adheres at present to its policy of not disclosing its specifications of V.R. cables. To those buyers who cannot themselves form an idea of the quality of cable from an inspection of it and particulars of the tests, our advice is to buy "Association" cable, as the reputation of the Association firms is good, or, if he is buying from a non-Association firm, at any rate to limit his custom to firms of equally high repute, and to exact a guarantee. The expert buyer, however, can hardly be blamed if he objects to adopting a standard without knowing what that standard is; and if he is forced to frame his own standard specification, or to buy from submitted samples, he will naturally desire to reap the advantage in price which an open market affords.

CORRESPONDENCE on this subject is invited.

SURFACE-CONTACT TRACTION CONDEMNED

Board of Trade Refuse to License Dolter and G.B. Systems

THE dispute between the Torquay Corporation and the Torquay Tramways Co. as to the practicability of making the Dolter surface-contact system a workable one in Torquay, reached an important stage on Monday, when arbitration proceedings in connection with the matter were commenced in London. The Board of Trade have definitely refused to renew the licence for the Dolter system on the nine miles of track in Torquay, and, acting under advice, the Company have given orders for converting all the lines to the overhead system, except the ones in Torbay Road, in respect of which a special clause applies. The Board of Trade have approved the plans of the overhead construction, without prejudice to any legal questions that may be raised with regard to the proposed change. The Company's original Act of Parliament was obtained in 1904, and various lengths of line have been opened at intervals since.

At the outset of the arbitration proceedings, the Corporation protested against any arbitration at all, on the ground that, by virtue of section 58 of the Act, and a subsequent agreement, they had an absolute veto in regard to the system to be adopted in the Torbay Road. After consideration, the arbitrator (Mr. Archibald Reed, Barrister) decided to proceed with the hearing, leaving it to the Corporation to apply to the Courts on this point of law when his award is issued.

The chief technical witnesses are Mr. W. M. Mordey for the Corporation, and Mr. James Swinburne and Mr. W. H. Patchell for the Company.

Mr. VESEY KNOX, K.C., in opening the case for the Company, expressed his conviction that surface-contact traction is hopeless, and that not one installation had been really commercially successful. At Torquay the Company was now working at an absolute loss, and he hinted that it seemed to be the intention of the Corporation to keep the Company in this position in order that they might be able to by them out at a nominal figure, the Corporation having powers under the Act to purchase on "going concern" terms. The Board of Trade had informed the Company that they would not sanction the G.B. system. With regard to another alternative, the Mitchell improved stud, he said that Mr. Mitchell, who was formerly Chief Engineer to the National Electric Construction Co., had invented five previous studs, all of which had proved quite unsatisfactory. The Lorain Co. had refused to guarantee their system, and in the opinion of the Company, therefore, all three alternatives were impracticable. The Dolter system had been installed at Mexboro, Hastings, and Torquay. At Mexboro it was taken out at the request of the Councils concerned, and at the suggestion of the Board of Trade, and the overhead system was substituted, with the result that the units per car mile had decreased from 2·3 to 1·7, the cost of maintenance from 3d. to 1d. per car mile, and the average revenue per car mile had increased from 7½d. to 10d. At Hastings, he said, although two miles of lines are worked along the front fairly successfully owing to the particular local conditions, *i.e.*, a wide road with the line running on one side and no gradients or curves, the cost of maintenance is double that of the rest of the line, which is worked on the overhead system. After mentioning the fact that the National Electric Construction Co., as the parent company of the Torquay Co., has spent £30,000 on inventions of Mr. Mitchell, Mr. Knox protested against having to spend a further £6,000 upon fitting the Torquay track with this newest stud of Mr. Mitchell. To convert the lines to the overhead system, and to construct the extension to Paignton, will cost £80,000, and this sum the Company are able to find; but no responsible financier, said Mr. Knox, would find any money if the surface-contact system remains on any section of the system.

Some of the defects of the Dolter system, carbonisation of the oil, water getting inside, and explosions due to accumulations of gas in boxes, were specially mentioned. Dead studs, as well as live studs, were common experiences, and, said counsel, it is not uncommon for the motorman and conductor to have to crowbar a car from a dead to a live stud. One run showed 63 extinctions of the lights on a mile of line, owing to dead studs. At the commencement of working, no fewer than 37 men were engaged in looking after the track. The consumption of energy per car mile was 0·26 unit more than the total consumption metered on the cars, and this was attributed to leakages in the system generally which cannot be detected.

Criticising Mr. Mordey's report (ELECTRICAL ENGINEERING, July 28th, p. 496), and also his reports upon the G.B. system in London, Counsel said that Mr. Mordey's was a type of electrical mind which was the terror of capitalists, suggesting

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all sorts of possibilities which, in fact, always had great practical difficulties.

The position of the Company was demonstrated by the following figures: In 1908 the gross revenue was £15,000 and the net revenue only about £3,000. In 1909, although the gross revenue went up to £15,545, the net revenue decreased to £2,426, and it seemed to be only a question of time for the net revenue to disappear altogether, owing to the heavy cost of maintenance of the Dolter system. These figures allowed nothing for depreciation or reserve.

Mr. W. B. COWNIE, General Manager of the National Electric Construction Co., and a director of the Torquay Tramways Co., gave further instances of the difficulties which had been encountered in connection with the working of the Dolter system at Torquay. No less than £10,549 had been spent there, in addition to the capital expenditure on the lines, in attempting to perfect the studs. The insurance company, owing to the large number of claims for injuries to persons and horses from the studs, had refused to continue the risk, and it was only at the urgent request of the Tramways Company that they had consented to continue until the end of the year. The cars used 2·3 units per car mile, and the average price paid to the Corporation was 1·6d. per unit.

Mr. JAMES SWINBURNE, F.R.S., expressed the opinion that in view of the difficulties which the Tramways Company had met with, and the manner in which they had endeavoured to overcome them, it was unreasonable for the Corporation to withhold their consent to the overhead system. He contrasted the use of overhead trolley tramways in such places as Zürich and Lucerne with the so-called æsthetic objections in England. There were exceptional difficulties on the Torbay Road, for during south-westerly gales it was flooded from the sea, and during the summer the road was watered with salt water. Further, the road had a very bad foundation, and was frequently subsiding. He described briefly the effect of water in the stud boxes, and also the carbonisation of the oil, both of which were instrumental in leaving "live" studs. In his opinion the improved Mitchell stud was not so good as the one now used, for it only employed one receptacle instead of two, thus making it more difficult to keep water from interfering with the working part. At present, the moving parts are contained in a pot which is, as nearly as possible, hermetically sealed. The great difficulty had been to secure an oil which was sufficiently heavier than water to keep it out, and, at the same time, not so heavy as to prevent the moving parts working. He did not believe the Board of Trade would sanction the system, even with the new Mitchell stud, which, he said, had not yet been constructed and put into use anywhere. Even assuming a good oil were discovered, he would not be satisfied, because it would still leave them in the region of experiment, which was not conducive to commercial success.

Mr. J. L. PRIMAVESI, Assistant Engineer to the National Electric Construction Co., described some of the details of the stud and the modifications carried out. At first the studs contained a fuse in conjunction with a short-circuiting device on the car, which operated when a stud remained alive. If, however, the fuses were made too light, they blew on starting up a car on a hill or in a heavy traffic. If too thick, the fuses did not blow, but the circuit breaker at the power-house came out. He emphasised the difficulty of getting an oil without acid, in order to avoid the metal and bitumen in the stud boxes being attacked. The oil now used, they found, was gradually attacking the metal work, although it was guaranteed not to. Criticising the new Mitchell stud, witness foresaw the possibility of arcing inside the stud box, and the consequent more rapid carbonisation of the oil. He also objected to the use of a porcelain pot in the stud box, owing to the liability of damage from heavy street traffic.

Mr. J. S. BRAITHWAITE, of Messrs. Foster & Braithwaite, spoke of the difficulty of finding capital for any tramway enterprise in Great Britain, and particularly so for a surface-contact system.

Mr. H. HOLLIDAY, Resident Engineer and Manager at Torquay, referred to the very heavy cost of maintaining the track free from live studs. For nine months in 1907, the wages bill of the track patrols amounted to £1,417, and even so there were accidents. The number of patrols had now been decreased to three, but on curves the conductors test the studs, sometimes being knocked down in the process. When a live stud is discovered, the motorman is signalled, and he stops the car and brings some insulating material, which is placed upon the stud until it is taken out for repair. The cost of the current lost by leakage in the stud boxes, represented by the difference between the current metered on the cars and at the power-station, was £679 per annum. When the Torbay Road is flooded the service has to be absolutely suspended, and this had happened four or five times a year.

The hearing was being continued when we went to press yesterday, and will be resumed on Friday.

LOCAL NOTES

Australia, Perth: *Tramway Strike.*—According to a Reuter telegram on Friday, the strike of the tramways employees in Perth, to which reference has been made in our last two issues, has been settled.

Belfast: *Street Lighting.*—In common with many other cities, the Belfast municipal authorities are finding it difficult to decide whether gas or electricity should be used for street lighting purposes. At present only two of the leading thoroughfares are well lighted, namely, Donegall Place and Castle Junction, and the brilliancy of these two streets, contrasted with the dimness of those adjoining, has often been the subject of criticism and complaint. The Police Committee, in the course of a few days, intend to substitute electric light for gas lighting in Castle Place, and its continuation, High Street, down to the Albert Memorial. Should the experiment prove successful it will possibly be extended to others.

Blackburn: *Medical Inspection of Tramway Employees.*—The Town Council have decided that all electric tramway drivers must be examined by the Medical Officer of Health at least twice per year.

Bradford: *Tramway Track Reconstruction.*—A large number of single-track lines in Bradford are at present undergoing reconstruction.

Greenock: *Supply to Admiralty.*—The supply which the Admiralty will require from the Corporation for the torpedo factory at Battery Park will be 400 kw., which is exactly double the amount originally stipulated.

Grimsby: *Commercial Methods.*—A proposal by Mr. W. A. Vignoles to hang showcards advertising municipal electricity in various properties belonging to the Corporation was discussed at the last meeting of the Council. Some objection was taken to this form of advertising electricity, and eventually the proposal was rejected.

Harrogate: *Supply Outside Boundary.*—The Corporation are recommended to apply to the Board of Trade for an order granting permission to supply certain premises outside the municipal boundary.

Hove: *Trolley Omnibuses.*—The local omnibus company have asked the Council to consider the adoption of the trolley omnibuses, but the Watch Committee do not recommend consent being given at present.

Manchester: *Gas and Electricity Committees.*—At the last meeting of the Council some discussion took place with regard to the supply of gas for cooking purposes where electricity is used for lighting. The point in itself was a small one, but Alderman Holt said it raised a serious question. The Gas and Electricity Committees were in competition for the supply of light in the town, and he thought the sooner the two Committees were joined together in one Light and Power Committee, the better it would be for the city. In his opinion they had no right to allow competition between the two departments.

New Tramways.—Several new electric tramway extensions are to be promoted in the next session of Parliament.

Newcastle: *Projected Tramways.*—The Newburn Council are urging the Newcastle Tramways Committee to extend their lines to that district. The matter was further considered at a special meeting last night, to which a deputation from the Newcastle Tramways Committee had been asked to attend.

Nottingham: *Tramway Construction.*—The work of constructing the Carlton Road tramway has been commenced. The estimated expenditure is £18,000.

Plymouth: *Street Lighting.*—The Electricity Committee are considering the use of metal filament lamps for side-street lighting.

Sevenoaks: *Electric Lighting.*—The local Chamber of Trade recommend the Council to canvass the town with regard to electric lighting before applying for a Provisional Order.

Swansea: *Electricity Works' Assessment.*—The assessment of the Corporation Electricity Works has been increased by £753, and the question of appealing against this has been left in the hands of the Town Clerk.

West Hartlepool: *Gas Critics.*—At the last meeting of the Town Council the Chairman of the Electric Lighting Committee took strong exception to some remarks made recently at the annual meeting of the local gas company. The Chair-

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man of that undertaking is alleged to have made a statement from which the inference was to be drawn that the municipal electric light undertaking was not carried on in a business-like fashion, and that proper provision was not made for depreciation and wear and tear. The Chairman of the Electric Lighting Committee pointed out that for several years past the electric lighting undertaking has paid 7 per cent. on the capital invested, of which 8½ per cent. has been devoted to interest, and 8½ per cent. to depreciation.

Weymouth: *Tramways.*—A newspaper poll for or against tramways is being conducted. A deputation from Weymouth have been inspecting the Plymouth tramways with a view to forming an opinion as to the capabilities of a certain type of car which is in use there, and which has been mentioned as suitable for the proposed tramways in Weymouth. The car in question is of the demy-car type. It is a single-deck car seating 24 passengers, the driver collecting the fares as the passengers board the car. The deputation in their report call special attention to the quietness with which this type of car runs.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Accrington.—To supply electric current in bulk to Haslingden, the Council will spend £9,687. Of this £2,670 will relate to Haslingden, the rest being made up of transformers, switchgear, &c. Extra buildings, mains, &c., will absorb £9,687. To lay cables in Church will involve an expenditure of £1,002. The Corporation are now seeking powers to borrow £16,359 for the work.

Barrow-in-Furness.—Application is to be made for a loan of £5,000 for mains, £4,000 for meters, switches, &c., £500 for street lighting extensions, and £500 for plant extensions.

Bootle.—A loan of £8,500 is required; £7,500 being for feeders, distributors, and services, and £1,000 for meters.

Burnley.—In order to supply current for working the tramways in Brierfield, it will be necessary to lay cable, at an estimated cost of £1,800.

Cleckheaton.—A Local Government Board inquiry was held last week into a loan of £2,210 for cables and services.

Colwyn Bay.—An inquiry was held last week into a loan of £23,000 for new mains.

Dublin.—Under a scheme prepared by the Corporation Electrical Engineer, extensions to the high tension cables are to be carried out at an estimated cost of £3,150.

Dunfermline.—The Fife Electric Power Co. propose to erect a new sub-station at Kingseat.

Edinburgh.—The Electricity Committee invite tenders for steam turbines, direct-current generators, and condensng plant; also interior parts of cooling towers. Particulars from the Engineer, Dewar Place. Specifications may be seen at Sir Alexander Kennedy's office, 17 Victoria Street, London, S.W.

Felixstowe.—A loan of £4,260 has been sanctioned for Diesel engine plant and extensions at the electricity works. Application is also to be made for a further loan of £3,000 for mains, extensions, house services, &c.

Huddersfield.—Extensions to the electricity works at an estimated cost of £10,185 are to be carried out.

Newport, Mon.—The Electricity & Tramways Committee require rubber cables, H.T. and L.T. lead-covered cable, motor starters and L.T. switchboard apparatus, &c. Particulars from Borough Electrical Engineer, and tenders by September 20th.

South Africa.—Tenders are to be invited by the Durban Council for a switchboard, jet condenser, plant converters, and two miles of H.T. cable.

Stockport.—The Electrical Engineer reports the need for extra feeder and distributing cables, boosters, and alterations to switchboard at an estimated cost of about £7,000.

Torquay.—The Local Government Board have expressed their willingness to sanction a loan of £4,500 for mains during the next three years on receipt of a formal resolution from the Council authorising the loan.

Warrington.—The Local Government Board have sanctioned a loan of £6,257 for additional electrical plant.

West Bromwich.—An inquiry was held last week concerning a loan of £11,386 for extensions at the electricity works.

MISCELLANEOUS

Canterbury.—An electrical pumping plant is to be installed at the workhouse, in connection with the fire protection apparatus.

Nottinghamshire.—The Notts & Derbyshire Tramways Co. is making a start with its tramway scheme from Nottingham through Heanor.

Shanghai.—According to the *Board of Trade Journal*, the Shanghai Electricity Department require electric heating and cooking appliances. The consulting engineers are Messrs. Preece & Cardew, 8 Queen Anne's Gate, London, S.W.

Tasmania.—The *Board of Trade Journal* states that negotiations in connection with a proposal by the Complex Ores Co., and the municipal authorities of Lovett, Franklin, Ranelagh, Hounville, and Geeveston, for supplying electric light and power in these towns are proceeding.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Baths at Goose Green, Dulwich.

Gainsborough Road School, Canning Town. W. Jacques, 2 Fen Court, Fenchurch Street, London.

Sorting office at Leytonstone. H.M. Office of Works, London.

School at Mason's Hill, Bromley. Kent Education Committee.

Eighteen houses in York Road, Ealing. A. J. Taylor, 22 Overdale Road, South Ealing.

Twelve houses in Kingsdown Avenue, Ealing. H. Cook, 15 Shaftesbury Avenue, New Barnet.

PROVINCES.

Accrington.—Extensions to Woodnook Mill for Messrs. Higham Bros., Ltd.

Amble.—Mineral water factory in Henderson Road. The Surveyor.

Annfield Plain.—Picture theatre. Architect, L. H. Armour, 16 West Street, Gateshead.

Banbury.—Memorial to the late Dr. Parker. Town Clerk.

Barrow-in-Furness.—Manual Instruction Centre at Cambridge Street School. Education Committee.

Birmingham.—Police Station at corner of Digbeth and Allison Streets. Architects, Mansell & Mansell, 47 Temple Row. Workshops, offices, &c., in Cambridge Street. City Engineer. Municipal Baths. Town Clerk.

Blackburn.—Council School in Ross Street. Borough Engineer.

Blackpool.—Printing works for Blackpool Advertiser.

New offices in Sefton Street for Health and Cleansing Department.

Cardiff.—Electric theatre.

Colne.—New church at Primet Bridge.

Colwyn Bay.—New drill hall for 5th Battalion Royal Welsh Fusiliers. Major Keene, Mold, Flintshire.

Darlington.—Offices for Prudential Assurance Co.

Darwen.—New school in Ross Street. Education Committee.

Dublin.—Fire Station, Thomas Street. Waterworks Committee.

Dumbarton.—Academy Buildings. Dumbarton School Board.

Electric theatre at 25 George Street. Architects, Messrs. T. H. Cowieson & Co., St. Rollox, Glasgow.

Dundee.—Alterations and additions to Drill Hall. Dundee Territorial Force Association.

Laboratories at University College.

Durham.—New schools at Mount Pleasant, Spennymoor, and Closehouse (Bishop Auckland). Architect, W. Rushworth, Shire Hall, Durham.

Church, Horden. Wesleyan Church.

Exmouth.—New Petty Sessions Room and Police Station. Town Clerk.

Farnworth.—Specifications are being prepared for wiring the library. Electrical Engineer.

Folkestone.—St. Michael's Parish Hall.

Glasgow.—Chapel in Garngadhill. Architect, C. J. Menart.

Warehouse and offices at corner of Killearn Street and Saracen Street for Messrs. Greenlees & Sons. Architects, Messrs. Wyllie & Blake.

Brewery buildings in Garscube Road for Messrs. Whitbread & Co., Chiswell Street, London.

Reconstruction of premises at 55 Argyle Street for electric theatre. West of Scotland Electric Theatres, Ltd., 41 St. Vincent Place.

Hull.—Electric Theatre. Architects, Messrs. James Young & Co., 62 Market Street, Bradford.

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Isleworth.—Laundry at Workhouse. Architect, W. H. Ward, Paradise Street, Birmingham.

Leeds.—Extensions to Training College, Beckets Park, Headingley. Architect, G. W. Atkinson, 1 Mark Lane.

Lincoln.—Children's Home. Board of Guardians.

Luton.—Extensions to Beech Hill Schools. Education Committee.

Manchester.—Extension to Royal Exchange. Improvement Committee.

Newcastle-on-Tyne.—Additions to Armstrong College.

Newport, Mon.—Buildings for new pumping and power station at Alexandra Docks. Sir John Wolfe, Barry & Partners, 2 Queen Anne's Gate, Westminster, London.

Paisley.—Block of buildings in Greenock Road. Architect, R. B. Millar.

Perth.—Infirmary at Tullylumb. Board of Guardians.

Peterborough.—Extensions of Deacon School. The Governors.

St. Austell.—Hospital. General Committee.

St. Helens.—Elementary school at Eccleston. The County Architect.

Shanklin.—United Methodist Chapel.

Sheffield.—A new building is to be added to the Mining Department of the University.—United Methodist Church, Penistone Road.

Primitive Methodist Chapel at Hathersage.

Skegness.—Church. Sir George McAlpine.

Southampton.—Additions to fish market. Borough Engineer.

Southport.—Municipal Buildings in East Bank Street. Town Clerk.

Stoke-on-Trent.—Hospital. Joint Hospital Board.

Sunderland.—Day Training College in Durham Road. Education Committee.

Tamworth.—Handicraft Centre at Boys' Council School.

Warrington.—Council Schools in Evelyn Street and Winwick Road. Extensions to School of Art. Education Committee.

Wellington, Salop.—Secondary School. Architects, Messrs. Shayler, Swan & Ridge.

Whitehaven.—Bank in Lowther Street. Architect, A. Huddart, 9 Lowther Street.

Wigan.—Council Elementary School, Scott Lane. Architect, H. D. Holland, 11 Library Road.

Worcester.—Primitive Methodist Church at corner of Hill Avenue.

Worksop.—Phthisis Hospital. Board of Guardians.

York.—Electric theatre in Foregate.

Lecture theatre for the Yorkshire Philosophical Society.

TENDERS RECEIVED AND ACCEPTED

Belfast.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., has been accepted for 37 flame arc lamps at £293.

Dewsbury.—Messrs. Cowans, Ltd., have received an order for a switchboard panel for the Electricity Works.

Dublin.—The tender of the A.E.G. Electric Co., Manchester, has been accepted for the wiring and fitting of the St. James Street workhouse, at £2,537, and £250 for maintenance.

Gosport.—The tender of Mr. W. M. Walter has been accepted for wiring the Council's offices at £55 11s.

London.—Messrs Siemens Bros. Dynamo Works, Ltd., have received the contract for the complete electrical equipment of the Palladium Theatre, Argyle Street, Regent Street, W. The wiring work has been sublet to Messrs. Rashleigh, Phipps & Co.

Montrose.—The tender of Messrs. A. & P. Steven, of Glasgow, for electric lifts at the Infirmary, has been accepted at £202.

Swindon.—Messrs. Babcock & Wilcox, Ltd., have received an order for a superheater at the Electricity Works, at £180, and a contract has been entered with the Tudor Accumulator Co. for the maintenance of the storage battery, at £66 per annum, for ten years.

Walsall.—The following tenders have been accepted:—British Westinghouse Co., rotary converters and switchgear (£1,145); Callender's Cable & Construction Co., high-tension mains (£5,026).

West Bromwich.—The tender of Messrs. C. A. Parsons & Co., Ltd., for a turbo-alternator has been accepted, subject to the sanction of the Local Government Board to the necessary loan.

Whitehaven.—The Corporation have placed an order with Ed. Bennis & Co., Ltd., for the supply of four "Bennis" stokers and self-cleaning natural draught furnaces, for B. & W. boilers, to the Electricity Works.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. E. Starkie, Borough Electrical Engineer at Burnley, is to be paid an honorarium of £60 for services rendered in preparing schemes and supervising the installation of electric lighting and apparatus at the Technical Institute.

Mr. C. H. Yeaman, who was recently appointed General Electrical Engineer to the new county borough of Stoke, entered upon his extended duties on Thursday.

An ex-Naval man, with experience in dynamos and motors, &c., requires a situation. (See an advertisement.)

An assistant engineer is required in the Operation Department of the Yorkshire Electric Power Co. (See an advertisement.)

A resident engineer is required for one of the electricity works of the county borough of Stoke-on-Trent. (See an advertisement.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. per ton (last week, £58 5s. to £58 15s.).

Tantalum Lamps.—Messrs. Siemens Bros. Dynamo Works, Ltd. (Tyssen Street, Dalston, London) send us the testimony of a Doncaster customer that of ten tantalum lamps installed three years ago, and in constant use, only two have had to be replaced.

Metal Filament Lamps.—The Metallic Seamless Tube Co., Ltd. (Wiggin Street, Birmingham), have completed arrangements with the manufacturers to act as wholesale selling agents for the "Brimsdown" metallic filament lamps, which they state are manufactured under conditions which give complete indemnity to every purchaser.

Change of Address.—The A.E.G. Electric Co., Ltd. (121-125 Charing Cross Road), are removing to Pembroke House, 133-135 Oxford Street, W. Telephone: Gerrard 8848. Telegrams: Galvanolon, London.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Yorkshire Electric Power Co.—Satisfactory progress was reported by the chairman at the half-yearly meeting last week. There was a net profit of £2,612 for the half-year, after meeting mortgage interest. It was decided to issue 20,000 six per cent. cumulative preference shares of £5 each.

Allgemeine Electricitäts-Gesellschaft.—Dividend of 14 per cent. for 1909.

Sao Paulo Tramway, Light & Power Co.—Quarterly dividend of 2½ per cent. on capital stock.

Puebla Tramway, Light & Power Co.—The net profits for the year 1909, namely, £48,700, are an increase of about 78 per cent. on the previous year.

Shawinigan Water & Power Co.—An issue of £100,000 ordinary stock is to be offered to the assistant shareholders.

Manila Electric Railroad & Lighting Corporation.—A dividend of 1 per cent. for the quarter ending September 30th.

Wireless Telegraphy.—H.M.S. *Bonaventure* and *Antelope*, with eight submarines, have arrived at Torbay for important experiments in the use of wireless telegraphy in connection with the submarines. According to newspaper reports, one of the latest type of the vessels has been fitted with wireless apparatus, and messages have been received with success, although no messages have yet been sent from the submarines. A series of further experiments is to be carried out in Babbicombe Bay.

The Electro-Metallurgical Society.—A new institution for the study of the application of electrical processes to metallurgy has been founded, and the initial meeting was held in Sheffield on Monday last. The meeting was presided over by Mr. A. Parsons. Prof. Arnold was elected president, and Prof. McWilliam, Dr. Hutton, and Mr. T. Scott Anderson, vice-presidents. The hon. secretaries are Mr. G. B. Brook and Mr. F. Mason. Monthly meetings are to be held at the Sheffield University.

The Municipal Wiring Bill.—In addition to the list we published last week, Burton-on-Trent, Luton, South Shields, and Nelson have promised financial support to the Municipal Wiring Bill, and Oban, Redditch, and Neath will give their moral, but not financial, support.

OSRAM-LAMPS

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ELECTRICAL ENGINEERING

No. 195 [Vol. VI., No. 38] THURSDAY, SEPTEMBER 22, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

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The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

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United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

On Monday a number of telephone engineers, press representatives, and others visited Glasgow as the guests of the Peel-Conner Telephone Works, Ltd., in order to inspect the new central exchange erected by that company for the Post Office. (Page 600.)

An article by Messrs. F. J. Moffett and N. B. Rosher deals with motor control, particularly as regards three-phase motors. Time lag attachments are discussed, and a new slow-motion device for starters is described. (Page 601.)

Two Papers on checking the consumption of tramcars by individual meters were read at the Tramway Congress at Brussels. Results of their introduction at various Continental towns show great savings, and in only very few cases have they been abandoned. On the whole the hour-meter seems more popular than the watt-hour or ampere-hour meter for the purpose. (Page 604.)

Electric welding is being introduced into the metal and general hardware factories with considerable success. Machines known as point welders are used, and these are fitted with special electrodes adapted to the work, which ranges from seam welding for heavy iron drums to the welding of can and kettle spouts. (Page 605.)

A large number of awards have been made in the British section of the Brussels Exhibition. (Page 605.)

The Smoke Abatement Exhibition at Glasgow includes an effective "electric home," arranged by the Corporation Electricity Department. Demonstrations of electric cooking are being given. (Page 605.)

Under "Electrochemistry and Electrometallurgy" are described some electrical methods for the manufacture of phosphorous. A note is also given on the working of copper ores in the electric furnace. (Page 606.)

A remarkable Paper by Prof. R. A. Fessenden, read at the meeting of the British Association at Sheffield, deals with sun and wind power, giving estimates for a system with hydraulic storage with two tanks, one on the surface and the other at the bottom of a 1,000 ft. shaft, the power to be furnished partly by steam from sun-heated tanks and partly from windmills (Page 594.)

A new form of cooling tower is described on page 607.

Among the Specifications published by the Patent Office on Thursday was one by the Beck Flame Lamp, Ltd., for a multiple carbon flame lamp mechanism.—Siemens Bros. & Co. cover an improvement in Pupin coils for submarine telephone cables, which consists in covering the coil with thin metallic foil or other material impermeable to moisture.—A patent for an arc furnace for treating gases by the Chemische Fabrik Griesheim-Elektron has been surrendered as the result of opposition.—Application has been made for the revocation of a patent covering a sparking plug with cup-shaped

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electrodes.—Among the patents expiring during the current week are one for a motor-driven centrifugal drying machine, and another covering an electromagnet telegraph tape perforating apparatus. (Page 608.)

IN a Paper read before the Institute of Marine Engineers, Mr. J. Lecoche described the application of his magnetic gear to marine propulsion. A slow-speed reciprocating engine drives the main propeller shaft, and a high-speed exhaust-steam turbine assists it through the magnetic gear. (Page 609.)

THE arbitration to decide whether the Torquay Tramways Co. shall substitute the overhead trolley system for the Dolter system was concluded on Saturday. Evidence was given by Mr. C. E. C. Shawfield (Wolverhampton) and Mr. S. Clegg (Lincoln) showing that the Lorain and G.B. surface-contact systems respectively were working admirably. Mr. W. M. Mordey described certain modifications of the existing Dolter stud mechanism, which he maintained would get over the chief troubles now experienced; he also suggested a new "live" stud detector, but the company stated they had actually tried this and found it a failure. Although one of the main objections of the Corporation is that the overhead wires would be unsightly, it was admitted in evidence that at one time the Tramways Committee offered to recommend the Corporation to agree to the overhead system all over the town if the Company would construct certain additional lines. (Page 609.)

THE Bradford Tramways Committee propose to purchase two trolley omnibuses.—Reductions in the charges for electricity are to be made at Eastbourne.—It is proposed to devote part of the profits of the Edinburgh Electricity Department to providing more up-to-date machinery at Dewar Place.—The question is being discussed as to whether it is legal for the Manchester Corporation to build their own tramcars.—The Newport electricity accounts show a profit of £380, as compared with a loss of £1,469 for the previous year. (Page 610.)

TENDERS are invited for turbo-alternators, boiler plant, &c., at Sheffield.—A loan of £30,000 is to be applied for, for a new turbo-alternator at Manchester.—Other loans for electrical purposes are proposed at Norwich, £18,790, and Warrington, £6,257.—The tenders of Messrs. Siemens Bros. for switchgear, and the British Westinghouse Co. for turbo-alternators for Bristol, have been accepted. (Page 611.)

THE balance sheet of the British Thomson-Houston Co. shows a profit of £10,932 after meeting debenture interest, &c. The company have exchanged licences with the owners of the Osram lamp patents on all their patents. The report of Dick, Kerr & Co. records a profit of £22,820. A dividend of 5 per cent. is proposed. The A.E.G. Co. of Berlin recommend a dividend of 14 per cent. (Page 613.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, SEPTEMBER 22ND.

Municipal Tramways Association.

10.30 a.m. Annual Conference at Bradford. (1) "Tramways in Relation to Town Planning," by A. Baker (General Manager, Birmingham Tramways). (2) "Lubrication of Car Bearings," Report prepared by Messrs. E. Cross, R. L. Acland, P. J. Pringle, and T. R. Smith.

7 p.m. Association dinner at Great Northern Victoria Hotel.

FRIDAY, SEPTEMBER 23RD.

Municipal Tramways Association.

10 a.m. Annual Conference at Bradford. Business meeting.

SATURDAY, SEPTEMBER 24TH.

Association of Engineers in Charge.

5.15 p.m. Visit to Engineering and Machinery Exhibition, Olympia.

7.45 p.m. Lecture on "Wireless Telegraphy: its Maritime Importance," by G. Langler Bullocke (by special permission of Mr. Marconi).

Association of Mining Electrical Engineers (Warwickshire and South Staffordshire Branch).

5.30 p.m. Meeting at Imperial Hotel, Birmingham. Discussion of Mr. W. Foster's Paper on "The Resistance of the Human Body to Electric Currents."

(Notts and Derbyshire Branch.)

3.30 p.m. Meeting at University College, Nottingham.

MONDAY, SEPTEMBER 26TH.

Iron and Steel Institute.

Meeting at Buxton. Reception and concert in evening in the Pavilion.

TUESDAY, SEPTEMBER 27TH.

Iron and Steel Institute.

10 a.m. Meeting in Old Theatre, Pavilion Gardens, Buxton. (1) "On Electric Steel Refining," by D. F. Campbell (London); (2) "On the Utilisation of Electric Power in the Iron and Steel Industry," by J. Elink Schuurman (Baden, Switzerland).

WEDNESDAY, SEPTEMBER 28TH.

Iron and Steel Institute.

9 a.m. Meeting in the Old Theatre, Pavilion Gardens, Buxton. Reading and discussion of Papers.

8.30 p.m. Dinner at the Palace Hotel, Buxton.

THURSDAY, SEPTEMBER 29TH.

Iron and Steel Institute.

9 a.m. Meeting in the Old Theatre, Pavilion Gardens, Buxton. Reading and discussion of Papers.

GLASGOW TELEPHONE SERVICE

BY invitation of the Postmaster-General and the directors of the Peel-Conner Telephone Works, Ltd., a number of telephone engineers, representatives of the technical Press, and other gentlemen paid a visit on Monday last to the new Central exchange of the Post Office Glasgow telephone system, a description of which appeared in an illustrated article in ELECTRICAL ENGINEERING of August 18th last, p. 581.

The new exchange is on the common battery system, and has 28 equipped subscribers' sections, and the ultimate capacity of the multiple is 14,400 lines. The incoming cables are 800 pair (1,600 wire) paper insulated, lead-covered cables of the type described in ELECTRICAL ENGINEERING, May 7th, 1908, Vol. III., p. 697. In the operator's cord circuit the repeating coil is dispensed with, and condensers are included in the speaking circuit. A 40-volt battery is used instead of the customary 24-volt. Another feature of the system is that the line resistance is made a smaller proportion of the whole, so that differences in the length of the line will cause less variation in the distinctness and loudness of speaking. The subscribers' meters are operated by the 40-volt battery.

The party, who were joined by a number of local representatives and Corporation officials, were entertained at lunch by the Directors of the Peel-Conner Telephone Works, Ltd. Mr. H. Hirst, Chairman of the Peel-Conner Co., after reading a letter of congratulation from the Postmaster-General, Mr. H. Samuel proposed the toast of the Post Office engineers, and referred to the personal work of Mr. A. M. Ogilvie, Assistant Secretary of the Post Office. In reply, Mr. Ogilvie pointed out that the Central Exchange was only the first of a series of new exchanges in Glasgow. It was pleasing to see that the Postmaster-General had adopted the policy of encouraging the telephone industry as a British industry, and he thought the new exchange was a triumph for the recently-formed company. Much credit was due to Mr. Hirst and Mr. M. S. Conner. Mr. Conner then enumerated the chief new features of the exchange, and remarked that it was the best central-battery exchange in the world, and would do duty for at least thirty years. In reply to the toast of the Corporation of Glasgow, Bailie Dunlop responded on behalf of the Lord Provost, stating that it was evident that the Post Office intended to keep the telephone system up to date. Mr. W. A. Smith, a director of the National Telephone Co., wished the Peel-Conner Co. every success. The party was then joined by the Lord Provost of Glasgow, and an official inspection of the exchange was made, followed by a visit to the Trunk Exchange at the General Post Office, which was enlarged and entirely re-equipped with apparatus of the latest patterns last year.

New Rolling Stock for the Metropolitan Railway.—Some new coaches are to be adopted experimentally on the Metropolitan Railway. According to the *Evening Standard*, each coach is to have three compartments, with a gangway in the centre running the whole length of the coach, and a door to each compartment. On either side of the gangway in each section seats are provided for four passengers, while the seat at either end of the coach can accommodate six people, making twenty-eight seats altogether in the coach.

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THE CONTROL OF THREE-PHASE MOTORS

By F. J. Moffett and N. B. Rosher

DIRECT-CURRENT motors have been in general use for a considerably longer period than those working with alternating-current, and the apparatus for the control of the former has reached a position somewhat approaching finality. Alternate-current motors, on the other hand, are a more recent development in this country, and the switchgear necessary for their starting and protection is still more or less in a state of fusion. It is now recognised fairly generally that direct-current motors should be protected against injurious overloads and provided with some suitable device to prevent the motor restarting after a temporary failure of supply; and it is gradually becoming an accepted proposition that the same provision should be made in the case of alternate-current motors, although the latter possess a rather more robust constitution.

As an instance of the present unsettled state of the switchgear for alternate-current motors, we may mention a case which was recently tried before the Official Referee in London. The plant which was the subject of litigation consisted of a motor-driven pump used for unwatering a mine. The pump was driven by a three-phase squirrel-cage motor, which was connected to the supply mains by means of a three-pole switch and three fuses, the size of the latter being calculated to carry the starting current. Owing to bad regulation of the supply, the motor was continually coming out of step, and consequently carried currents of abnormal value, since the fuses were too large to operate at any ordinary overload. The representative of the firm which supplied the plant stated that it was the usual practice to instal fuses of sufficient size to carry the current at starting, and was not disposed to admit that this procedure by no means adequately protected the motor under normal running conditions. The need for more efficient protection was very forcibly demonstrated by the fact that the stator winding was repeatedly ruined by overheating.

We may safely assume that in the case both of direct and alternating-current motors of any considerable size, it is advisable to provide for the automatic disconnection of the motor from the supply mains in the event of an excessive overload being put on the motor for a period of sufficient length to cause injury to the windings, or of a temporary failure of the supply, which involves the risk of serious accidents on the supply being resumed.

The most usual method adopted to provide against the above-mentioned contingencies is to instal a circuit-breaker fitted with a "no volts" trip coil and with one or more overload coils, or, alternatively, with fuses.

Circuit-breakers with overload trips suffer under a peculiar

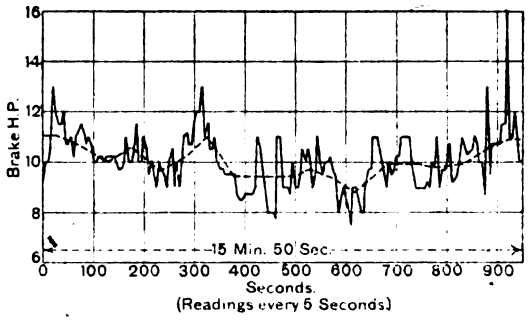


FIG. 1.—POWER CURVES FOR 10 B.H.P. THREE-PHASE MOTOR DRIVING :—

One small grinder, five twist drill turning lathes, two saws, three millers, one gear-shaper, three hobbing machines, one profiling machine, one driller, one boring machine, one slotter.

disadvantage owing to the rapidity of their action. The current need only reach for a fraction of a second the value corresponding to the overload at which the breaker is set in order to operate the breaker, and this in ordinary circumstances is an undesirable arrangement, as the current through the motor often rises instantaneously to this value, but it is not maintained for a sufficient length of time to allow of any injurious action taking place.

The difficulty due to the rapid operation of the overload release of a circuit-breaker can, however, be met by the provision of an inverse time element device or time-lag, which allows of the passage for short intervals of time of a current much in excess of that necessary to operate the breaker if applied continuously. The curve in Fig. 1 shows the variation of the load on a motor which is employed in driving a line shaft from which several machine tools are driven. It will be noticed that whilst the average load as shown by the broken curve is only 10 h.p., there are several peaks during which the h.p. rises to 13 h.p., and occasionally reaches 16 h.p. If the ordinary breaker is used and set at, say, 50 per cent. overload, it would be constantly cutting out the motor owing to the sudden short demands for power. These demands, whilst not of sufficient duration

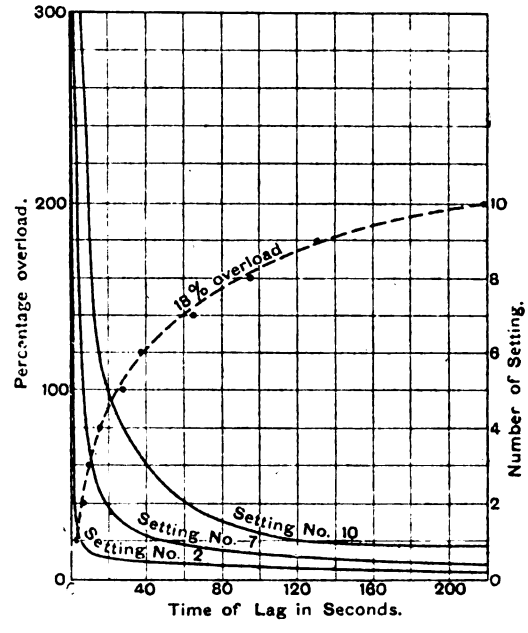


FIG. 2.—TEST OF VARIABLE SETTING OF TIME LAG.

to cause overheating of the motor, would be quite large enough to operate the breaker.

The only satisfactory way to dealt with this position of affairs is to fit on the circuit-breaker a time-lag with a characteristic corresponding to the load characteristic of the motor; that is to say, a time-lag which will allow of an overload only for such a period as will not prove injurious to the motor winding. As is well known, a number of such devices, depending on various principles, are on the market. The Statter time-lag depends on the suction of two surfaces between which is a film of oil or other liquid. Mr. Palairet, of Messrs. Siemens Bros. Dynamo Works, is responsible. for the introduction of a time-lag depending on the resistance to motion of air vanes. A small fan is driven by a train of wheels actuated by a rack attached to the tripping gear of the circuit-breaker. An example of another class of time-lag is the one invented by Messrs. Morris & Lister depending on the expansion of a metal strip which releases a trigger and thereby operates the breaker. A different principle is involved in the relay invented by Dr. Garrard and made by Messrs. Ferranti, Ltd. It consists of a shunted meter element which by its rotation winds up a cord to which a weight is attached. It also moves together at the same time a pair of contacts which close the tripping coil circuit. The position of one of the contacts is adjustable so that the time limit can be adjusted.

Mr. George Ellison has recently introduced a modification of the suction disc time-lag in which provision is made by varying the clearance between the bottom of the cylinder and the piston for a series of settings of the lag with the same setting of the plunger of the overload coil. The results obtained by the writers from three of these settings are given in the curves in Fig. 2, the current being increased from 6 to 20 amperes. The broken line curve gives the various lags obtainable with a constant current of 6·5 amperes and settings from 1 to 10.

It is sometimes necessary to instal circuit-breakers at

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different points in the same circuit; in such cases this arrangement enables all the breakers to be set for the same current, but for different time-lags. The breakers will then, in case of overload, come out in any required order, or possess what is usually termed a discriminating characteristic. Time-lags depending on the suction between two surfaces possess the desirable feature that the position of the plunger or armature of the overload coil remains constant until the current has risen for a sufficient period to a value high enough to operate the release. This prevents what is usually termed "climbing up the setting," or "floating."

A method used occasionally to give a time element characteristic to an ordinary circuit-breaker is to shunt the trip coil with a fuse. The current normally flows through the fuse, and not through the trip coil until the fuse blows, when the whole current passes through the trip coil. This method can only be adopted with alternating current as with direct current, practically the whole of the current passes through the trip coil, and the fuse will not blow.

We shall now consider shortly the points of difference between circuit-breakers for direct and for alternate current. With direct current it is possible to use solid iron for the magnetic circuits, but in breakers for alternating current it is usual to laminate or split the yoke and plungers of the solenoids on account of the heating due to the eddy currents produced. The "no-volts" coil fitted to a direct-current breaker cannot easily be wound for a higher voltage than 250 volts, and consequently, when higher voltages are used, it is necessary to take up the excess above 250 volts in an external resistance; the limit in the case of alternating currents is, on the contrary, above 400 volts. As an alternating current arc does not persist to the same extent as the direct current, it is not so customary to fit blow-out coils on alternating-current breakers, and an additional advantage which the latter possess over the former, is that they can be immersed in oil. Oil-immersed breakers are practically a necessity in places such as coal-mines, and consequently, the alternate-current system possesses a great advantage in this respect.

With respect to three-pole breakers for the control of three-phase motors, it is necessary in order to comply with the conditions that an overload coil be inserted in two of the three phases, in order to provide against the interruption of one phase, and consequent heavy currents flowing through the motor. In order to obviate the necessity for using two overload coils in the case of a slip-ring motor, Mr. Ellison has adopted the plan of inserting one overload coil in the rotor circuit. This will naturally operate when the load on all three leads to the motor exceeds the safe limit, but it also protects the motor windings in the event of one phase of the supply being interrupted. Even when the motor is only partially loaded, there is a large increase in the stator and rotor currents when one phase of the supply is interrupted.

In order to ascertain the lowest percentage of full load at which the current on breaking one phase rises to a value sufficient to operate the overload trip, a test was made by the writers on a 10 b.h.p. three-phase slip-ring motor, wound for a voltage of 200 and a periodicity of 50 ~ . At full load the value of the rotor current was 65·5 amperes, and it was found that, with the overload trip set to operate at 25 per cent. overload, the lowest value of the rotor current, at which the overload trip operated on the interruption of one phase, was 35 amperes, or about 50 per cent. of full load on the motor. Naturally, should the load on the motor when one phase is interrupted not exceed 50 per cent. of full load, the increase of current would not be sufficient to cause an injurious rise of temperature in the windings.

There is an objection to this scheme, since it does not allow of the use of a short-circuiting and brush-lifting device on the motor. This, however, is not a very serious disadvantage, as the loss in efficiency, when carbon brushes and cables of ample sectional area are employed for the rotor connections, is so small as to be almost negligible, and even this economy is frequently rendered inoperative owing to the attendant omitting to make use of the brush-lifting and short-circuiting device.

We shall now discuss generally the starting of motors, dealing more particularly with three-phase induction motors.

For the efficient operation of a starting-switch it is essential: (1) that the switch arm should move rapidly from contact to contact to prevent undue arcing, and (2) that the arm should pause for a definite period on each contact in order to enable the motor to reach the speed corresponding to the voltage on that contact.

With the ordinary type of starter the speed of the arm between contacts and the length of pause on each contact is left to the attendant, who generally does not take excessive care to observe the two conditions stated above To obtain the requisite slow motion, starters have been fitted with a worm gear and also with a dash-pot motion, the latter device automatically allowing the starter-arm to travel over the contacts at a predetermined slow rate. Unfortunately, with the above device the rate of travel between the contacts is equally slow, and burning of the contacts ensues. The converse of the above is the ratchet type of starter, which allows of a quick movement from contact to contact, but does not enforce a pause on each contact.

After a careful consideration of the existing types of starters, the authors were led to the conclusion that there was need for a more effective starting motion, and they therefore designed a starting mechanism which fulfils the two conditions above stated. The scheme adopted will be clear from an inspection of Fig. 3. It is evident that each operation of the starting-switch handle rocks a lever, and thus causes the plunger of a dash-pot to be depressed. Until the plunger has been forced back to its normal position by means of a spring, further operation of the switch-handle is impossible, since a stop, or retaining-dog, has been moved into its path. The interval between successive movements

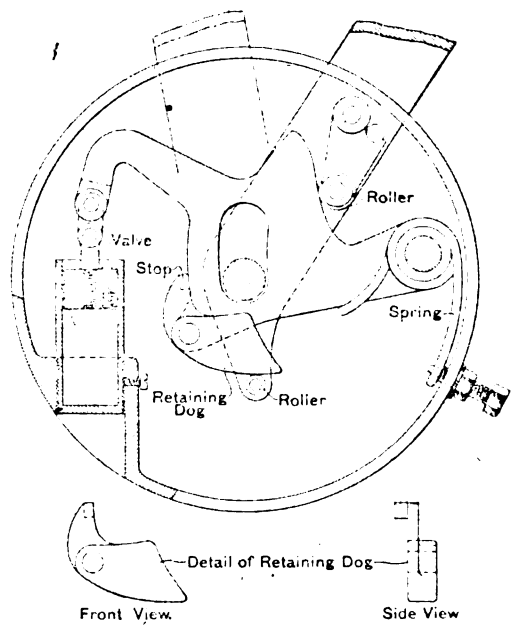


FIG. 3.—SLOW MOTION ATTACHMENT TO STARTER.

of the handle can be regulated within wide limits by adjusting the air-vent in the plunger or the strength of the spring which acts upon same. As a general rule starting-switches are provided with too large a number of steps or contacts, the necessity for these arising out of the desire to provide for a gradual raising of the voltage applied and the avoidance of current rushes. With the mechanism just described, the need for a large number of steps disappears, since a sufficient pause is enforced on each step to enable the motor speed to rise to the full value corresponding to that step. The advantages of this device are specially evident when it is applied to a two-position switch, such as the star-delta or auto-transformer, where a prolonged pause on the intermediate position is an absolute necessity.

The switchgear for the starting and protection of a slip-ring motor should provide for: (*a*) Making the stator circuits and breaking same in the event of an overload being put on the motor, or a failure of supply taking place; (*b*) making the rotor circuit through resistances and gradually short-circuiting these, and (*c*) rendering it impossible to start the motor without all the resistances being inserted in the rotor circuit.

The type of rotor rheostat most commonly employed for small and medium-size motors is the face-plate variety, with iron grid or wire resistances, but liquid starters are more usually employed for large motors. The latter allow of the gradual reduction of the resistance, without the sudden jumps which are inseparable from the metal type of rheostat. There is considerable divergence of opinion amongst motor manufacturers as to the voltage for which rotors should be wound. The following are the rotor currents for a 400-volt,

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three-phase, 25 ~ motor of 10 b.h.p., as supplied by four of the leading manufacturers :—

Firm A.	Firm B.	Firm C.	Firm D.
30 amps.	35 amps.	63 amps.	100 amps.

In these days of standardisation, one would expect that a definite ratio between primary and secondary voltage would have been adopted. From the point of view of the switchgear, a high voltage possesses advantages, as it enables leads of smaller section to be used, and reduces the C^2R losses in these leads. Probably one reason for the variation is that a bar-winding is preferred by some firms to a wire-winding, on account of the better mechanical features of the former.

The curves in Fig. 4 show the relation of starting torque

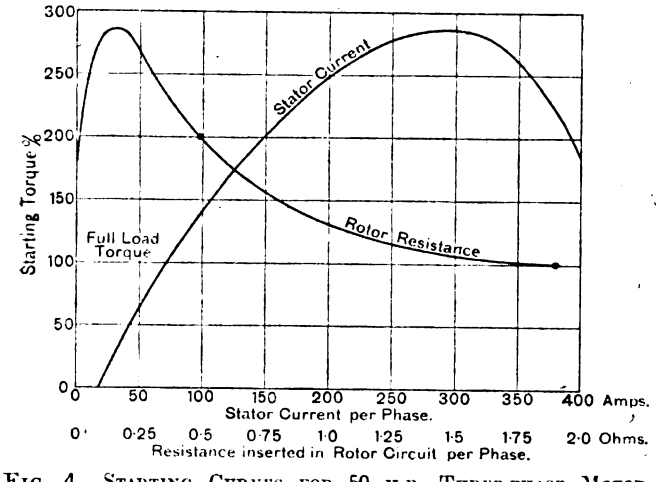


FIG. 4.—STARTING CURVES FOR 50 H.P. THREE-PHASE MOTOR, 400 VOLTS, 25 CYCLES.

to resistance in rotor circuit, and of starting torque to stator current in the case of a three-phase induction motor of 50 h.p., 400 volts, 25 ~. For these we are indebted to Mr. Stanley P. Smith, of the General Electric Co., Ltd. From such curves the total resistance to be inserted in the rotor circuit to produce a given torque, and area of same can be found, but in order to determine the values of the different sections, it is necessary to know the relations between torque and resistance at various speeds between standstill and synchronism.

The curves shown in Fig. 5, taken from Maurice Oudin's

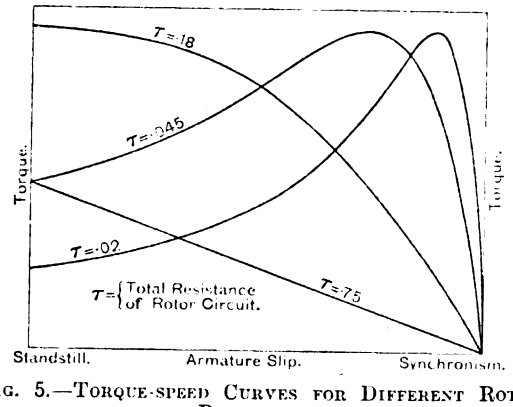


FIG. 5.—TORQUE-SPEED CURVES FOR DIFFERENT ROTOR RESISTANCES.

"Standard Polyphase Apparatus and Systems," shows the varying values of the torque at different speeds for certain values of the rotor resistance. A perfect starter would provide the necessary drops in resistance of rotor circuit at the proper points in the progress of the motor from standstill to full speed, the time interval between these points being, of course, dependant on the rate at which the motor accelerated with the existing conditions of load.

In the case of the squirrel-cage motors, all control must be effected in the stator circuits. Since it is not possible to vary an external resistance in the rotor circuit, the current at starting reaches a value far exceeding that corresponding to full-load torque when running near synchronous speed, even when there is no load on the motor. With the aid of the oscillograph, an examination was made of the values at starting of the current for a 10-b.h.p. squirrel-cage motor wound for a voltage of 200 and a periodicity of 50 cycles, which showed that the starting current reached at least 300 or 400 per cent. of the full load values. There is thus some difficulty in providing for the protection of these motors against overloads. If fuses are used for this purpose, and are of sufficient capacity to carry the starting currents, they will afford no protection to the motor in the case of an ordinary overload of, say, 100 per cent. of full load. This difficulty is generally overcome by the device of short circuiting the fuses until the motor has run up to speed. With breakers the difficulty is apparently just as great, if not greater, since there is no interval of time between the current reaching its limiting value and the operation of the breaker. It is common practice to set a circuit-breaker to operate with a current 50 per cent. in excess of full-load current; a time element device will enable the breaker to carry this overload for several seconds, or an overload of 500 per cent. for, say, one second, a period often long enough to effect the starting of the motor. It is possible that a still longer lag with high overloads could be obtained by arranging the saturation of the core of the overload solenoid at a moderate overload. The pull would not then increase proportionately with the current.

A different method of enabling the breaker to tide over the starting period consists in the use of what is known as a double-rating device. An additional load is placed on the plunger of the overload solenoid during the starting period, and is removed as soon as full speed is obtained. In the breaker made by one firm the plungers of the overload solenoids are gripped by springs operated by means of an auxiliary coil, which is only in circuit whilst the switch is in the starting position.

There are four methods in common use for starting up squirrel-cage motors.

Switching direct on to the mains is at present practically confined to small motors of not more than 5 h.p., since the supply companies find these sudden large demands do not make for good voltage regulation on their systems.

Another method is switching on through resistances which can be gradually cut out, the resistances being inserted in all three or in two phases, or a reduced pressure may be applied by an auto-transformer or compensator. In the auto-transformer method of starting it is the usual practice to provide several tappings so that various starting voltages may be obtained. When the motor is put into service, the lowest voltage compatible with obtaining sufficient starting torque is employed; and should it be necessary on account of increasing the load to increase this torque, it is only necessary to change the tapping at which connection is made for the starting voltage. For economical reasons, the amount of copper and iron in the auto-transformer is reduced to the lowest limit, consequently provision should be made against the starting switch being left in the intermediate position for any length of time, or dangerous overheating will occur. Further, it should not be possible to connect the motor direct on to the line, or the excessive currents which it is desired to avoid will be derived from the line. Many auto-transformer switches now on the market do not provide for either of these conditions.

Dr. Benjamin Bailey has recently discussed in the *Electrical World*, of New York (January 2nd, 1909), the comparative advantages of the rheostatic and transformer types of starters. He has stated the case so clearly that we make the following extracts from the article :—

"The great fluctuation in voltage when a squirrel-cage induction motor is started from rest is due not so much to the current taken as to the low power factor. A current that is in phase with the E.M.F. reduces the voltage of the circuit very little. When, however, the current lags 90° behind the E.M.F., the reduction is much more marked. If, therefore, the current which the induction motor takes at starting is considered as divided into two components, one in phase with the E.M.F., the other lagging 90° behind it, the one in phase reduces the voltage but little, while the component lagging 90° reduces it very greatly.

"It can easily be shown that the wattless component of the starting current is the same whether an auto-starter is used or whether the motor is started by resistance alone.

"It is evident, without proof, that the value of the volt-amperes received by the motor at starting will depend solely upon the voltage impressed upon its terminals. Hence it is seen that the component of the current actually reaching the motor, which causes the reduction in voltage when the motor is started, is the same whether an auto-starter or rheostatic starter is used."

He points out that of the two starters, the auto-starter requires a larger wattless component of current from the line

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than does the rheostatic starter, and consequently the fluctuation in voltage is fully as great with the auto-starter as with the rheostatic starter. There is another respect in which the rheostatic starter is superior. As soon as the motor gets under way the current becomes less; this change, of course, reduces the CR drop through the rheostat, and consequently a higher voltage is supplied to the motor. Thus either less current will be required in the motor or a greater torque will be available than if an auto-starter were in use. With the auto-starter, the starting voltage and the maximum available torque remain practically constant until the motor is connected directly to the line. In starting certain loads, such as a fan, where the torque required increases somewhat with the speed, this is a decided advantage in favour of the rheostatic starter. For a given value of starting current, the motor will attain a higher speed with the resistance starter than it would with an auto-starter, and the circuit is not opened during starting. This avoids burning the contacts.

The rheostatic starter is much cheaper than the auto-starter, but requires in starting more current from the line in proportion to the ratio of the voltages of the auto-transformer. The extra power used would probably not amount to more than 15 per cent. This difference decreases as soon as the motor gets under way. The wattless component of the line current required by the motor is somewhat less with the rheostatic starter; consequently the disturbance to the line voltage, on starting the motor by the two methods, is approximately the same. The starting can be made somewhat more gradual with the rheostatic starter, since it is feasible to introduce a number of contacts, and the disturbance on finally connecting the motor to the line is less than with the auto-starter.

In order to confirm the results arrived at by Dr. Bailey, the writers carried out tests on a 7½-h.p. squirrel-cage motor wound for a voltage of 440 volts and a periodicity of 25 cycles. This motor was first connected up to a rheostatic starter, the total resistance of which was of such value as to produce half the full-load torque of starting, and was subsequently connected to an auto-transformer starter, arranged to produce the same starting torque.

The results obtained are as follows :—

	Volts on motor.	Starting torque (% full load).	Starting current (times full load).
Rheostatic starter ...	220	0·475	2
Auto-starter	225	0·517	1·73

The method is applicable to motors which are designed for running under normal conditions with the stator windings connected in mesh. The ends of the stator windings are brought out to convenient terminals so as to enable them to be connected in star. The starting switch first applies the line voltage to the stator when star connected and when the rotor has run up to speed changes the connections to mesh. The starting torque with star connection reaches one-third of the full-load torque, with a current 0·577 of that required to produce a full-load torque at starting with Δ connections. The star-delta method of starting has the advantage over the two previous methods in that it avoids the necessity of employing transformers or resistances, the only switch required being a simple change-over switch. It should be borne in mind, however, that it requires extra terminals on the motor and double the number of leads between motor and starter.

Whatever method of starting is employed, squirrel-cage motors have but little starting torque, in spite of their requiring a large starting current.

Numerous ways have been proposed of escaping from this difficulty. Naturally, the first and perhaps the best scheme to be adopted is to fit an automatic clutch, which will enable the motor to start absolutely light, and only take up its load after acquiring a suitable speed. If the motor is controlled by a star-delta change-over switch, the starting current can be reduced by practically one-half and full-load torque exerted by the motor on the load with not more than twice full-load current. Several firms supply motors fitted with this type of clutch, some of which are capable of reversing. They possess the further advantage of enabling provision to be made for slipping to take place when the overload on the motor exceeds the desired value.

Other methods which may be mentioned are those of Görges, who alters the arrangement of the rotor windings at starting so as to reduce the secondary current; of Boucherot, who provides the rotor with two or more independent windings of varying resistance and inductance; and of Zani, who uses auxiliary inductance coils to limit the starting current, and subsequently automatically reduces the impedance of these coils by increasing the reluctance of their magnetic circuits. All these arrangements appear, however, rather complicated for ordinary everyday use.

CAR METERS

TWO reports dealing with questions of checking the consumption of current of tramcars by meters on the cars themselves with a view to economical driving were read at the recent International Tramway Congress at Brussels, and are translated in the Official Circular of the Tramways and Light Railways Association. One of these, by Mr. Battes (General Manager, Frankfort Municipal Tramways), contains a *résumé* of the opinions expressed at previous Congresses, when Mr. Otto, of the Grosse Berliner Strassenbahn Gesellschaft and the author himself both spoke from experience of the advantages to be obtained, and favoured the use of simple hour meters as cheaper than watt-hour meters and sufficiently accurate. M. Bouton (East Paris Tramways), however, advised the use of ampere-hour meters. A considerable amount of information has now been obtained, and a digest of the experience at different Continental towns is given in the report. Of some 34 cases where particulars are given, the largest total saving is that of the Berlin Co., all of whose cars (1,491) have been fitted with hour meters at a cost of £2 each, and a total saving due to their use of £21,344 per annum, or 7·8 per cent., is reported. At Cologne, where all the cars are also equipped with hour meters, a saving of 8·6 per cent. is given, and at Dresden the figure is as high as 10·95 per cent. The highest figure given is for Magdeburg, where only 42 out of 130 have meters, but a saving of 19 per cent. is recorded. All the cars are equipped with meters also at several other towns, and savings varying from 1·25 to 15 are reported, where figures are available. Other authorities are still experimenting, and only three cases are mentioned where car meters have been discontinued. In 11 cases out of the 34 of which particulars are given, hour meters are used, in 3 cases ampere-hour meters are preferred, while the remainder use watt-hour meters. In some cases it is reported that the use of car meters made it possible to provide accelerated services, and the Cologne tramways declare that the use of meters has led to a decrease in the number of accidents.

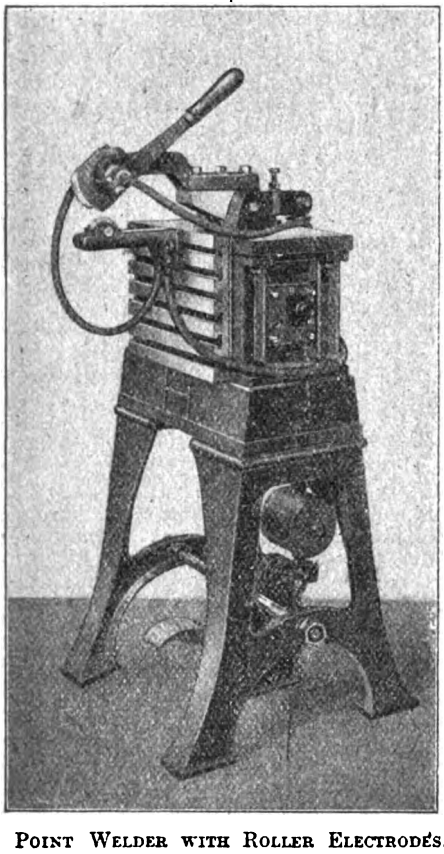
The other report is by M. Bouton (General Manager, East Paris Tramways Co.), who compares the advantages of watt-hour, ampere-hour, and hour meters. He considers most watt-hour meters too delicate and liable to become inaccurate, and prefers a simple form of ampere-hour meter. He does not think that the hour meter gives sufficient information. Various methods of rewarding drivers whose meters show economy are suggested.

New Swiss Electric Railway.—The new single-phase railway connecting Orsières with the Swiss State Railway system at Martigny (Canton Valais) was opened to public service last month. The railway has been constructed for the Cie. du Chemin de Fer Martigny-Orsières, in connection with the British Aluminium Co.'s water-power works now under construction at Orsières, but may become of considerable national importance, as it may form the first section of a suggested new line connecting Switzerland with Italy. The capital for the railway has been provided entirely in this country. The length of the line is about 12 miles. It is a normal gauge railway, with 80-lb. rails laid on impregnated beech or oak sleepers. The minimum radius of curvature is 197 yards, and the maximum gradient 3·5 per cent., or 1 in 28·6. A great deal of blasting and tunnelling has had to be done, particularly in the gorge of la Drance, where the line traverses two bridges, four galleries supported on the side of the mountain, and three tunnels, while in the neighbourhood of Sembrancher there are three bridges, two galleries, and four tunnels. The trolley-wire supplies single-phase current to the trains at 8,000 volts, 15 cycles, and consists of an 8 mm. wire with simple suspension, except in the stations, where catenary suspension is employed. Each passenger motor-coach is fitted with four 80-h.p. single-phase motors of the Brown-Boveri type, in which regulation is effected by altering the position of the brushes on the commutator. The weight of a complete motor-coach is 45 tons. Three brakes are fitted, hand, electric and compressed air respectively. The speed on the level is 25 m.p.h., and 19 m.p.h. on a gradient of 3·5 per cent. Work was commenced on the line on August 1st, 1907.

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ELECTRIC WELDING IN HARDWARE FACTORIES

ELECTRIC welding is being introduced with considerable success into metal and hollow-ware factories in place of soldering, brazing, and riveting. There are two main processes of electric welding, viz., the arc welding process and the resistance method. The former is employed principally for the repairing and elimination of faults in casting, &c., whilst the latter is adapted for use in metal work factories producing repeat work, where the low cost of operation and the rapidity of manipulation tend to a reduction of works costs. Resistance welding machines consist of a transformer, the primary of which is connected to the supply mains and the secondary to the electrodes between which the articles are welded. This method of welding is divided into two classes, viz., "butt" welding and "point" welding.



Point Welder with Roller Electrodes.

In butt welding, the two pieces to be welded are pressed together and a heavy current at low voltage is then passed through the joint. Upon the welding temperature being attained, the current is cut off and the weld is then completed by applying a sudden increase of pressure. The weld is perfectly homogeneous and differs in no way from the solid piece of material. The heat is generated first in the centre of the material, and then penetrates to the outer surface, so that oxidation, burning of the surface through overheating, or formation of scale, is impossible. Further, the operator can follow the process without being handicapped by the presence of fumes and heat. Shafts, hoops, metal tyres, rods of all sections, &c., are welded by this process. Cycle rims having a cross sectional area of about 0·5 sq. in. take about 16 kw. for 20 seconds for each weld, while heavy wheel rims of some 0·7 sq. in. section take about 25 kw. for 45 seconds. Shafting of about 1¾ in. diameter would take 30 kw. for 60 seconds for every weld. A number of different patterns of butt-welders have been designed by the A.E.G. Electric Co., Ltd. (121 Charing Cross Road, London), and include hand-operated, semi-automatic, and automatic machines. These machines are covered by British patents No. 22,981/03 and 6,127/04.

Point welding is employed in the hollow-ware, enamel ware, and general hardware industries, and replaces riveting. In point welding the materials are placed in position between the open electrodes, which are then brought together by means of a foot lever which closes the circuit. A further depression of the lever completes the welding. Upon pressure being removed from the lever the current is cut off and the material released from the machine. In the welding of thin sheet material the welding is practically instantaneous. A point welding machine of the A.E.G. Electric Co.'s design is illustrated herewith. The lower electrode is adjustable, and is carried by a massive bracket, which serves to support the article being operated upon, and at the same time may be used as an anvil. The upper electrode is carried on the end of a pivoted arm connected to a foot lever, which, upon being depressed, first brings the electrode down into contact with the work. At the right-hand side of the machine a change-over switch is mounted, by means of which the power may be regulated according to the work in hand, and at the left-hand side D.P. fuses are fitted. The machine illustrated has roller electrodes which are especially adapted for such work as the welding of spouts on to cans or the welding of seams in hollow ware. The power taken by these point welders is from 3 to 40 kw., according to the thickness of the material being worked. The upper electrode can be operated automatically, and is used for the making of continuous point welds, or point welds at predetermined distances. With electrically-welded enamelled articles, there are no projecting rivet-heads from which the enamel is liable to flake off. The A.E.G. Electric Co., Ltd., will give any further information respecting the welding of special articles, and will weld samples of firms' own productions free of charge, giving data as to the time taken and the approximate cost of carrying out the work.

AWARDS AT THE BRUSSELS EXHIBITION

THE full list of awards at the Brussels Exhibition is now published. A list of the principal awards to British exhibitors whose exhibits were of interest to electrical engineers is given below :—

Scientific Instruments : *Grand Prix.*—Kelvin and James White. *Gold Medal.*—The Reflector Syndicate. *Silver Medal.*—W. J. Brooks & Co., Messrs. Gambrell Bros., J. J. Griffin & Sons, Townson & Mercer.

Steam Plant : *Grand Prix.*—E. Green & Son, Ltd., J. Hopkinson & Co. *Diploma of Honour.*—The Underfeed Stoker Co., Ltd., G. & J. Weir, Ltd. *Gold Medal.*—Holden & Brooke, Ltd., The National Gas Engine Co., Ltd., The Oil and Waste Saving Machine Co., Ltd., The Sturtevant Engineering Co., Ltd.

Other Kinds of Engines : *Grand Prix.*—Crossley Brothers, Ltd., The Campbell Gas Engine Co., Ltd., The Power Gas Corporation. *Gold Medal.*—The National Gas Engine Co., Ltd. *Bronze Medal.*—Reavell & Co., Ltd.

General Machinery : *Grand Prix.*—Hans Renold, Ltd., R. Waygood & Co., Ltd. *Diploma of Honour.*—Marryatt & Place, Reavell & Co., Ltd., G. & J. Weir, Ltd.

Mechanical Production and Utilisation of Electricity : *Grand Prix.*—Kelvin and James White, Ltd., The Morgan Crucible Company, Ltd., C. A. Parsons & Co., The Reflector Syndicate, Ltd., R. Waygood & Co., Ltd. *Diploma of Honour.*—Marryatt & Place. *Gold Medal.*—Lancashire Dynamo and Motor Co., Ltd.

Electro-Chemistry : *Gold Medal.*—John J. Griffin & Sons, Ltd., The Reflector Syndicate, Ltd.

Electric Lighting : *Gold Medal.*—Faraday & Sons. *Silver Medal.*—Ropley. *Bronze Medal.*—J. Dugdill & Co.

Miscellaneous Applications of Electricity : *Grand Prix.*—Kelvin and James White, Ltd., R. W. Paul. *Diploma of Honour.*—Gambrell Bros., Nalder Bros. and Thompson, Ltd., The Synchronome Co., London.

The Cambridge Scientific Instrument Co. were placed *Hors Concours.*

GLASGOW SMOKE ABATEMENT EXHIBITION

THE Electricity Department of the Corporation of Glasgow have made good use of the opportunity afforded by the Smoke Abatement Exhibition now being held in Glasgow, to demonstrate the practical advantages of electric lighting, heating, and cooking. Their exhibit comprises a tastefully arranged model home, with three living rooms, kitchen, laundry, and bathroom. There are no fireplaces or chimneys, the ventilation being effected on the Glover-Lyon system, in which the air is circulated and heated by electrical means. A large variety of domestic appliances supplied by Simplex Conduits, Ltd., the General Electric Co., the British Thomson-Houston Co., and other firms, are shown in use, and the special advantages of electric cooking are being practically demonstrated by an enthusiastic *chef.* The various rooms are most effectively lighted, and some novel radiators for fixing underneath tables and desks are shown. Several different patterns of electric ovens are being used daily, and interesting comparisons are being made. The new G.E.C. range is giving particularly good results, and the "Tricity" D.C. cookers and the Bertram-Thomas "Gray" oven are proving their convenience and efficiency. Messrs. Giffen & Bissett, Ltd. (Cathkin Laundry, Rutherglen), who employ electricity for irons, &c., as well as for lighting and power in their laundries, demonstrate the use of electric irons of various sizes. The bathroom contains a "Therol" heater and electric geysers. A number of Glasgow contractors have arranged effective exhibits, and there is a brilliant display of metal filament lamps. There are also exhibits to illustrate the convenience of electric drive for sewing machines and other domestic appliances. The Telewriter, an instrument for taking down autographic messages, several patterns of the "Beck" and other flame lamps, the Mavor & Coulson tube-cooled motor, and other interesting apparatus, are also exhibited. There is an extensive exhibit of gas lighting and cooking apparatus, and as the representatives of the two rival methods are collected on the two opposite sides of the hall, an instructive comparison of the æsthetic and hygienic conditions resulting may be made.

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ELECTROMETALLURGY AND ELECTRO-CHEMISTRY

IN the last number of the *Elektrochemische Zeitschrift* (XVII., p. 91), there is an article by Dr. C. Herrmann upon the "Present Position of the Manufacture of Phosphorus by Electrical Methods." As a matter of fact, the bulk of the phosphorus manufactured to-day is made by electrical processes. The first process, which was started in 1893, was that of Parker, Robinson, and Readman, and even now most of the works use this process, or a modification of it. It is, however, by no means easy to know exactly what is done, as the manufacturers maintain the strictest secrecy. The process, as originally designed, consisted in striking an arc in a closed receptacle, containing a mixture of calcium phosphate, silica, and carbon. This particular mixture had, in fact, been used before in the old fire-heated furnaces, but as the temperature required for the reaction is exceedingly high, it was difficult to obtain a retort which would stand the heat. But by arc heating the walls of the retort can be kept comparatively cool. By means of the process just mentioned the Electrical Construction Company manufactured, in 1893, about 320 lbs. per day. At the present time the Oldbury Chemical Company, at Niagara, manufacture about 3,200 lbs. per month, and probably Messrs. Albright and Wilson, of Oldbury, turn out a still larger quantity (exact figures are not available). Dr. Herman Hilbert and Albert Frank patented an electrical process: a metallic phosphate was heated with carbon, and beside phosphorus a carbide of the metal was obtained. Thus, with calcium phosphate and aluminium phosphate respectively, the reaction is as follows:—

$$Ca_3(PO_3)_2+4C=3CaC_2+2P+8CO.$$
$$4AlPO_4+19C=Al_4C_3+4P+16CO.$$

That is to say, in the one case calcium carbide, and in the other aluminium carbide, is produced. The process was worked on a commercial scale by the Compagnie électrique du phosphore of Paris, who put up works at 'Chatelaine, near Geneva. But, notwithstanding the fact that such a useful by-product as a carbide was obtained, the process was not a commercial success, and after a short time the works had to close down. The latest process, that of Louis Dill, is electrolytic, as distinct from electrothermic. In this case phosphoric acid, with which is mixed a certain proportion of carbon, is directly electrolysed. This process can be worked continuously, whereas in the electrothermal processes, the operation has to be interrupted for recharging.

In *Metallurgie* 7, 435, W. Borchers discusses the advantages of electrical methods of smelting and refining copper. In the electric furnace, the finest calcined ore, and even ore dust, can be smelted without having first been briquetted. The ore itself may be employed as a resistance material, by being placed in the direct path of the current, on a long hearth, or else in a deep pan, so that the reactions between the sulphides and oxides and the slag formation may be completed without the disturbing influence of large quantities of combustion gases—such as is the case in the ordinary furnaces. The reactions take place, and are completed, in the molten mass; the gaseous products escape, but their amount, compared with the large quantities which escape in the reverberatory furnace, is small. The dust problem is very much simplified and the loss through volatilisation is very much minimised. Another great advantage is the freedom of the slag from copper; in fact, there is so little copper left in it, that it can be thrown away. The working of complex ores is also very much simplified by using the electric furnace.

SUN AND WIND MOTORS

AT the concluding meeting of the Engineering Section of the British Association at Sheffield, a remarkable Paper was down for reading by Prof. R. A. Fessenden on the "Utilisation of Solar Radiation, Wind Power, and other Intermittent Natural Sources of Energy." The Paper, which was, however, not read in full at the meeting, deals first with methods of power storage. Storage batteries could not be used in the scheme described on the score of expense. Experience had shown that storage capacity for at least two weeks was necessary, and the cost of the battery was estimated at £140 per h.p., the interest on which would be more than the cost of producing the power by steam plant. Hydraulic storage was therefore decided upon, and a scheme was gone into in detail with two tanks, one at the surface and the other forming an excavated chamber at the foot of a shaft 1,000 ft. deep, and it was stated that from actual tender the cost would work out at £7 10s. per horse-power for a fortnight as against £140 for the battery. A storage efficiency of 85·5 per cent. is claimed for the hydraulic method, using Pelton wheels with 1,000 ft. fall as against 65 per cent. for the battery. The pumps, turbines, &c., for a 3,000-h.p. plant were given at £2 10s. per h.p., and the total cost of storing the h.p. per annum was worked out as 13s. for the hydraulic method against £26 for the battery, taking 4 per cent. interest and 4 per cent depreciation.

There were two main sources of power available, solar radiation and wind, as in general the rise and fall of the tide was too small to be commercially applicable. Experiments in Central Europe had shown that 4 to 6 million kw. hours were actually available per 100 sq. metres per annum. For the north of the United States the figure was 5 to 7½ million, and for the arid south-western States from 10 to 15 million. These work out to from 4 to 10 per cent. of the maximum radiation as calculated from Langley's constant.

Experiments made at Brant Rock had shown that a windmill 300 ft. in diameter would be capable of delivering on an average during the entire year 800 h.p., a figure about 30 per cent. higher than that obtained by experiments in Denmark, probably on account of the greater height of the tower. In practice, an equivalent number of smaller windmills would be used.

To utilise solar radiation, a solar tank was used containing water which was heated until the steam reached approximately the pressure of the atmosphere. The steam drove a low-pressure steam turbine. A working temperature of 100° C. was chosen because with the steam at atmospheric pressure the transparent top of the chamber containing the working fluid could be made very thin. The fluid flowed in a thin stream across the bottom of the tank, and the thickness of the stream was varied automatically with the amount of radiation received. The working fluid contained a small amount of bichromate of potash. The glass forming the transparent covering contained a small amount of sulphate of iron, to make it reflecting for wave-lengths corresponding to those emitted by the heated water, while remaining fairly transparent to the radiation from the sun. The thermodynamic efficiency of the system was approximately 15 per cent., and it was anticipated that approximately 10 per cent. could be obtainable on the shaft of the steam turbine.

The estimated costs of the plant per h.p. are given as follows:—Solar tank, £2; turbine and condenser, £5; dynamo, £3. Adding the costs of the pumps, Pelton wheels, and reservoirs, the total first cost is £20 per h.p., or £1,143 per annum for capital charges. The assistance of a windmill would cheapen power production and improve the efficiency by evening up to load. With a 200 sq. metre solar tank and an 800 kw. windmill plant, the author estimates that an average output of 1,500 kw. could be obtained at a cost of £1 10s. per h.p. per annum.

The above figures referred to average conditions, but the first plant that had been erected had taken advantage of an existing shaft of a copper mine and worked-out chambers for the lower reservoir; again the solar radiation was more than double the value given above. Some existing pumping plant was also available. In the concluding portion of the Paper the following comparative figures for cost of power per h.p.-year are given:—Steam, £4; gas, £3; water power at Niagara, 15s.; from intermittent natural sources, 18s. (this figure is presumably based on the author's experiments, and not on the estimate given above); water power, exceptionally favourable conditions, 10s. Finally, it is suggested that although England is not well situated as regards solar power, more than sufficient power could be obtained to supply all the factories, lighting plants, and railways in Great Britain by excavating reservoirs on the top of the cliffs, mounting windmills there, pumping the water up from the sea to the upper reservoirs and letting it run back through turbines and dynamos placed on the beach.

The Incorporated Institution of Automobile Engineers.—This Institution has moved its offices from Caxton House to a suite on the ground floor of No. 13, Queen Anne's Gate, where council meetings will be held and a reading-room provided. At the opening meeting of the session on October 12th, Mr. F. W. Lanchester will give his presidential address.

Engineering Exhibition at Olympia.—In consequence of the success of the Naval, Mercantile Marine and General Engineering Exhibition, now being held at Olympia, it has been decided to hold a similar exhibition under the same management in 1913.

The Electrical Standardising, Testing and Training Institution.—A new prospectus for the coming session is to hand from the Electrical Standardising, Testing and Training Institution (Faraday House, 62 to 70 Southampton Row, W.C.), giving full information as to the arrangement of the courses for the term now about to commence. The next term opens on September 26th, and the entrance examination will be held at Faraday House on 23rd inst., at 11 a.m. Full particulars can be obtained from the secretary.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

SHIP FITTINGS.—A leaflet from Simplex Conduits, Ltd (113 Charing Cross Road, London, W.C.) illustrates a number of cast brass lamp brackets and ceiling fittings for ships' cabins.

DRY CELLS.—Siemens Bros. & Co., Ltd. (Caxton House, Westminster, London) have sent us the August, 1910, issue of their catalogue of dry cells. The notes on the use of dry cells for ignition purposes have been re-written, and new illustrations to scale have been inserted.

PYROMETERS.—Another new list from Siemens Bros. & Co., Ltd., gives particulars and prices of optical pyrometers for measuring furnace temperatures above 600° C. Two patterns are described; the standard pattern with cast-iron or wooden tripod stand, and a portable pattern.

ADVERTISING LITERATURE.—The Electric Supply Publicity Committee (Moorgate Court, Moorgate Place, London, E.C.) have issued some further publicity matter for the use of supply undertakings, including an electric heating poster in colours, a six-page booklet extolling the advantages of electric radiators, a pamphlet emphasising the economy of electric driving of machinery, and two coloured postcards with a similar aim.

The Marylebone Electricity Department has secured several pages for the purpose of advertising electricity for lighting and power, in an illustrated guide to the Borough, published under the auspices of the Council. A brief description of the electricity undertaking, with a photograph of the interior of the generating station is also included.

D.-C. MOTORS.—The Union Electric Co., Ltd. (Park Street, Southwark, London, S.E.) have issued a new list of D.-C. shunt-wound motors of from ¼ to 50 h.p. Illustrations of various patterns of machines and separate parts are given.

TRAMCAR CONTROLLERS.—A copiously illustrated pamphlet from Messrs. Dick, Kerr & Co., Ltd. (Abchurch Yard, Cannon Street, E.C.) describes the latest form of the Dick Kerr metallic shield blow-out controller. The action of the blow-out solenoid is effectively shown by diagrams. The novel feature of the braking type of controller is the combination of the brake and power cylinders on the same shaft. This eliminates the mechanical device previously necessary for throwing over a special brake cylinder when passing from the off-position on to the brake notches. The power handle is now made non-removable, and the motor cut-out switch now consists of a knob projecting through the back of the controller at the top, which can only be worked by the reversing handle. This in a four motor controller is arranged with four positions to cut out any pair. Particulars of controllers for heavy railway service are also given.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

TELEPHONES.—An abbreviated illustrated list is to hand from the Sterling Telephone & Electric Co., Ltd. (200, Upper Thames Street, London, E.C.). This covers all classes of telephones, switchboards, and accessories for telephone installations.

LIMIT GAUGES.—The Newall Engineering Co. (Peter Hooker, Ltd., Walthamstow, London, E.) have issued a new edition of their illustrated catalogue of Newall gauges, and will forward copies gratis on application. The various patterns and sizes of limit gauges are listed and their purpose and use described. Straight edges, internal and external micrometers, screw gauges, and measuring rods, surface plates, and measuring machines are also listed. A price list of metric sizes is appended.

LIGHTING FITTINGS.—An illustrated pamphlet from the Benjamin Electric, Ltd. (1a Rosebery Avenue, London, E.C.) gives particulars and prices of Benjamin wireless cluster fittings and lighting specialities, including waterproof holders for high candle-power lamps, canopy grouping switches, weatherproof fittings, &c.

CENTRIFUGAL PUMPS.—Messrs. Ernest Scott & Mountain, Ltd. (Close Works, Gateshead-on-Tyne) have published a new pamphlet giving an illustrated description of their centrifugal pumps. Particulars are given of various patterns, both horizontal and vertical, and for high, medium, and low lift. Some useful hydraulic tables and formulæ are included. The illustrations and diagrams show clearly the action and construction of these pumps.

TRANSFORMERS.—A leaflet from the A.E.G. Electric Co., Ltd. (121 Charing Cross Road, London, W.C.), gives an illustrated description of a transformer switchcase suitable for operation by unskilled persons, and especially adapted to mines. No live parts are exposed, and interlocking arrangements are provided. The transformer is of the oil-immersed type.

POCKET LAMPS, etc.—A new list from G. Braulik (8, Lambeth Hill, Queen Victoria Street) contains particulars of a series of pocket lamps with refillable batteries and metal filament lamps and other portable lamps and novelties.

BOILER-HOUSE TESTING APPARATUS.—Messrs. Sanders, Rehders & Co., Ltd. (108 Fenchurch Street, E.C.), have sent us a copy of their "Sarco" Bulletin, which contains a quantity of interesting reading on the subject of boiler-house practice and the combustion of coal, emphasising the economies that can be obtained by the use of suitable CO_2 recorders and other testing appliances, in which they are specialists, and giving some useful information regarding the use of this class of apparatus.

TELEPHONE APPARATUS.—A new leaflet from Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster), gives particulars of a compact "instrument protector" for protecting telephone instruments against damage by lightning discharges and high-tension currents, as well as from "sneak-currents," which, though only small, may, by flowing for a prolonged period, do serious damage. The apparatus comprises two pairs of carbon-block lightning arresters, two non-arcing line fuses, and two safety fuses, mounted on a porcelain base and enclosed in a cover.

ELECTRIC SYRENS.—Another list from Messrs. Siemens Brothers & Co. deals with a new form of motor-driven syren which they are introducing for factories, fire-alarm signals, and other purposes where a clear, loud, distinctive signal is required. These can be fitted with an attachment for giving sharply defined signals, consisting of an electromagnet which opens and closes the air inlet as the motor is switched on or off.

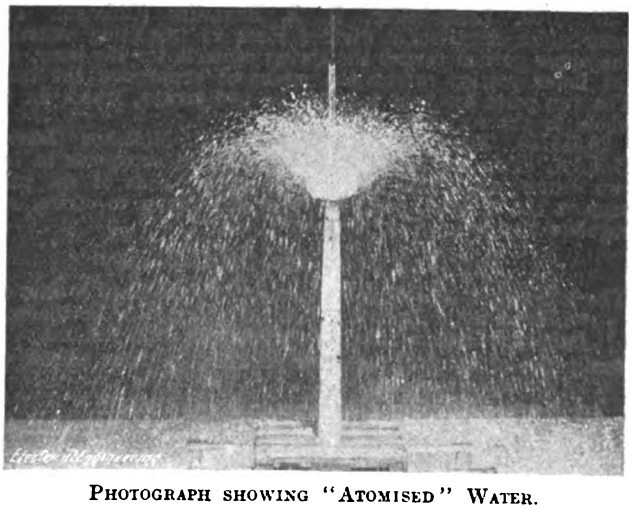
OZONE GENERATORS.—An illustrated pamphlet from Ozonair, Ltd. (96, Victoria Street, Westminster, London, S.W.), describes laboratory apparatus for generating ozone in various degrees of concentration for research and other purposes. Complete outfits for treating liquids, &c., and capable of producing from two to 120 litres of pure, dry, ozonised air per minute, are also listed. The principle and construction of the Ozonair generators were described in ELECTRICAL ENGINEERING, April 14th, 1910, p. 241.

TANTALUM LAMPS.—We have received from Messrs. Siemens Brothers Dynamo Works, Ltd. (incandescent lamp and fittings department, Tysson Street, Dalston), copies of two new show-cards which they are issuing—one of the well-known satisfied consumer design, and the other containing reproductions of some of their other advertising matter.

ELECTRIC DRIVE OF SPINNING MACHINERY.—A leaflet from the A.E.G. Electric Co., Ltd., illustrates a three-phase collector motor direct-coupled to a ring spinning machine, with automatic speed regulation through brush adjustments.

"CASCADE" COOLING TOWERS

MESSRS. RICHARDSONS, WESTGARTH & CO., LTD. (Hartlepool), have for some time been experimenting with a view to obtaining the maximum possible cooling effect of the air in cooling towers, and have now on the market an improved form known as the "cascade" cooling tower, of which a number of examples are already in use. The principle on which it works depends upon the way in which water can be "atomised" by allowing a solid jet to fall on a suitable platter in the manner shown in the illustration, and thus



PHOTOGRAPH SHOWING "ATOMISED" WATER.

to offer a very large surface to the air. The water is delivered to the tower in troughs, from which it is distributed by pipes arranged in rows. These pipes discharge the water in jets on to sprayers, which are so formed that the water rebounds in an upward direction in a finely divided state, and before it can attain a high downward velocity it is caught on diagonally placed collecting planes, which are constructed as a series of parallel steps separated from each other for the passage of air, so that the water falls from one step to another, and finally flows into another set of receiving troughs.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 15th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

13,728/09. **Enclosed Arc Lamp.** F. W. SCHUER (London). All parts of the lamp in communication with the inner globe are hermetically sealed, with the exception of a long narrow outlet of 1/16 in. bore, for the release of the generated gases. Entrance of oxygen into the globe is prevented and the combustion of the electrodes reduced. One figure.

19,387/09. **Flame Arc Lamp.** S. C. MOUNT and BECK FLAME LAMP, LTD. This specification describes mechanism for multiple carbon lamps, to move the swinging carbon of the second pair of electrodes nearer its fellow electrode than is the case with the other pair when the first pair is consumed, so that the arc is struck between the fresh pair. For several pairs of carbons the mechanism is arranged so that only one pair is brought together each time the striking mechanism is operated. Two figures.

19,496/09. **Electric Drive.** W. G. BAMBRIDGE (Kettering). A mechanism suitable for use with motor-driven drills comprises a countershaft supported by rotatable eccentric bushes, so that by rotating the bushes the position of the shafting and the tension of the driving belt can be altered. The bush is provided with a lever, and has ratchet teeth engaged by a pawl to prevent back movement. The driven pulley is mounted loose on the shaft, and a conical collar on the shaft is pressed into the bore of the pulley by springs. This allows the pulley driving the countershaft to slip and rotate when the load exceeds a predetermined amount. Three figures.

23,351/09. **Insulating Material.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). Talc or clay is mixed with a compound of titanium and a silicate binder, and the product is compressed and fired at a temperature of 900° to 1,500° C. The presence of the titanium has been found to increase the strength and refractory qualities of the material.

25,719/09. **Plug Connector.** N. HOSGOOD (Dublin). The one or more sets of three pins of the plug, and the corresponding holes of the socket are arranged at the angles of equilateral triangles, and may be connected in three different ways. Marks are made on plug and socket to indicate the particular connection made. Four figures.

26,250/09. **Submarine Telephone Cables.** SIEMENS BROS. & Co., LTD., and W. DIESELHORST. The Pupin or inductance coils of submarine telephone cables are wound with more or less hygroscopic material, and to prevent moisture being gradually absorbed by this, the coils are provided with a light sheathing of impermeable material, such as tin or lead foil. This sheath may be placed between the coil itself and the gutta-percha protecting tube. Two figures.

27,208/09. **Lamp-holder.** R. B. BENJAMIN (Chicago). This lamp-holder comprises a divided block of insulating material; the upper portion carries the spring contacts for the lamp, and the lower portion carries the means of supporting the lamp. The two parts are held together by two screws, which fix the whole to the reflector. Four figures.

28,555/09. **Magazine Arc Lamp.** L. M. MCBRIDE (Denver, U.S.A.). Two magazines deliver carbons in succession to feed two converging tubes. Stops at the lower ends of the tubes support the carbons, and the tubes are swung to strike, and regulate the arc. Four figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: KÖNECKE [Three-phase lamp] 6,868/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MILLER [Lead jointing] 9,043/10; ETTLINGER [Underground cable conduits] 10,054/10.

Dynamos, Motors, and Transformers: SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens-Schuckertwerke Ges.*) [Voltage regulation of machines] 3,915/10; SIEMENS BROS. DYNAMO WORKS, LTD., and PICKERING [Armature windings] 11,896/10.

Electric Ignition: DELAGE and WOOG [Ignition of gas burners] 17,486/09; WECKERLEIN & STÖCKER [Contact-breakers for dual ignition system] 6,033/10.

Electrometallurgy and Electrochemistry: COWPER-COLES [Electroplating] 20,057/09; JOHNSON (*Badische Anilin & Soda Fabrik*) [Production of long continuous arcs] 20,129/09 and 22,715/09; SALTPETERSÄURE INDUSTRIE GES. and PAULING [Manufacture of nitrates] 9,884/10.

Incandescent Lamps: BOOTH and BOOTH [Connection of lamps in series] 25,288/09; WOLFRAM LAMPEN A.-G. [Supports for metal filaments] 6,397/10.

Instruments and Meters: STROMBERG and WILLIS [Counting trains for meters] 2,275/10; CHAMBERLAIN & HOOKHAM, LTD., and SPRAGUE [Prepayment meter] 8,922/10.

Switchgear, Fuses, and Fittings: SOC. DU GAZ DE PARIS [Illuminated signs] 29,502/09; HIRST and TAYLOR [Conduit wiring system] 29,953/09; ADAMS MANUFACTURING Co. (*Cutler Hammer Manufacturing Co.*) [Starters for polyphase motors] 7,318/10; J. STONE & Co. and DARKER [Change-over switches for train lighting systems] 7,469/10; NOVAK [Circuit-breakers for overhead conductors] 7,799/10; LUNDBERG [Switches] 8,418/10.

Telephony and Telegraphy: MARCONI and MARCONI'S WIRELESS TELEGRAPH Co., 20,230/09; BRITISH RADIO TELEGRAPH & TELEPHONE Co. and BALSILLIE, 24,388/09; ROMER [Intercommunication telephones] 28,462/09; POTTS [Automatic telegraph transmitter] 15,123/10.

Traction: SPENCER and DAWSON [Tramcar trucks for varying gauges] 19,655/09; BROOKS [Electrical starting of motor-cars] 19,747/09; SNOW and RADLEY [Signalling] 9,164/10; MARKS (*Hill*) [Brake-shoes] 9,344/10; SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Signalling apparatus] 14,355/10.

Miscellaneous: REES [Centrifugal pumps] 15,084/09; LAKE (*Fried. Krupp A.-G.*) [Magnetic separators] 17,459/09; CHARLES [Therapeutic garments] 20,408/09; WALTON and SMITH [Exhaust steam plant] 27,200/09.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: GALVAO [Vapour lamps] 19,671/10.

Electrometallurgy: SOC. ANON, ELECTRO-METALLURGIQUE (Procédés Paul Girod) [Polyphase furnace] 3,421/10.

Telegraphy: SIEMENS & HALSKE A.-G. [Signalling apparatus] 13,985/10.

Traction: SIEMENS & HALSKE A.-G. [Safety device] 18,670/10.

Opposition to Grant of Patents

11,060/09. **Arc Furnace for Treating Gases.** G. W. JOHNSON (*Chemische Fabrik Griesheim-Elektron*). As the result of opposition, the right to a patent on this application has been surrendered. The specification covers a furnace in which a long horizontal arc is drawn out, the gases being blown down on to the arc at a sharp angle from a series of slits arranged above it in the manner of louvres.

10,802/10. **Prepayment Meter.** W. V. PALMER. Opposition has been entered to the grant of this patent, which covers a device for use in prepayment meters to prevent the insertion of too many coins at one time, which causes jamming of the mechanism.

Application for Revocation

18,628/08. **Electric Ignition.** A. M. LOW. Application has been made under Section 26 of the Patents Act for the revocation of this patent, the applicant having failed to oppose the grant of the patent. The patent covers a sparking plug in which one electrode is cup-shaped, and the other a point at the axial centre of the cup.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

21,262 of September 26th, 1896. **Centrifugal Drying Machines.** R. WILLIAMSON. The motor armature is fixed to the top of the vertical shaft of the suspended cage, and the field system is suspended so that it receives the same oscillatory movements as the rotating shaft and armature, but is prevented from rotating by fixed pins.

21,548 of September 29th, 1896. **Telegraph Punching Machine.** W. L. WISE (*C. L. Buckingham, U.S.A.*). This patent covers an electromagnetic apparatus for perforating a strip of paper for use in a telegraph transmitter, with groups of holes, each representing a letter.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: W. P. THOMPSON (*Berliner Maschinenbau-A.-G.*) [Polyphase transformer cores] 12,688/02; L. LOHNER and F. PORSCHE [Field-magnet coils] 12,694/02.

Electrometallurgy, &c.: M. OTTO [Ozonising apparatus] 12,521/03.

Incandescent Lamps: C. D. ABEL (*Siemens & Halske A.-G.*) [Manufacture of tantalum filaments] 12,157-8/02.

Instruments, &c.: L. B. ATKINSON [Maximum-demand indicator] 11,235/01.

Traction: N. A. CHRISTIENSEN [Air brakes] 10,972/01; L. KRIÉGER and COMPAGNIE PARISIENNE DES VOITURES ELECTRIQUES (PROCÉDÉS KRIÉGER) [Petrol-electric system] 25,175/05.

Miscellaneous: H. HAWTHORN [Fire alarm] 12,579/05; A. TAYLOR [Fire alarm] 11,275/05.

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MARINE PROPULSION

AT a meeting of the Institute of Marine Engineers held at the Naval and Engineering Exhibition, Olympia, London, on Saturday, a Paper was read by Mr. J. Lecoche describing the use of his system of magnetic frictionless gearing in connection with the combination of a reciprocating engine and an exhaust-steam turbine for marine propulsion. As an example, the case of a gear for a 300-h.p. 3,000-r.p.m. exhaust-steam turbine was chosen. The turbine is coupled to the main propeller shaft, driven by the reciprocating engine, and running at 75 r.p.m., through a magnetic worm gear comprising a cast-steel field magnet with laminated pole-pieces, and a worm and wheel also laminated. The wheel has a hollow rim made up of sprockets, having the same angle, width, and pitch as the threads of the worm opposite which they move with a clearance of about 0·25 in. There is a slight advance of the worm threads under load, and the wheel is dragged round unless the load is sufficient to cause it to fall out of step. The field-coil losses for such a gear are given as 1,200 watts, or about 1 per cent. of the power transmitted, and the losses through hysteresis and eddy-currents in the teeth about 4 per cent., giving an efficiency of 95 per cent., excluding the small friction losses of the bearings. The weight of the complete gear is given as 11 tons, and this is compared with the estimated weight of 30 tons for an electrical transmission employing a 250-kw. 3,000-r.p.m. dynamo and a 300-h.p. 75-r.p.m. motor.

Two other Papers were read. One, by Mr. W. P. Durtnall, reviewed the history of the internal combustion engine, and briefly referred to the advantages to be gained by its use in connection with electrical transmission for marine purposes, and the other, by Mr. W. G. Gibbons, described the Brown telemotor, a hydraulic device for operating ships' steering gear.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to The Editor, ELECTRICAL ENGINEERING, *203–6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

S. M.—No.

Z.—Certainly.

DOUBTFUL.—Ask the Supply Co.

STUDENT.—"Electric Motors," by Hobart. Post free, 18s. 6d.

WIRELESS.—"Radiotelegraphy," by Monckton. Post free, 6s. 4d.

Q. Q. Q.—We cannot prescribe electrical treatment in this column. Consult a medical man.

ANON.—(1) It is a departure from the regulations and current practice. (2) We are publishing your letter.

SEVEN DIALS.—No, you cannot expect the supply people to pay you if the meter registers backwards.

R. L. M.—We know very little of the firm you mention, and should recommend you to obtain quotations from two or three of the firms in the "Trades Directory" on our last advertisement page.

"CONTRACTOR SMITH."—The Corporation are quite within their rights to insist that the installation should be wired in two separate portions for connection to their three-wire system if the maximum current exceeds a certain amount. The two sets of main switches and fuses should be at least 6 ft. apart.

COUNTRY COUSIN.—A fuse and heat coil are not necessary for your short overhead telephone wire, as there are neighbouring buildings and trees at a higher elevation. There will be no harm, however, in using "window terminals" with spark gaps at the points of entry of the line; the earth terminals of these may be connected to the water-main by a bare wire.

AN ENQUIRER FROM MANCHESTER.—We hope to be able to publish shortly some particulars of the machine you mention. There is no competition between the British and foreign firms to build the largest motor in existence, and it is only for very special purposes, such as rolling mills, that single motors of 1,000 h.p. and over will be required.

SCEPTIC.—It is quite true that metal filament lamps consume about 70 per cent. less energy than carbon lamps *for the same candle-power*, but as your circuit is 200 volts, you will have to be content with replacing the 16-c.p. lamps by 30-watt metal filament lamps, which will consume half the energy, but will give about 25 c.p., as this is the smallest size at present on the market. Replacing the 8-c.p. carbon lamps by 30-watt metal filament lamps will not reduce the consumption, but will give you three times the light.

SURFACE-CONTACT TRAMWAYS AT TORQUAY

THE arbitration commenced in London on Monday of last week to settle a difference whether the Torquay Tramways Co. were to be allowed to replace their surface-contact system of electric traction by the overhead system was continued on Wednesday last week, and concluded on Saturday. A report of the previous proceedings was given in our last issue. The arbitrator reserved his award.

Mr. W. H. PATCHELL, called on behalf of the Tramways Company, gave evidence to the fact that the number of live studs on the Torquay system was increasing; it had been an average of 28 per month during 1908, and for the first seven months of this year the average was 47 per month. He did not think it possible to eliminate the faults of the Dolter system. The cost of repair and maintenance was very high, and experience showed that it would increase in the future. It would be most difficult to give a satisfactory service if the Torbay road route were on the surface-contact system while the rest of the Torquay system and the extension to Paignton were on the overhead system, as it would necessitate a shuttle service on the Torbay route, with considerable inconvenience to the public. He considered that the Company had done their utmost to make the system a success. The new stud proposed by Mr. Mitchell was impracticable. He would not recommend the G.B. system, and he was certain that the Lorain system would be objected to in Torquay.

This concluded the case for the Company.

Mr. C. E. C. SHAWFIELD, Borough Electrical Engineer of the Wolverhampton Corporation, was then called for the Torquay Corporation to give evidence of the efficient working of the Lorain system in Wolverhampton. There are now 21¾ miles of single track on this system in Wolverhampton, 12 miles of which have been in operation for nearly nine years, and the system, he said, had given every satisfaction. The cost of the electrical equipment per mile of single track was £1,800 against an estimated £1,000 per mile for the overhead system. The operating costs were now 6·4. per car-mile, or 9·37d. including all capital charges. They had had very few cases of live studs, and the system was approved indefinitely by the Board of Trade.

Mr. VESEY KNOX, interposing, mentioned that the Lorain Co. had quoted a figure of £2,680 per mile of single track for equipping the Torquay system, and without any guarantee.

In reply to a question concerning the abandonment of the live stud indicating device, Mr. Shawfield stated that they had found that above a speed of about 8 miles on hour the bell rung continuously, as it took some considerable fraction of a second for the stud switch to open. It was difficult to give any figure for the number of live studs reported, as many gave no reading on a low-resistance voltmeter, while registering a considerable pressure on an electrostatic or high-resistance voltmeter. The average number giving any reading at all over a period of seven years was two per mile of track per annum, and about half of these only were really "live." It was true that 109 live studs were reported in 1904. In his opinion, the reason why the Lorain system had not been adopted elsewhere was the action of the Press some eight years ago in carrying on a campaign of calumny against all surface-contact systems.

Mr. W. A. LUNTLEY, General Manager of the Wolverhampton Tramways, confirmed Mr. Shawfield's remarks as to live studs, stating that no serious accidents had occurred, but that about £40 per year was paid for compensation in respect of accidents to horses. No complaints had been received with regard to the projecting of the contacts above the roadway. The net profit of the system for 1909 was £6,334, and they had accumulated a reserve fund of £32,000. The capital of the system was £248,000.

Mr. STANLEY CLEGG, Electrical Engineer to the Lincoln Corporation, gave evidence as to the satisfactory working of the G.B. system there. There was a guarantee that the current consumption would not be more than 1·3375 units per car-mile, and for the year to March 31th, 1910, it was 1·075 units per car-mile. The detector on the cars had never failed to indicate a live stud, and there had not been one accident during the five years the 3½ miles at Lincoln had been working. The working expenses for the year to March, 1910, were 0·54d. per car-mile less than on any other system of municipal tramways. In cross-examination, Mr. Clegg admitted that the number of live studs was increasing, and that the cost of maintenance had gone up every year. Nevertheless, they had a permanent licence from the Board of Trade.

Mr. W. M. MORDEY, who was called in by the Corporation and had reported on the working of the Dolter system at Torquay (ELECTRICAL ENGINEERING, July 28th, p. 496), dealt at length with his proposals to improve the system. The whole of the trouble has been with the stud mechanism, and the main part of his evidence was intended to demonstrate the advantages of a stud invented by Mr. E. A. Mitchell, at one time Chief Engineer to the National Electric Construction Co.

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It was subsequently pointed out by the Company's representative that the patent in question was taken out in 1907, before Mr. Mitchell left the Company, and that Mr. Mitchell had never drawn the attention of the Company to it. Mr. Mordey said he was surprised that the patent had not been worked before, because it certainly covered a number of details which would overcome the difficulties at Torquay. It may be explained that the present stud-boxes consist of an inner and outer vessel, the outer containing a heavy oil to keep out water, and the inner a thinner oil, in which the switch contact works. The main advantages claimed for the Mitchell stud are that only one vessel is used, so that the switch contact works in a much larger space, rendering carbonisation of the oil less frequent owing to the greater quantity of oil, and the break of the switch is greater and better, and that the contact when closed is better owing to the magnetic action being more powerful. Mr. Mordey detailed a large number of defects now existing which would be remedied by the abolition of the inner vessel, but as the Company had spent about £20,000 in working Mr. Mitchell's inventions on the Torquay tramways, they refuse absolutely to look at any others. It was pointed out to Mr. Mordey that all the advantages which he claimed for the single vessel did not show themselves when the Company used such a contrivance, and that it was for this reason that a double-vessel arrangement was adopted. The Company's officials and Mr. Mordey were similarly diametrically opposed on the question of the oil in the boxes. Mr. Mordey felt convinced, from experience with oil switches in power-houses, that a satisfactory oil could be found, but experience at Torquay had convinced the Company that no oil existing can be satisfactory, in spite of the apparent freedom from trouble on this head at Hastings. Mr. Mordey did not consider the electrical losses on the Torquay lines extravagant, viz., 11·9 per cent. In fact, he should consider this quite good even for a trolley system. On the L.C.C. conduit lines, he said, there was a considerable leakage. Mr. Mordey also strongly recommended a patent live stud detector invented by Mr. Mitchell, but it was interposed on behalf of the Company that this identical device had been tried at Torquay under Mr. Mitchell's supervision, and admitted to be a failure. On the question of maintenance, it was claimed that the Torquay lines compared favourably with overhead lines. In Mr. Mordey's report, however, he complained that the system had not been maintained efficiently. The Arbitrator pointed this out, and suggested that if more money was spent on maintenance, as was suggested in the report, the comparison would not be so favourable.

Mr. VESEY KNOX cross-examined Mr. Mordey at great length, and pointed out that the proportion of live studs at Hastings was greater than at Torquay. He also put it to Mr. Mordey that the greater magnetism in the Mitchell stud would result in its remaining magnetised after the car had passed, and ringing the detector bell, whether it was alive or not, but Mr. Mordey said this could be avoided by using materials for the stud of smaller retentiveness. Specimens of oils were produced which it was claimed would prevent water getting into the boxes. Mr. Knox put it forward, however, that one of these very oils had actually been tried at Torquay, and had failed, and that Mr. Swinburne himself knew of no oil that would do this effectively. Mr. Knox also referred to a statement made by Mr. Shawfield in his evidence, that he would hesitate to use a switch of this character in oil.

On Saturday the proceedings were concluded. Mr. F. S. Hex, Town Clerk, detailed the negotiations between the Corporation and the original Dolter Company, which led up to the construction of the tramways. At present, he said, the travelling on the cars was very easy, the service was a good one, and the gradients of the town were taken well by the cars. The Corporation was quite satisfied with the system, and held the view that the general conditions of the undertaking were in striking contrast to any overhead trolley system. There was little doubt, in the opinion of the Corporation, that the system could be kept in a state of repair which would meet the objections of the Board of Trade. Indeed, it was on the strength of assurances from the Company that they would make further efforts to improve the Dolter system that the Corporation gave their sanction to the Paignton extension. An important part of the Town Clerk's evidence was the production, at the request of the Company, of an offer on the part of the Corporation to agree to the introduction of the overhead system provided the Company gave certain guarantees to construct additional lines. This offer, which was made "without prejudice," was refused by the Company, owing to the difficulty of raising the necessary capital.

The Mayor of Torquay said the general feeling of the borough was against a change, whilst Councillor Pike, Chairman of the Tramways Committee, expressed the view that rather than have no tramways on Torbay Road, he would agree to the installation of the overhead. On the other hand, the Mayor would rather have no tramways at all than have the trolley system. Some further local evidence concluded the case for the Corporation.

The arbitrator, who paid a visit to Torquay on Monday, reserved his award.

LOCAL NOTES

Austria: *Strike.*—According to Reuter telegrams, about 300 employees of the Municipal Electrical Works at Lemberg have gone on strike. As a consequence the electric tramway service is suspended.

Ayr: *Tramway Accounts.*—The net profit for the past year's working amounts to £2,491. The sum of £1,962 is carried to depreciation, and £529 to relief of rates. The number of passengers carried—namely, 3,588,628—is a decrease of 21,909. The traffic receipts—namely, £15,007—show a decrease of £74. The Manager reports the fitting of the water-car with a track brake to which has been attached blocks of a very hard substance known as alundum blocks, which, when screwed down to the rail, effectively grind out corrugations.

Electricity Accounts.—After meeting interest and sinking fund charges, the accounts of the Electricity Department for the past year show a surplus of £2,444, which is an increase of £120 over the previous year. The sum of £200 has been transferred to relief of rates and the remainder to reserve fund. Mr. R. Marshall, the Borough Electrical Engineer, recommends that all future surplus revenue should be placed to reserve until this fund reaches a sum sufficiently large to ensure the financial stability of the undertaking.

Bath: *Electrical Trades Union.*—A meeting was held on Friday in the Foresters' Hall with the object of forming a local branch of the Electrical Trades Union. There are about a hundred electrical workers in Bath, but very few attended the meeting. Eventually the idea of establishing a local branch was abandoned, and the Bath workers were urged to join the Bristol branch.

Belfast: *Tramway Extensions.*—The Tramways and Electrical Committee have decided, in connection with the proposed new line from Antrim Road to Old Cavehill Bridge, to omit from the sub-committee's report the recommendation to purchase the interests of the owners of the Old Cavehill railway, which lies to the north of the proposed extension.

Bradford: *Town Hall Wiring.*—The Bradford Electrical Co. are carrying out the work of re-wiring the old portion of the Town Hall. The installation includes the fitting of 379 lamps. In addition, an internal telephone system and electrically controlled clocks, are to be installed, these two latter portions of the work being carried out by Messrs. Steinthal & Boydell.

Trolley Omnibuses.—The Tramways Committee have approved a recommendation of the Sub-Committee to purchase two trolley omnibuses for running along the route from Sticker Lane to Dudley Hill.

Canada: *Dawson City.*—The directors of the Northern Light, Power & Coal Co., Ltd., have received a cablegram stating that their power-house at Dawson City has been completed, and that current has been successfully transmitted over 44 miles of transmission line.

Cardiff: *Telephone Exchange.*—The new telephone exchange, which has been at work for some time, was formally inaugurated last week. A full description of the equipment appeared in ELECTRICAL ENGINEERING, Vol. IV., page 721, December 3rd, 1908.

Dalkey: *Electric Lighting.*—When the Dublin United Tramways Co. obtained powers to run trams to Dalkey, it appears that the Council refused to grant facilities to the company for supplying electricity. No move, however, has been made by the Council itself in the direction of giving a supply, and complaints are now being made on this ground. The Council are being urged to waive the clause preventing the Tramway Co. from supplying electrical energy.

Eastbourne: *Reduction in Electricity Charges.*—From October 1st the charge for lighting will be reduced from 5½d. to 5d. per unit; for outside arc lamps or incandescent lanterns, from 4½d. to 4d. per unit; and for heating and cooking, from 2½d. to 1½d. per unit. Where there are two or more ordinary meters on a consumer's premises, the charge will be 1s. 6d. each per quarter, instead of 2s. 6d. each.

Edinburgh: *Electricity Department Profits.*—The Town Council have a sum of £7,300 in hand from surplus profits of the electricity undertaking, and are recommended by Sir Alexander Kennedy to devote this to paying off the unpaid portion of the outstanding loan on the plant at the Dewar Place power-house, and to replace it with more up-to-date machinery. The Electricity Committee have decided to recommend this course to be adopted.

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Leeds: *Trolley Omnibus.*—The Corporation having decided to instal the system of trolley omnibuses in Leeds, the directors of the Mercédès-Stoll system have been inspecting the route from City Square along Whitehall Road to Drighlington.

London: *Hampstead.*—An exhibition of electrical domestic appliances is to be held at the Finchley Road Baths from October 4th to 8th.

Manchester: *Tramcar Building.*—The Manchester Ratepayers Association has expressed to the Town Clerk their doubts as to whether the Corporation have Parliamentary powers to undertake the building of tramcars, as has recently been done. In reply the Town Clerk has drawn attention to the Manchester Corporation Acts of 1897, 1899, and 1900, but the Ratepayers Association retorts that these merely give the power to "provide" cars and not "manufacture" them. This latter communication is to be placed before the Tramways Committee.

Loans without Inquiry.—The Ratepayers Association is also still dissatisfied with regard to the action of the Local Government Board in recently granting a loan of £40,000 for electrical extensions without holding the usual inquiry. A number of letters to the Local Government Board on the matter have carried it no further than a statement by the Board of the purpose for which the loan in question was required, and intimating that in respect of a further loan for £30,000 for a turbo-alternator at Stuart Street powerhouse a local inquiry will be held.

Monkseaton: *New Sub-station.*—The growth of the demand for electric light at Monkseaton has necessitated an increase in the plant of the Newcastle-upon-Tyne Electric Supply Co. in that district. As the district is a high-class residential one, it was necessary to depart from the somewhat plain design usually adopted by the company in its sub-stations, and to build one of a rather more handsome type to suit the æsthetic tastes of the neighbourhood. It is a one-floored building, and will contain a three-phase transformer by Richardsons, Westgarth & Co., which will convert the current from 5,500 volts to 440 volts. It is interesting to note that the power for this new sub-station is supplied from the main station at Carville via the North Eastern Railway Co.'s substation at Cullercoats. The low-tension switchgear is by Messrs. Reyrolle & Co., of Hebburn-on-Tyne.

Newport (Mon.): *Electricity Accounts.*—The electricity accounts for the past year show a profit of £380, compared with a loss of £1,469 in the previous year. Mr. H. Collings Bishop, Borough Electrical Engineer and Tramways Manager, is justly proud of this achievement, as it has been brought about without increase of prices, and a still falling revenue due to metal filament lamps. The total cost per unit, namely, 0·81d., is a decrease of 0·05d. per unit. The total number of units sold was 4,012,909. The load factor was 19 per cent., slightly less than the two previous years; the maximum load was 2,324 kw., and the total connections in 8-c.p. lamps equivalent, are now 187,703. The net profit of £380 is arrived at after meeting interest and sinking fund charges.

Oldham: *Smoke Nuisance.*—Quite a number of complaints have been made from time to time concerning the emission of black smoke from the Electricity Works' chimney. Mr. S. W. Newington, the Borough Electrical Engineer, has been making a large number of experiments with a view to improving the conditions, and on Sunday a test was made using the worst coal he could obtain. The members of the Electricity Committee were present, and expressed themselves satisfied with the result of the test.

Rochdale: *Tramways Inspection.*—The tramways which have been constructed in the Whitworth Valley by the Corporation were inspected on behalf of the Board of Trade last week by Lieutenant-Colonel P. C. Von Donop. The line runs for nearly three miles beyond the Rochdale boundary, and will ultimately be extended to Bacup, linking up Rochdale with Rossendale. The latter line is now under construction.

Sevenoaks: *Electric Lighting.*—The Council last week decided to apply for a provisional electric lighting order. Messrs. Mordey & Dawbarn have prepared a report dealing with the town.

Stirling: *H.T. Wires across Highways.*—The Stirling County Council have approved a proposal by the Scottish Central Electric Power Co. to carry high-tension cables across certain public highways between Denny to Stirling.

Weymouth: *Tramways.*—At the last meeting of the Council the Electric Lighting Committee presented a report proposing an expenditure of £27,000 on a tramway system, to which reference has recently been made in our columns. The scheme has met with such keen opposition from the ratepayers that the Committee withdrew it, and promised to bring out an alternative proposal in a month's time. A postcard poll of the ratepayers ended in a majority of 342 against the Corporation working a tramway system.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Heckmondwike.—Application has been made to the Local Government Board for a loan for electrical extensions.

Ireland.—The Cookstown and Listowel Councils are making inquiries regarding electric supply.

Manchester.—A Local Government Board inquiry will shortly be held concerning a loan of £30,000 for the provision of a turbo-alternator at Stuart Street.

Norwich.—A loan of £18,790 for mains, services, exhaust steam turbine, condenser, balancer, coal elevator, &c., is to be applied for.

Sheffield.—Tenders are invited for a turbo-alternator, exciter, condensing plant, pumps, and accessories, three water-tube boilers, economisers, induced draught fan, steel chimney, &c. Particulars from the General Manager, and tenders by September 30th.

Warrington.—The Local Government Board have sanctioned a loan of £6,257 for plant extensions at the Electricity Works.

MISCELLANEOUS

Hereford.—The provision of an improved electrical equipment is being urged upon the Hospital Committee.

Isle of Thanet.—The Isle of Thanet Electric Tramways Co. invite tenders for general stores for the year commencing October 1st. Particulars from the Manager, St. Peters, Kent.

Metropolitan Railway Co.—Tenders are invited for stores for the year commencing November 1st, including electric wires and cables, electric lamps, carbons, switches, fuses, telephones, batteries, and insulating materials. Particulars from the Secretary, 32 Westbourne Park, London, W., and tenders by October 3rd.

Wigan.—An application is to be made to the Local Government Board for a loan of £6,900 as follows: Extensions to present loops and construction of additional loops, £2,700; six new single-truck double-deck cars, £4,200.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

New Sunday schools for Seven Kings and Goodmayes.

P.O. buildings at Chislehurst. H.M. Office of Works.

New branch libraries at Hackney.

Three public libraries at Deptford.

Cinematograph theatre in Romford Road. The Manor Park Cinematograph Theatres, Ltd.

Tenders are invited by the London County Council for electrical installations at the Coroner's Court, Poplar, E., and Hoxton House Schools, Shoreditch, N. (See an advertisement.)

PROVINCES.

Aberdeen.—Craibstone House, New Hills.

Aberdeen & North of Scotland College of Agriculture.

Abertillery.—Thirty-one houses at Cwmtillery. Borough Engineer.

Aldershot.—Additions to Aldershot Steam Laundry.

Altrincham.—Extensions to hospital (£8,000). Board of Management.

Andover.—Post office. H.M. Office of Works, London.

Atherton.—Chapel in Back Lane.

Ayr.—School in Green Street Lane.

Barrow-in-Furness.—New Corporation Fire Station.

Belfast.—Addition to Royal Hospital.

Bishop Auckland.—Workhouse.

Blackburn.—Higher Elementary School (£24,150), and new Sessions House and Police Court (£15,000), at Blakey Moor.

Blackpool.—Public Swimming Baths.

Blaydon.—Electric theatre. Local company being formed.

Blythe.—Town Hall and Municipal Offices.

Bognor.—School in London Road. Rev. A. Gilling.

Bradford.—Wesleyan Methodist Sunday Schools at Oakenshaw.

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Braintree.—Drill hall. Essex Territorial Association.
Canterbury.—The Canterbury Guardians have decided by ten votes to three to light the Workhouse and Infirmary by electricity. Borough Electrical Engineer.
Clitheroe.—Secondary School (£19,300).
Crewe.—Cinematograph theatre.
Darlington.—Aged Miners' Home. Architects, Messrs. Kitching & Lee, Houndgate Chambers.
Douglas (I. of M.).—Ball room in new public garden. Town Clerk.
Droylsden.—Extensions to Messrs. W. M. Christy's mills.
Dunfermline.—Extensions to St. Margaret's Linen Works.
Edinburgh.—Alterations to organ factory, Saughtonhall Drive. Architect, J. M. Maclean, 33 Dundas Street.
Epsom.—New Fire Station.
Farnworth.—School for St. Thomas' Church. Rev. C. F. Ockford.
Glasgow.—Hall. Scottish History Exhibition.
Church in Southern suburbs. Congregational Union.
New Fire Station.
Halesowen.—Alterations to Council Schools. Managers.
Hayes.—Works for Goss Manufacturing Co.
Hebden Bridge.—Thirteen houses in Braceswell Street. J. Downs.
Street of houses in East View. E. Harrison.
Helensburgh.—Post Office. H.M. Office of Works, 3 Parliament Square, Edinburgh.
Hindley.—Electric theatre in Market Street.
Kidderminster.—Beet sugar factory. The Mayor.
King's Lynn.—Extensions to West Norfolk and Lynn Hospital.
Larne.—Technical School in Victoria Street.
Leith.—Town Hall and Library.
Lincoln.—Twenty-six houses in Peel Street. F. Clark.
Twenty-nine in Burton Road. J. M. Harrison.
Malvern.—New Parish Hall.
Mansfield.—Schools in Carter Lane.
Middlesborough.—Sunday School at Linthorpe Road. Primitive Methodist Church in conjunction with business premises.
Newton Abbott.—Infirmary. Architect, Mr. S. Seagar.
Norwich.—Alterations and additions to Halvergate Non-provided School. Architects, Messrs. Lacey & Upcher, 6 Upper King Street.
Padiham.—School at Hopton. Education Committee.
Penge.—Additions to offices at Town Hall. Town Clerk.
Perth.—New school (£20,000).
Portsmouth.—150 new houses.
Ramsgate.—Picture theatre in King Street.
St. Ann's-on-Sea.—Primitive Methodist School.
Sudbury.—Isolation Hospital. Architects, Abdey Haserodt & Co.
Swansea.—Extensions to central police station.
Tipperary.—Workhouse. Board of Guardians.
Torquay.—New Town Hall.
Twickenham.—Cinematograph theatre. Mr. W. C. Phillips.
Weston-super-Mare.—Pavilion in Clarence Park. Town Clerk.
Weymouth.—Pier pavilion. Architects, Messrs. Manquall & Littlewoods, Manchester.
Wolverhampton.—High School for Girls in Tettenhall Road. Enlargement of Sunbeam Motor-car Works.
Drill Hall, Riding School, and Headquarter Offices, County Territorial Force Association.

Wireless Telegraph Notes.—According to the *Cape Times*, the South African Government have decided upon a tender for a wireless telegraph station on the Cape coast, but the exact spot where the station will be erected will not be decided upon until the expert sent out from England has made investigations and reported.

The *Financial News* states that the Marconi Co. have obtained an order for fitting eleven Turkish battleships with wireless telegraph apparatus, and the erection of a coast station, probably at Stefano.

Interruption on the Mersey Railway.—On Wednesday evening of last week a stoppage of supply and extinction of the lights occurred at the Central Station, Liverpool, of the Mersey Railway, just as the passengers had alighted from a train. The interruption appears to have been due to a short-circuit on a jumper cable connecting a track feeder to the track. Some inconvenience was caused by the darkness, and the smell of burning insulation, but the trouble was quickly remedied, and traffic was soon resumed as far as James-street, and later on to the central station. It would appear that the exit lights were run on the same circuit as the track, which is not the case in the London electric railways.

TENDERS RECEIVED AND ACCEPTED

Bacup.—A contract has been entered into with the D.P. Battery Co. for the maintenance of the electricity works' battery for a period of ten years. The tender of Messrs. Crompton & Co. has been accepted for the supply of a negative booster, and that of Messrs. Whipp & Bourne for additional switchboard panels.
Belfast.—Messrs. Coates & Son, Belfast, have got the contract for the lighting of the Whiteabbey Sanatorium with electricity. A gas plant is to be installed.
Blackburn.—The Council have accepted the tender of Messrs. Burrows & Garland, for the supply of wrought iron tubes to the Electricity Department.
Bristol.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of three-phase extra high-tension and low-tension direct-current switchgear at the Dock sub-station, Underfall Yard, has been extended at £204 15s., and that of the British Westinghouse Co. for two three-phase 3,000-kw. turbo-alternators at £25,290. A contract for the supply of arc lamp globes for 12 months has been placed with the City Glass Co. at £38 15s.
Kirkcaldy.—The tender of Mr. W. Dobson, of Edinburgh, at £6,664, is recommended for acceptance for the extension of the tramways at Dysart, consisting of a mile of single track with four passing places.
Radcliffe.—The tender of Mr. W. Brierly has been accepted for the electric lighting of the new Council Offices.
South Africa.—The Durban Council have accepted the tender of Messrs. C. A. Parsons & Co. for the supply of two 2,000-kw. turbo-alternators at £12,920.

The Maschinenfabrik Augsburg-Nürnberg A.-G. (M.A.N.) (London office, Caxton House, Westminster) have recently received an order from Messrs. Mitsui & Co., the well-known Japanese mine-owners, for two gas engines of 3,200-h.p. each for running off coke oven gas and driving electrical generating plant. The Lilleshall Co., of Shropshire, who are the licensees under the M.A.N. Co. for the manufacture of the Nuremberg engine in this country have also recently secured orders from the United Alkali Co., Widnes, and Messrs. Allwright & Wilson, of Oldbury, for large gas-engine plants.

Extensions of Power Supply at Newcastle.—Another new sub-station installation has recently been put into commission for supplying the growing demand for power at the works of Messrs. C. A. Parsons & Co., Henry Watson & Sons, and Messrs. Donkin, at Heaton. The building is of a size for accommodating some 1,500 h.p. of transforming plant, there being at present in it two 700-h.p. transformers, both supplied by the Electrical Co., of London. The object of the addition is to give a duplicate supply, and also to meet the increased load, and the transformers are cooled by oil. The switchgear for the high-pressure side, which works at 5,500 volts, is of the Brown-Boveri type, there being two combined feeder and transformer panels. The switchgear for controlling the low-pressure current, 440 volts, which is used in the works, was made by Reyrolle & Co., of Hebburn.

Speed Indicators for Tramcars.—According to the official circular of the Tramways and Light Railways Association, the committee on speed indicators of the Association has reported that out of a total of twenty-four firms who replied to the committee's invitation to submit instruments for trial purposes, fifteen had accepted the conditions laid down by the committee, and their respective indicators were now being tried on various tramway systems. The report of the committee will be prepared in November.

University College.—The session in the faculty of engineering at University College begins on October 3rd. The Provost and the Dean will attend on Monday and Tuesday, October 3rd and 4th, from 10 a.m. to 1 p.m., for the purpose of interviewing students and advising them as to their courses. In addition to the regular undergraduate courses, the following post-graduate courses will be given during the coming term:—Steam Turbines (supplementary to course in session 1909–10), by Mr. E. G. Izod, of Messrs. Willans & Robinson, on Fridays, at 5.30, beginning October 21st; Railway Engineering, by H. Deans, M.Inst.C.E., of the Great Western Railway, on Mondays and Thursdays at 5, beginning October 6th; Photographic Surveying, by M. T. Ormsby, on Fridays at 4, beginning October 14th; Electrical Design, by H. M. Hobart, M.Inst.C.E., on Mondays from 5 to 7, beginning October 10th.

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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 15s. to £58 per ton (last week, £58 to £58 10s.).

Agency.—Messrs. Pooley & Austin, 25 Victoria Street, London, have been appointed sole London agents for Messrs. I. Frankenburg & Sons, of Salford.

Holophane Reflectors.—Messrs. Siemens Bros. Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.), inform us that they will shortly be placing on the market a series of eighteen new prismatic reflectors of the holophane type, specially suitable for "Tantalum" lamps.

Bankruptcies.—The last day for receiving proofs in the bankruptcy of Harold Bristow, electrician, 368 Hessel Road, Hull, is September 26th. The trustee is Mr. G. H. Atcheson, York City Bank Chambers, Lowgate, Hull.

The last day for receiving proofs in the bankruptcy of J. G. Cunnington and H. P. Allison is September 30th. The trustee is Mr. Alfred Page, 28 King Street, Cheapside, London.

A first and final dividend of 4s. in the £ will be paid on September 23rd at 1 Clothhall Street, Huddersfield, in the bankruptcy of Harry Graham, Electrician, Albion Street, Huddersfield.

APPOINTMENTS AND PERSONAL NOTES

Messrs. Snell & Moore Ede, Consulting Engineers (Caxton House, Westminster) are amalgamating with Messrs. Preece & Cardew as from October 1st. The firm will be known as Preece, Cardew & Snell, and the offices will remain at Messrs. Preece & Cardew's address, 8 Queen Anne's Gate, S.W., to which address all communications should be sent after September 30th. Mr. J. H. Woodward, who has been upon Messrs. Preece & Cardew's staff for the past twelve years, will also become a partner. The partners will thus be:—Sir W. H. Preece, Mr. A. H. Preece, Mr. J. F. C. Snell, Mr. Llewellyn Preece, Mr. J. H. Woodward, and Mr. S. S. Moore Ede.

Mr. W. H. Chatten, electrical fitter apprentice at Sheerness Dockyard, who was recently awarded the first Admiralty scholarship in electrical engineering, has now been awarded the Kent County Scholarship for Science valued at £60 per annum for two years.

Sir Clifton Robinson was entertained to dinner on Friday evening by the Metropolitan Association of Electric Tramway Managers in celebration of the jubilee of the introduction of tramways in England.

We regret to learn of an accident to Mr. W. T. Le Feuvre, Borough Electrical Engineer at Bexhill. Whilst undergoing his annual training with the Royal Engineers at Chatham on Friday, Mr. Le Feuvre slipped to the ground from a distance of 15 feet and broke his ankle.

A draughtsman is required in the York Electricity Department. Salary, two guineas per week. Applications to the City Electrical Engineer by September 24th.

Mr. W. Vincent Waite, late Works Manager to Messrs. Bruce Peebles & Co., Ltd., was entertained at a complimentary dinner in Edinburgh on the 14th inst., on the occasion of his leaving the firm to start business on his own account in Cardiff. Earlier in the day Mr. Waite was presented with a handsome sideboard, and Mrs. Waite with a silver salver by the workmen and staff. The presentation was made by Mr. Lee Murray, General Manager. Mr. W. A. Scott, formerly Assistant Works Manager, has been appointed to fill the vacancy created by Mr. Waite leaving the firm.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

United Electric Car Co.—A dividend of 2½ per cent., less tax, is recommended for the year on the ordinary shares.

British Thomson-Houston Co.—The balance-sheet for the year to March 31st, 1910, shows a profit of £10,932, after meeting debenture and loan interest. The sum of £5,000 is written off for depreciation on Rugby factory; £2,825 for depreciation on apparatus, meters, supplies, &c.; £1,045 for depreciation on goodwill, patents, and licences; and £500 for depreciation on office furniture, &c. A balance of £248 is carried forward. The company have exchanged licences with the owners of the Osram lamp patents on all its patents. An addition has been made to the incandescent lamp factory, costing £19,000, practically doubling its size, and an extension to the main factory, largely in connection with the turbine business, at a cost of £30,000, is nearing completion, whilst a further building is being enlarged at a cost of £11,000.

Melbourne Tramways & Omnibus Co.—Dividend of 4½d. per share for the quarter to September 30th.

Allgemeine Electricitäts Gesellschaft.—A balance of 18,425,000 marks is shown by the accounts for the June half-year, after meeting debenture interest and depreciation. A dividend of 14 per cent. is recommended, compared with 13 per cent. in the previous year. In addition to the usual sums written off, 1,000,000 marks are added to general reserve, and a further 1,000,000 marks to special reserve. The proposals with regard to the Felten Guilleaume-Lahmeyer Works (ELECTRICAL ENGINEERING, September 8th, p. 572) will be laid before the shareholders on October 15th.

Dick, Kerr & Co.—The report to be submitted to the meeting next week gives the profits for the year ended June 30th at £22,820, leaving a balance of £10,416, after payment of debenture interest, &c. £63,141 was brought forward from last year, and it is proposed to pay a dividend of 5 per cent. and to carry forward £42,258.

The Municipal Wiring Bill.—In our issue of September 8th we published a full list of the towns which had come to a decision with regard to the proposed Municipal Wiring Bill, giving their attitude in the matter in each case. A short supplementary list was published on p. 598 of our last issue. The following additional decisions have now been come to:—Ayr, Wakefield, and Manchester have promised financial support. Northampton, Chester, Shrewsbury, Radcliffe, Burnley, and Leytonstone have promised "moral" but not financial support. Sunderland has expressed itself in favour of the Bill. St. Anne's-on-Sea will take no action, and Bexley Heath will consider the matter again.

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General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
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Concordia Electric Wire Co., Ltd., Cricklewood Lane, N.W.
Connolly Bros., Ltd., Blackley, Manchester.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
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Bridge (David) & Co., Ltd., Castleton, Manchester.

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EBONITE.
Mountford Rubber Co., Ltd., 18, Weaman Street, Birmingham.
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WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

No. 196 [Vol. VI., No. 39] THURSDAY, SEPTEMBER 29, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

Another correspondent criticises the rule of the Association of Consulting Engineers to admit only corporate members of the Institution of Civil Engineers. He questions the need for the new Association. (Page 616.)

We publish an illustrated description of the cable works at Derby, where Rickard's, Macintosh's, and Simplex cables are manufactured. (Page 617.)

A short article gives particulars of the new series of posters, showcards, and other advertising matter relating to tantalum lamps, which Siemens Bros. Dynamo Works are placing at the disposal of contractors and agents, and also refers briefly to the testing and dispatching department at the firm's lamp works in Dalston. (Page 619.)

Permanent showrooms with model rooms in which continuous demonstrations of electric cooking and ironing are given, have been opened by the Hackney Borough Electricity Supply Department. (Page 620.)

A short description is given of the Trotter accelerometer, which is a simple instrument depending on the spirit level principle. (Page 620.)

At the annual Conference of the Municipal Tramways Association in Bradford last week, Mr. A. Baker, of Birmingham, recommended reserving a portion of the roadway for tramways, keeping the ordinary traffic off the track. If this were done, he estimates that there could be a saving of £3,500 per mile of double track in cost of paving, in addition to a large saving in maintenance. The question of the durability of brake shoes and tyres was also dealt with, but opinions differed as to the possibility of standardisation in this respect, owing to the varying conditions of different tramway systems. A report upon motor bearings recommended ring lubrication, and quoted some interesting but very divergent figures as to the life of bearings. Tramway authorities were urged by Mr. C. J. Spencer (Bradford), the President, to develop the carriage of goods and parcels on tramways. The "trackless trolley" system was also discussed. Mr. J. Dalrymple, general manager of the Glasgow Corporation Tramways, was elected President. (Page 621.)

A Board of Trade report has been issued on certain boiler tube troubles at Whitehaven electricity works, which were due to corrosion caused by unsuitable feed-water used during a stoppage of the town water supply. (Page 622.)

Mr. P. Cooper-Hewitt claims to have produced a fluorescent reflector which is capable of absorbing high-frequency rays and radiating a sufficient amount of red rays to supply those wanting in the light of the mercury vapour lamp, and thus producing a light approximating to daylight. (Page 622.)

Three new designs of single-phase locomotives, two for the Lötchberg tunnel railway in Switzerland and one for an Austrian railway, are described. Each is

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equipped with two large motors raised well above the frame, and driving through coupling rods. In two of the locomotives, gearing is interposed between the motor and the coupled driving wheels. (Page 623.)

A NEW design of petrol-electric railway car is being put into service on the Prussian State Railways. It has two two-axle bogies; one carries a 100-h.p. 6-cylinder V-type petrol engine coupled to a 60-kw. dynamo. The dynamo is controlled on the Ward-Leonard principle, and supplies two 82-h.p. interpole motors mounted on the other bogie. The total weight of the car, carrying 100 passengers, is 47 tons, and a speed of 30 miles per hour is attained. (Page 623.)

AMONG the specifications published by the Patent Office on Thursday last were two by the Badische Anilin and Soda Fabrik, covering improvements in their arc furnace for the fixation of atmospheric nitrogen.—A directive aerial for wireless telegraphy, comprising a low horizontal antenna in the plane of the two stations is described by G. Marconi.—Opposition has been entered to a patent by Pope's Electric Lamp Co., for a cement for joining metal filaments to leading-in wires, and consisting of a mixture of tungsten powder, ammonia, and silicic acid. (Page 624.)

THE work of the Physikalisch-Technische Reichsanstalt during 1909 included important work on resistance and E.M.F. standards, and some interesting tests on meters. A new mercury resistance thermometer proved very successful. Experiments are being conducted with a view to the production of an iron free from hysteresis. (Page 625.)

A CONSULTING engineer is to be called in at Coventry regarding the purchase of the tramways.—The proposal of the Edinburgh Electricity Committee to use the electricity profits for reducing capital has not been approved.—An effort to restrict Mr. Vignoles, the Borough Electrical Engineer at Grimsby, in regard to advertising, has been defeated.—The capital for the electric power scheme in Bombay is being subscribed locally.—Keighley Corporation are to apply for powers to adopt trolley omnibuses.—The Leicester Electricity Committee formally recommend the Corporation not to appeal against Mr. Justice Neville's decision *re* wiring.—A report upon the new Thames Bridge to carry tramways is to be prepared.—The Scarborough Tramways Co. are suspending their service during the winter. (Page 626.)

EXTENSIONS are to be carried out at Dartford (£10,000); Norwich (£18,790); Walsall (£23,225); and also at Oldham. Generating sets are required by the Secretary of State for India. A number of electric lighting schemes are under consideration in South Africa; arc lamp carbons are required at Hackney; and electrical stores by the York Corporation and Mersey Railway Co. (Page 627.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY), THURSDAY, SEPTEMBER 29TH.

Iron and Steel Institute.

9 a.m.—Meeting in Old Theatre, Pavilion Gardens, Buxton.
(1) "On Electric Steel Refining," by D. F. Campbell.
(2) "On the Utilisation of Electric Power in the Iron and Steel Industry," by J. E. Schuurman.

MONDAY, OCTOBER 3RD.

Society of Engineers.

7.30 p.m.—At Caxton Hall, Westminster. "Current Professional Topics," by H. C. Adams.

The Association of Mining Electrical Engineers.—A meeting of the Warwickshire and South Staffordshire Branch of the Association was held last Saturday at the Imperial Hotel, Birmingham, when Mr. W. Maurice, President of the Association, addressed the meeting on the working of the Association generally. The discussion on Mr. W. Foster's Paper on the resistance of the human body to electric currents was held over till the next meeting.

CORRESPONDENCE

THE ASSOCIATION OF CONSULTING ENGINEERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—So far as I can see, the Association of Consulting Engineers will defeat its own object by insisting that membership of the Institute of Civil Engineers is compulsory before election to the Association, and will exclude a considerable number of the best men. The Association will, therefore, not be representative, and thereby the benefit to its members will be reduced. I cannot quite understand why consulting electrical engineers should bother about the Association; it can, with such restrictions, be only a small body, and where one is evidently not wanted as a member, why trouble about it? The Institution of Electrical Engineers is now so well-known and recognised that I fail to see the use of the new Association.

Hampton Wick, September 24th, 1910.

Yours, &c.,
A. C. COCKBURN.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to The Editor, ELECTRICAL ENGINEERING, *203-6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

S.E. Co.—200 and 100 volts alternating 50 cycles, and 500 and 240 volts continuous; 230 volts continuous; 220 and 440 volts continuous.

WAITING.—If you are within 60 ft. of a distributing main the company must supply you if you request them to. If the distance exceeds 60 ft. but is less than 50 yards, you can also demand a supply on agreeing to defray the cost of the service main, and contracting to take a supply for two years.

CONSULTANT.—The contractor's delay is unpardonable, but the legal position with regard to the enforcement of the penalty clause is difficult. On the other hand, the contractor may be made to realise that his delinquencies will not be forgotten when you have other work to place.

NEWPORT asks, is it allowable to deduct subscriptions to the Institution of Civil Engineers, and other professional bodies, from income tax returns, as part of expenses of one's profession?—We see no reason why this should not be in order, and advise you to try it. We shall be pleased to hear the result.

Telegraph Traffic.—In the report of the Royal Commission on Trade Relations between Canada and the West Indies, the high rates for telegraph messages to and between the West Indies are commented upon, and the public ownership and operation of the cables in the British West Indies, and possibly of the whole system northward to Halifax, is suggested as advantageous. The Commissioners express the hope that this might be arranged by the Imperial Government in conference with the Canadian Government. It is estimated that the three cable companies could be bought out for £525,000, and that a new cable and the partial installation of wireless telegraphy would cost £475,000.

A French telegraph office will be opened at El Aŭourn Sidi Mellouck, in Morocco, on October 1st next.—The Bagdad-Bassorah line was repaired on the 21st inst., and on the following day communication between Tangier and Mogador was restored.—On the 24th the Rome-Constantinople line failed, and communication between Oran and Tangier was stopped.—On the 25th inst. the cable between Tourane and Amoy ceased working.—On the 22nd inst. the Compagnie Française des Cables Télégraphiques managed to repair their section between New York and Haiti, which had been down since July 29th last.

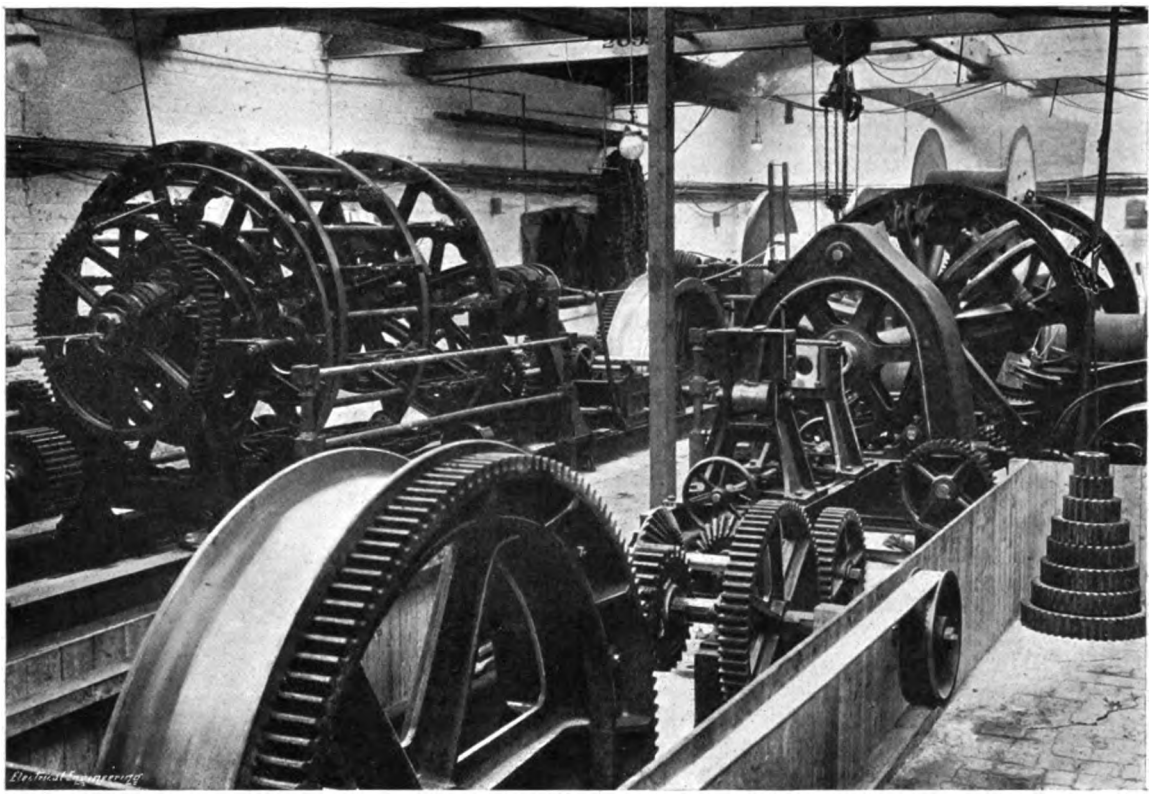
The C.S. *Mackay-Bennett*, of the Commercial Cable Co., has been occupied in repairing, not only the cable of the Direct United States Cable Co., but also of the Commercial Cable Co. of Cuba.—The *Minia*, of the Anglo-American Telegraph Co., has been at work on the cables of the Western Union Telegraph Co., and on the Sydney-Placentia cable. She also had to do work in connection with the North Sydney and St. Pierre cable.—The French cable steamer *Contre Amiral Coubet*, after a long rest in port, was called upon to repair the break in the New York-Haiti cable, which was done successfully, the break being about 350 nautical miles from New York.—The *Robert C. Clowry*, of the Western Union Telegraph Co., was engaged on the Canso-New York sections of the Company, and afterwards returned to New York.

The Western Union Telegraph Co. have applied to the Board of Trade for a licence to land two additional cables from America at Sennen Cove, Cornwall.

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RICKARD'S CABLE WORKS

WE had an opportunity last week of visiting the cable works at Derby, where the cable supplied by Messrs. W. Rickard, Ltd., Chas. Macintosh and Co., and Simplex Conduits, Ltd., is manufactured. At these works, which have recently been extended, originally only house-wiring cable, flexible, bell-wire, and other light insulated wire was produced, but they are now equipped for the manufacture of the heaviest vulcanised rubber cable, and also bitumen cable, and a lead press has been put in for lead-covered rubber cable for which there is a growing demand. The actual rubber mixing is not carried out at these works, as the vulcanising rubber is supplied in sheets from Messrs. Chas. Macintosh's works at Manchester (the old-established rubber manufacturers who were the originators of the "macintosh" and the vulcanised rubber process).



LARGE LAYING-UP MACHINE AND PART OF ONE OF THE LARGE STRANDING MACHINES.

The works are arranged in shops corresponding rather to the various classes of wire than to the operations carried on, so as to avoid as much as possible the transference of the cable from one shop to another during manufacture. Thus, for instance, instead of there being one stranding shop for all classes of cable and wire, practically every department has its own stranding machines. In the shop for small V.R. cable the compound rubber sheets are cut into bobbins of the required width in a simple cutting lathe. A number of wooden discs are threaded on a mandrel, the rubber sheet is wound on it, and then the mandrel is rotated in the lathe, and the rubber is cut through in widths corresponding to the discs. The copper wire has previously been stranded and covered with a lap of pure Para rubber, and the compound rubber strip is put on in a "longitudinal" covering machine. Over the pure rubber a layer of separator rubber is placed, then a "vulcanising jacket," and then the compound rubber is put on in layers to the desired radial thickness. The intermediate "separator" and "vulcanising jacket" are to ensure a perfect vulcanisation of the pure rubber to the compound rubber in the subsequent vulcanising process. In the longitudinal covering machine, the wire and rubber strip pass between grooved steel cylinders, which fold the rubber round the wire and trim it off. The rubber adheres together where it is cut, and the longitudinal seam subsequently disappears in vulcanisation. When comparatively small wire or cable is covered, several wires can pass simultaneously through the machine. At Messrs. Rickard's works there are machines taking 12 to 24 wires, and by replacing the steel cylinders with others having larger and fewer grooves, cables up to 61/12 can be covered in the same machine.

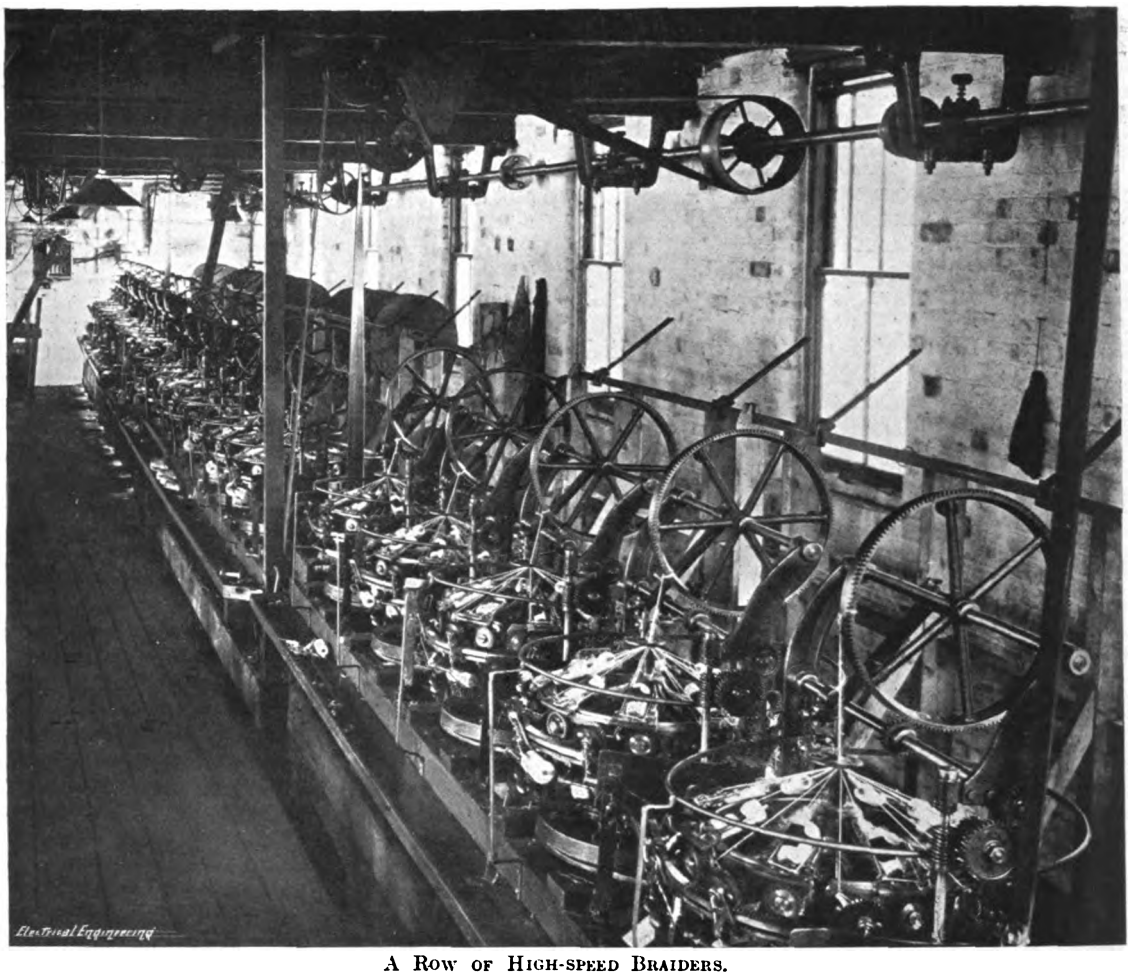
There is no novelty in this method of rubber covering, which is the one customarily employed in this country, but we have described it in some detail, as it may not be known to all our readers, who, as users of cable, will doubtless be interested in the method of manufacture. The rubber-covered cable is next lapped with a waterproof tape in a taping machine, and is then vulcanised. One of the taping machines is a 4-spindle vertical machine, which can tape 300 miles of cable in a week. The vulcaniser consists of perforated circular trays and cylinders, upon which the cable is coiled; these are placed one over another in a deep cylindrical drum, through which dry steam under about 40 lbs. per square inch pressure is passed.

The lead press is of the Friedr. Krupp make, with a pair of horizontal hydraulic rams. In this pattern the melting-pot for the lead is on the press. The lead cools down to about 120° C. in the cylinders, and is pressed on to the cable in a plastic condition between a point and die.

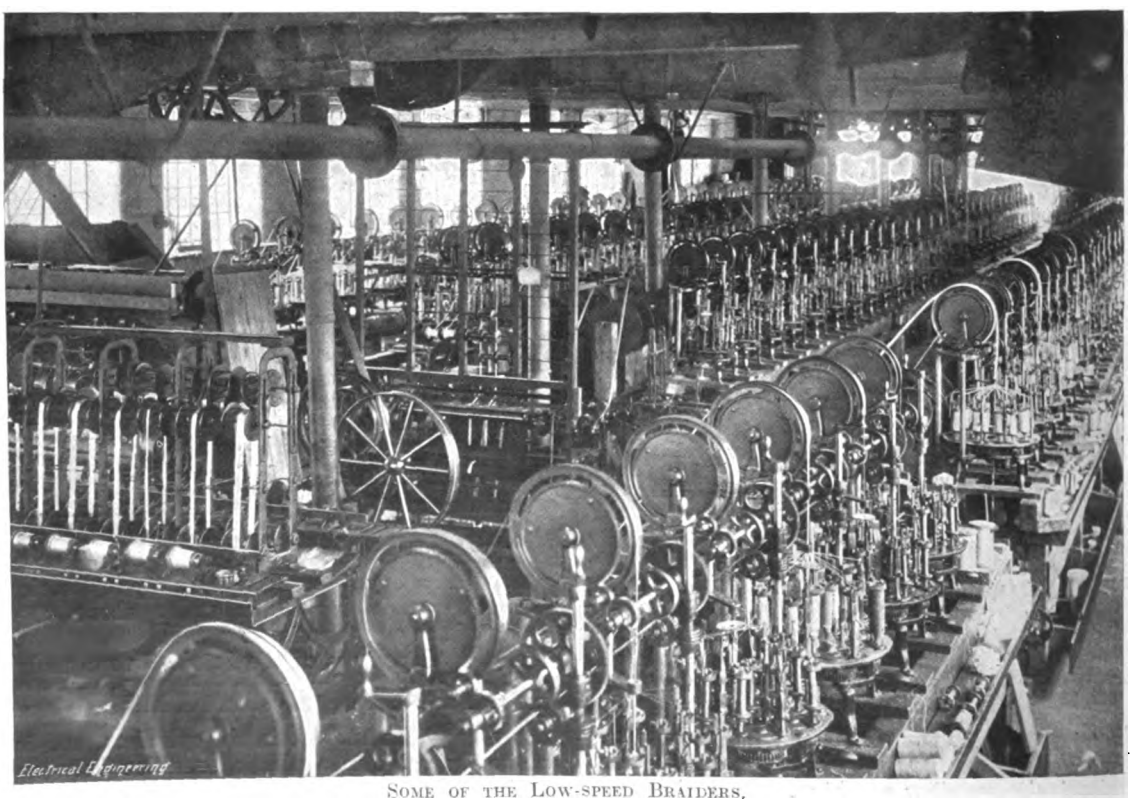
So far as the machines are concerned, bitumen covering is simpler than rubber covering. The bitumen is fed, in the form of small rough blocks, on to a pair of heated calenders and worked up into sheets about $\frac{3}{8}$ in.

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thick. The conductor to be covered is first wrapped with a special "friction" tape, a tape impregnated by friction instead of between rollers. The bitumen sheet is cut up into short strips about 18 in. long, and is fed into a forcing machine through which the conductor passes. This machine consists of a worm revolving in a cylindrical vessel—on the same principle as a sausage machine—and the bitumen is forced round the wire. There are two of these machines, and quite small wire up to cable 4 in. in diameter can be dealt with.



A ROW OF HIGH-SPEED BRAIDERS.



SOME OF THE LOW-SPEED BRAIDERS.

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A large laying-up machine is seen in one of our illustrations; this is employed chiefly for 3-core bitumen cable, and has been used with cable up to 61/12. It is driven by a 25 h.p. motor. On the same picture is seen part of one of the two large stranding and armouring machines, which can lay-up a 169-strand cable in one operation if necessary. All these heavier machines and a fair proportion of the smaller ones are driven by A.C. motors, but they are being replaced shortly by D.C. motors. Power is taken from the Derby Corporation mains, and about 200 h.p. is employed. The remaining machines, which are steam-driven, will ultimately be motor-driven also, as soon as the output of the works is sufficiently large for all the steam from the boilers to be required for the vulcanisers etc.

Two types of braiding machines are employed. In one of the shops there are 70 high-speed braiders (see illustration), made by Vickers, Sons and Maxim, and each capable of braiding three miles of cable per week. These are employed for the braiding of V.R. cables, and also for flexibles with ordinary cotton braiding. For silk and glacé cotton flexibles, however, slow-speed machines have to be employed, and there are about 600 of these in the works. The third illustration is a view of some of the braiders in one of the "flexible" shops. In these shops the stranding, rubber-covering, and cotton-lapping is also carried out, and among the machines are a pair of most ingenious combined laying-up and cotton-covering machines for fine flex, in which there is a simple but effective device for indicating when a wire breaks. One girl can look after 6 heads of this machine, and in the case of the slow-speed braiders one girl can attend nine or ten machines. Besides the combined laying-up and cotton-covering machines are a number of stranding and cotton-lapping machines, both of the vertical type. The machine seen to the left in the illustration is one of several for winding off the skeins of cotton and silk into bobbins for use in the lapping and braiding machines.

Before leaving the works we visited the test room, where we were shown a sample of 7/14 V.B. cable, insulated to 100 mils radial thickness, which had stood the test of being bent 12 times in reverse directions round a 6 in. drum without the insulation being impaired. Another sample had been subjected to steam heating at 280° F. for two hours without showing signs of decentralisation. There are six testing tables, three for insulation and capacity tests with the usual Rymer Jones Keys, two for bridge tests with the bridge sunk so that the top of the box is on a level with the table, and one table provided with a circular bridge wire for low resistance measurements. Moving coil galvanometers are used, placed on brick pillars and with transparent scales, so that the room can always be well lighted. There are arrangements for high pressure testing, and a transformer for extra high pressure tests is being added.

Our thanks are due to Mr. T. Martin Harvey for showing us over the works, and also for having the three photographs taken specially for the purpose of illustrating this article.

The Borough Polytechnic.—We have received a copy of the prospectus of this Institution for the session which commenced last Monday. The electric wiring courses have been re-arranged, and there are certain new classes in mechanical engineering, besides extension and development of the work in other departments.

Electric Power in Shipbuilding.—Considerable extensions have been made in the electrical equipment of the Wallsend shipyard of Messrs. Swan, Hunter & Wigham Richardson. Power is supplied from the Carville station of the Newcastle-upon-Tyne Electric Supply Co., through a special sub-station, of 2,000 to 3,000 h.p. capacity, equipped with four transformers supplied by the Electrical Co., and is distributed at 440 volts. The high-tension side is controlled from the power house, which almost adjoins the works, so that there is no high-tension switchgear in the sub-station. The low-tension side is equipped with Reyrolle ironclad switchgear.

"TANTALUM" POSTERS AND ADVERTISEMENT LITERATURE

WE have been asked by Messrs. Siemens Bros. Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.), to invite wiring contractors and sellers of electric lighting material to apply to them for the new series of posters, showcards, and other advertising literature which the firm have now prepared for the lighting season. Messrs. Siemens' policy is to assist the trade as much as possible in the sale of tantalum lamps, and the pictorial matter which has been prepared should certainly be of value to those who act as retail intermediaries between the works and the general public.

First and foremost we may mention the latest edition of the "Satisfied consumer" series of posters, &c. The satisfied consumer, with his beaming countenance, remains as before, but in place of the words "My electric light bill halved," the picture bears the motto, "Lighter than ever." Posters measuring 80 ins. by 60 ins., and also 120 ins. by 80 ins., will be supplied to any person who has a suitable space for displaying them about his premises, and of more service to the majority of retail firms will be the showcard measuring 12 ins. by 9 ins., in which the design is printed in five colours with the main features embossed, the lettering being glazed to make it stand out very prominently.

The firm are also supplying a five-coloured card giving reduced *facsimiles* of all types of literature, which they overprint in quantities with the contractor's name and address, free of charge. This includes picture postcards, and three or four types of adhesive labels, supplied for attaching to correspondence. The postcards are printed with the same design, and on the back the contractor's name and address can be overprinted so that they may be used as correspondence cards. The adhesive



labels, with the Hassall "Brilliant passage" picture and the photograph of the Dalston works, are well known and widely used, and the latest production of the firm in this respect is a cut-out in the shape of a "Tantalum" lamp, which has been lithographed in colours and on which the words "Use 'Tantalum' lamps" appear.

Sellers of tantalum lamps are also being assisted considerably by the large posters of the new edition of the "Satisfied Consumer," which are appearing on hoardings in all the large provincial towns, and in the metropolis and suburbs, tube railways, and railway stations.

On the occasion of a recent visit to Messrs. Siemens' Dalston lamp works, we were privileged to inspect the testing and packing departments, which is as far in the direction of the lamp factory as the visitor is permitted to penetrate. In both departments the one impression imparted is a realisation of the great mechanical strength of the lamps and their filaments. Lamps for despatch by road or rail are packed in casks simply wrapped in the usual corrugated card and paper, with such packing as would be employed for any other glass goods, and in the testing department a glance at the methods of handling the lamps is sufficient to dispel any anxiety as to their fragility. The tests to which we refer are not the accurate ones which are carried out during manufacture and previous to capping in the manufacturing portion of the works, from which strangers are excluded, but the last tests of a rougher nature, made before the lamps are finally allowed to leave the works. These are performed both on the lamps manufactured at Dalston and on those which have still to be imported from the German works to make up the enormous demand that has to be met.

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The first test is for vacuum. The lamps are placed cap downwards in a tray connected to earth and filled with iron filings, and a sort of cap of insulating material, containing a metal contact plate charged at 10,000 volts through a heavily insulated flexible cable, is placed over each lamp in succession. If a glow is set up in the bulb of the lamp, the vacuum is imperfect, and the lamp is rejected. The lamps are next placed in holders on racks, where they are run at their rated pressure, and if any glow too brightly or are dull this is seen at once and the lamp is taken out either for rejection or for placing among the other lamps of its own voltage and candle-power. After these weeded-out lamps have been removed from the testing rack, the indication of the wrong voltage and candle-power on the caps is removed on a small polishing machine. The lamps which are correctly rated are stamped with a stamp bearing letters representing the date before being taken off the racks and sent down to the stores. In the same department of the works is a testing room for the use of inspectors and engineers taking reception tests; it is fitted with a photometer with a Simmance-Abady flicker head, a self-contained Siemens voltmeter with three ranges, a similar ammeter, and the necessary switches and regulating resistances.

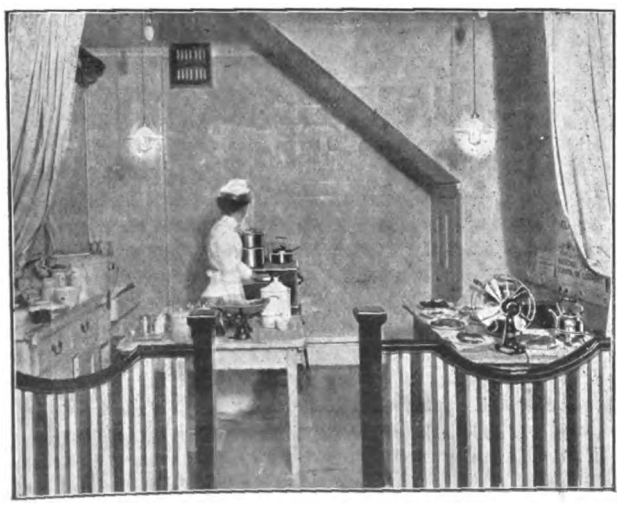
MUNICIPAL SHOWROOMS AT HACKNEY

NEW show-rooms, comprising a permanent exhibition of electrical domestic appliances, lighting fittings, and power accessories, have just been opened at the offices of the Metropolitan Borough of Hackney, Electricity Supply Department,



A CORNER OF THE GENERAL SHOWROOM.

306 Mare Street, Hackney. The ground floor is divided into four portions, fitted up as a general show-room, model sitting-room, kitchen, and reception-room respectively, and special demonstrations will be arranged from time to time in the display windows. At present one window is occupied by a local



THE MODEL KITCHEN.

laundry, who are demonstrating the advantages of electric ironing, while in the other window a group of girl-workers from the Siemens Dalston lamp works illustrate the testing and sorting of Tantalum and "Onewatt" tungsten lamps. The exhibits in the general room comprise a large assortment of lighting fittings, samples of the O.S. "Stannos" and other wiring systems, motors and switchgear for small power users, and domestic appliances of all kinds, most of the apparatus being connected up for demonstration.

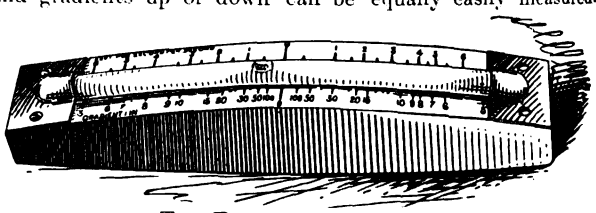
The inquirer or the consumer who calls at the offices to settle an account is obliged to pass first through the show-room and then past the model sitting-room and kitchen before reaching the reception-room. The sitting-room is fitted up to illustrate three different methods of lighting, namely, central pendant fitting, side brackets with candle lamps, and indirect lighting with concealed ceiling lamps. In the kitchen are various patterns of heating and cooking apparatus, including the new G.E.C. oven and various grills, and appliances on the "Archer" system. A continuous demonstration of electric cooking is carried on by a certified cook, who explains the methods and advantages to lady visitors. Electric radiators are fitted in chimney-less fireplaces.

In the reception-room are desks and comfortable chairs, and tables on which are distributed pamphlets on the various uses of electricity, including an attractive booklet on the nature of the supply and the systems of charging in vogue in Hackney. The lighting of this room is most effective. Two 100-c.p. lamps are separately suspended some 18 in. from the white ceiling, and a shallow reflector of inverted-bowl shape, comprising a wire frame 2½ ft. in diameter, with a covering of red silk and a white silk lining, is hung just below each. These inverted shades are made locally to the design of the department.

Mr. L. L. Robinson, Borough Electrical Engineer, and Mr. Chas. Lill, Sales Engineer, are to be congratulated on their enterprise in arranging this exhibition. The department sells or hires out the fittings and apparatus exhibited, and will carry out complete installations either entirely themselves or through local contractors. We are indebted to Messrs. Siemens Bros. Dynamo Works for the illustrations.

THE TROTTER ACCELEROMETER

A SIMPLE and compact form of pocket accelerometer has lately been designed by Mr. A. P. Trotter, and has now been put on the market by Messrs. Everett, Edgecumbe & Co. (Collindale Works, Hendon, N.W.). The instrument is particularly well adapted for railway and tramway tests, and, as shown in the accompanying illustration of one of its forms, is on the spirit-level principle, with a curved glass tube containing a bubble, which is deflected over a scale from its zero position. The position of the bubble is affected, of course, both by the gradient and by the acceleration to which the instrument is subjected, so that the scale can be calibrated to read direct either acceleration on the level or gradient at rest or constant speed. The acceleration and gradient scales are on opposite sides of the tube, and the zero is in the centre, so that acceleration or deceleration and gradients up or down can be equally easily measured.



THE TROTTER ACCELEROMETER.

In use, the instrument has only to be placed on a window-ledge or on the floor, so that the bubble is at zero when the car is at rest, and the tube points in the direction of motion. Starting acceleration or braking retardation can then be read direct in feet per second per second, and calculations of the distance in which a car can be stopped at any speed can be made without the necessity for speed or distance measurements. Tractive resistances may be measured for cars coasting by noting the retardation. The draw-bar pull and brake horse-power during acceleration and running can then be deduced. It is important to notice that the instrument will always indicate the retardation due to frictional resistance &c. of a coasting vehicle only, whether on the level or on a gradient, as the effect of the part of the acceleration or retardation due to gravity is cancelled by the effect of the gradient on the instrument. In like manner in the case of a train starting on a hill, the acceleration due to the propelling power only is indicated, and not the actual acceleration relatively to the track. The instrument is very much simpler and less likely to become deranged than those of the pendulum pattern, and should be useful in connection with tests of electric tramcar and railway equipment and brakes, studying traffic conditions, as well as for testing motor-cars on the road. In addition to the pocket instrument illustrated, another form, fitted to a bracket for attachment to the car, is made.

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MUNICIPAL TRAMWAYS CONFERENCE

A Cheaper Form of Tramway Construction v. the "Trackless Trolley." Brake Shoes and Tyres. Motor Bearings.

THE annual Conference of the Municipal Tramways Association was held in Bradford on Wednesday, Thursday, and Friday last week, under the presidency of Mr. C. J. Spencer, General Manager of the Bradford Corporation Tramways.

In his Presidential Address, Mr. Spencer first quoted a large number of figures from the Board of Trade return on tramways and light railways for the year to December, 1908, and March 31st, 1909, for companies and municipalities respectively, in order to demonstrate that municipal tramways in the mass are commercially sound. He deduced from this return that whereas company tramways have put by last year for depreciation, obsolescence, &c., an amount equal to 1·05 per cent. on a capital outlay of £23,888,485, municipal tramway undertakings in the same period put by for sinking fund, reserve, and renewals account 3½ per cent. on a capital outlay of £47,184,754. Without suggesting that municipalities in earmarking this larger sum are adequately meeting their obligations, he thought they compared with company tramways in a very satisfactory manner. The greater portion of the address was directed to the more immediate possibilities of street traction in this country. He was astonished to find so little progress had been made in the carriage of goods on tramways, and he criticised the present attitude of the House of Commons in relation to municipal Bills asking for these powers. Last year the Bradford Corporation was unsuccessful before Parliament, and Mr. Spencer attributes this to the fact that so many corporations already possess these powers but do not exercise them.

The use of trolley omnibuses met with Mr. Spencer's cordial approval, as indeed it should, for the Bradford Corporation were, with the Leeds Corporation, the first to obtain Parliamentary powers to adopt them, and arrangements are being made for an installation to be put down. He thought accumulator traction was worthy of more than passing interest, and believed developments in this direction might be looked for. Improvements in tramway motors, he said, were rapidly taking place, and even now a guarantee of from ten to twelve per cent. higher electrical efficiency for tramway equipments could be obtained than formerly. Car equipments were improving so much in the direction of greater efficiency that it was not at all improbable that in the future the cars could be propelled with 50 per cent. less energy than at present; in this connection he pointed out that present cars wasted, by the wearing away of brake shoes and tyres, 40 per cent. of the energy supplied. As assisting in this direction, progress should be made with regeneration.

References were made to the work of the Corrugation Subcommittee, which is at present being carried on, and also the Conference between the Association and the Incorporated Municipal Association with regard to the price of current to be charged to municipal tramways departments by municipal electricity departments. The concluding portion of Mr. Spencer's address urged municipalities to recognise that tramway concerns must be conducted on strictly business lines, which even now is not recognised in many places.

In the course of his address, Mr. Spencer also referred to the arrangements which are being made for the incorporation of the Association.

The Presidential Address was followed by a Paper on "The First Decade of Municipal Tramway Working," by Alderman A. Flint, Chairman of the Leicester Tramways Committee. The author said that the municipalisation of tramways had been necessary and wise, and had been justified by the results. At present there are 176 municipal tramway undertakings in the United Kingdom, of which 92 are leased or worked by either corporations or companies. The 84 purely municipal undertakings had a total reserve fund to 1909 of £4,200,462. They have paid to sinking fund account £6,619,450, and have paid in relief of rates £2,481,760. The author urged the need for placing all net profits to reserve, and argued that it was a mistake to pay anything in relief of rates unless there is already a large reserve fund. The Paper also dealt with the improved conditions now enjoyed by tramways employees, and the possibilities in the direction of carrying goods on tramways. It was also suggested that, although the obligation upon a tramway authority to keep in repair the centre of the track and 18 in. outside might have been quite right under the old conditions of horse cars, yet it now might be revised.

The lengthy discussion on this Paper was mainly devoted to the policy which Tramways Committees should adopt. A complaint was made that the low fare charges in large populous towns set the running for the smaller towns which could not afford such low fares, and consequently met with financial disaster. A similar principle applied to wages and hours of labour for employees. Cheaper fares to certain classes might, it was thought, be granted out of philanthropy or pity by a Corporation, but the Tramways Committee should expect the Corporation to meet any loss in respect of it. Mr. J. M. McElroy, General Manager at Manchester, urged the laying of tramways into districts in order to develop them, instead of waiting for the districts to develop themselves. Mr. J. R. Salter, representing the Tramways & Light Railways Association, took the opportunity of pointing out that the onerous conditions objected to by Tramways Committees, with regard to repairs of roads, &c., were also objected to by Tramway Companies, but the latter got very little assistance from the Corporations. In the discussion, the point was again emphasised by several Chairmen of Tramway Committees that any relief of rates from the tramway revenue should be postponed until sufficient reserve fund, &c., had been set aside. This is a point of view which tramway managers have been impressing upon their chairmen for many years, but hitherto without much success, and it is gratifying to see that the chairmen are now adopting the same view.

The next Paper, by Mr. J. W. Dawson, Assistant Engineer to the Bradford Corporation Tramways, described investigations which had been undertaken with the object of ascertaining the comparative durability of the various grades of brake shoes used on tramcars in this country, together with their wearing effect upon steel tyres. Twenty different grades of shoes had been tested. Figures were given of the wearing properties of shoes and tyres run under ordinary service conditions, and the results showed that the individual shoes of each group vary considerably in durability. The rate of wear of soft grey iron shoes was more uniform than that of other groups, and the most excessive wear was obtained with white iron. Similar large variations were found in the wearing effect upon tyres. The author advocated a microscopical analysis, in addition to chemical analysis and physical tests, so that the particular structures producing the different characteristics of the shoes might be indicated, and a standard specification drawn up. In the author's opinion, it matters little from the point of view of cost which suffers most, the shoe or the tyre. When it is desirable to economise energy for brake application and to reduce mechanical stress upon brake gear to a minimum, it is best to use a shoe with a high coefficient of friction. The discussion, whilst emphasising the advantages of the investigations carried out by Mr. Dawson, indicated a difference of opinion amongst tramway managers as to the possibility of evolving a standard specification for brake shoes. Mr. A. L. C. Fell, of London, for instance, pointed out that the slightest variation in the tyre or local conditions, such as whether the paving was of granite, macadam, or wood, were important factors militating against standardisation, other factors being the gradients and speed. On the other hand, Mr. J. M. McElroy, of Manchester, thought the matter of such importance as to warrant investigation by a Subcommittee.

On Thursday a Paper was read by Mr. A. Baker, General Manager of the Birmingham Corporation Tramways, on "Tramways in Relation to Town Planning." The Paper was a plea for the construction of roads sufficiently wide to carry a double line of tramways in the centre and roadways for ordinary traffic on either side. Mr. Baker claimed that under the Town Planning Act of 1909 land for such roadways could be obtained cheaply, and he mentioned the figure of from £100 to £200 per acre. In this way it was suggested that instead of developing tramways outwards from the centre of a city, property several miles out should be "town planned," and the roads built towards the big city. With such a roadway Mr. Baker would considerably cheapen the cost of tramway construction, either by the use of macadam

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paving, which would not be worn out by ordinary traffic or by leaving the space between the rails filled in with turf. He put the saving in cost of construction at some £3,500 per mile of double track, irrespective of the saving in maintenance. Incidentally, the Paper condemned the trolley omnibus system, the author believing it to be the best policy to lay down tramways in the first place, and, if necessary, face a loss for a year or two. It may be mentioned that Mr. Baker's ideal roadway has a maximum width of 91 ft., and provides for two 10-ft. foot-paths, two roads for vehicles, each 24 ft. wide, and a way for tramways 23 ft. wide, and he expects to have such a road in operation near Birmingham within the next 12 months.

The Paper was severely criticised by a large number of speakers, principally on the cost of land mentioned by Mr. Baker, and his condemnation of the trackless trolley system.* A figure of from £500 to £1,000 per acre was mentioned in regard to Liverpool, and £1,200 per acre at Southampton. Practically every speaker looked to the trackless trolley system as the best means of developing districts near populous centres, and it was left to Mr. J. Hamilton, of Leeds, to point out that Mr. Baker appeared to mean that he would not have the trackless trolley system in connection with such schemes as he was advocating in the Paper, as in that case new roads were being built, and with the cheaper form of construction proposed the capital cost would probably be very little, if any, more than the trackless trolley system. He thought every one would admit that this was the chief difference, and that no advantage was claimed in running expenses for the trackless trolley system over tramways. Councillor Hill, of Bournemouth, who also mentioned that a new roadway would be opened at Bournemouth shortly somewhat on the lines advocated by Mr. Baker, preferred tramways on either side of the road near the footpaths, and incidentally mentioned that he looked forward to a "silent" tram in the future.

The final Paper was a report on "Lubrication of Car Bearings," which had been prepared by Mr. E. Cross (Rotherham), Mr. R. L. Acland (Chesterfield), Mr. P. J. Pringle (Burton-on-Trent), and Mr. T. R. Smith (Leicester). The Committee have found that oil is most in favour, and that out of 56 tramway undertakings, only 7 use grease. From replies received from all the tramway undertakings in the United Kingdom it is found that the cost of oil varies from 5½d. to 2s. per gallon, and, indeed, this large variation has manifested itself throughout. So startling are these variations that the Committee is unable to account for them. Rotherham are able to run their motors 51,000 miles for 1/16th in. wear on the armature bearings, while at Bournemouth the corresponding figure is 3,000, and at Aberdeen and Blackpool about 5,000; Belfast are able to make their suspension bearings last for 27,000 miles, when in Burton-on-Trent they only lasted 5,300, and at Lincoln the axle bearings have run 106,500 miles, at Darwen 350,000, at Liverpool 5,000, and Manchester 3,600. Messrs. Cross & Pringle quite independently, and unknown to each other, have been experimenting with a system of chain lubrication with the older type of DK motor in order to obtain the advantages of the "ring" system as far as possible. Mr. Acland is also carrying out experiments with his Westinghouse (46 M. type) motors in a similar direction. It is recommended that a system of ring lubrication or its equivalent should be insisted upon in all new motors, as excellent experience has been obtained in a few undertakings who have had these motors installed for a sufficient time to give a decided opinion. With the ring system the wastage of oil is practically nil, and, consequently, a higher grade of oil can be used without excessive cost. The better supervision of the work of the "greaser" than is generally the case was insisted upon.

There was only a very short discussion upon this Paper, and so many explanations were asked of various figures that the Committee were asked to continue their investigations, as the results tabulated were admittedly incomplete. Mr. C. Hill, Tramway Manager at Bournemouth, one of the speakers, said that if he could obtain such good results as some of the undertakings mentioned in the Paper with his present equipments, he would save some £300 per annum.

At the annual general meeting on Friday, Mr. J. Dalrymple, General Manager of Glasgow Corporation Tramways, was elected President for the year 1910-11. Mr. H. E. Blain, Tramways Manager at West Ham, was elected Vice-President. The Conference next year will be held in Glasgow.

* We employ the expression "trackless trolley system" as it was used by all the speakers and is now becoming general; but it is an exceedingly bad designation, as the only part of the system which is not trackless is the trolley. Trolley omnibus is the proper name for these hybrid vehicles.—ED. *E.E.*

FEED WATER AND BOILER EXPLOSIONS

A BOARD of Trade Report has been issued concerning a series of small explosions which occurred to tubes of a water-tube boiler at the Whitehaven Corporation Electricity Works in May and June last. In each case a small hole had been formed in the tube, through which the hot water escaped. At the last explosion, on June 8th, a hole ⅜ in. in diameter was formed in the tube, through which the hot water escaped, and the fires were put out. The explosions appear to have been due to internal wastage of the tubes, caused by the corrosive action of the feed water, which at the time was not being obtained from its usual source. The town water supply had to be cut off owing to the sticking of a scraper in one of the mains, and, consequently, water from a stream containing a large amount of impurities had to be utilised for feed. Five days later the tubes in two boilers began to give trouble, which became so serious that the whole boiler plant had to be temporarily shut down, as the erection of the new boiler was not completed. The inspector emphasises the importance of good quality of feed water, and points out that serious explosions are liable to take place from corrosion of tubes.

IMPROVING THE COLOUR OF THE LIGHT FROM THE MERCURY VAPOUR LAMP

THE *Electrical Review and Western Electrician* (Chicago), reports an interview with Mr. P. Cooper-Hewitt, the inventor of a well-known form of mercury vapour lamp, in which is described a method which he has lately devised to improve the colour of the light emitted by these lamps without any other auxiliary source of illumination. The light from the ordinary mercury vapour lamp is particularly deficient in red rays as compared with daylight. Mr. Hewitt has, however, succeeded in producing a selective fluorescent reflector, which is capable of absorbing the rays of higher frequency from the lamp and emitting rays of the lower frequency required, acting, so to speak, as a light transformer. By this means, it is claimed that a sufficient supply of red rays can be obtained to make the quality of the light approximate to daylight. Tests of a lamp fitted with the reflector are reported to have given very good results as regards colour-matching. The reflector consists of a trough round the lamp tube with a white enamelled surface, coated with a film of fluorescent material, tinted with rhodamine, and it is stated by the inventor that about the same amount of light as given out by four standard candles can be given out per square inch of surface.

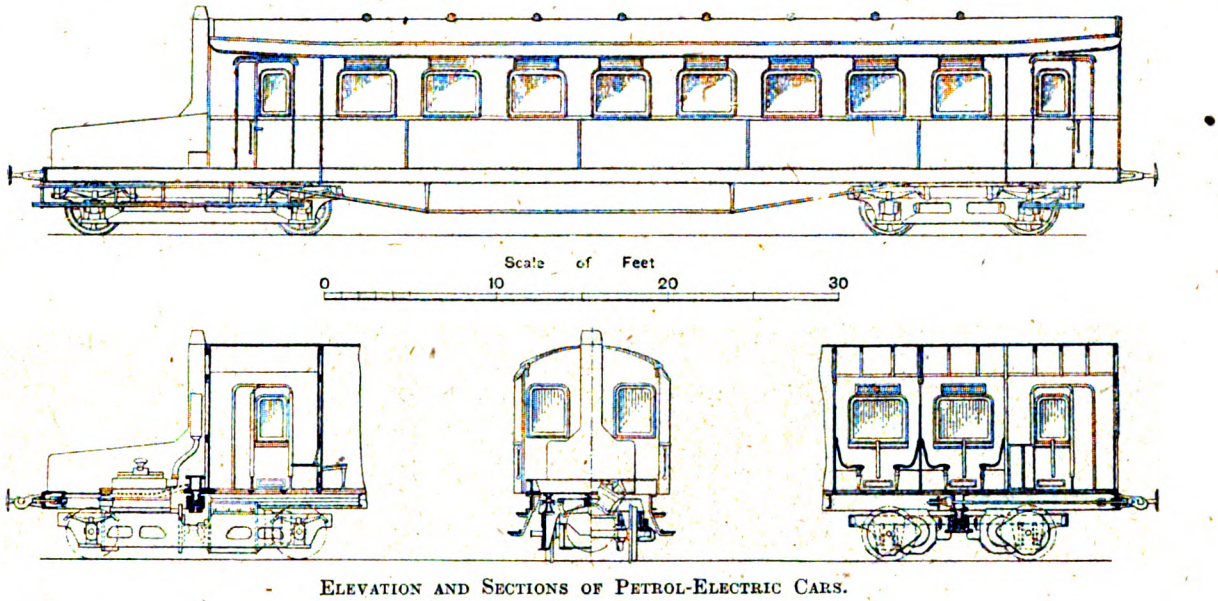
Bare Aluminium Wire for Tramway Motor Field Coils.—At the annual meeting of the Verein Deutscher Strassenbahn- und Kleinbahn-Verwaltungen, Herr Paulsmeier, chief engineer of the Hamburg tramway system, stated that there were already some 30 motors on the Hamburg tramcars with field coils of bare aluminium wire, and that 52 further coils had been ordered. The absence of insulating covering and the use of wire of square-section resulted in the aluminium coil taking up the same space as a copper coil in spite of the larger wire required. By their use, the weight of a tramway motor of normal size was reduced by about 100 lbs. This, and the fact that the coils are not so easily ruined by overheating and vibration as copper coils appear to be the chief advantages. It appears that eleven other tramway undertakings in Germany are experimenting with aluminium coils, and report favourably. Most of the coils employed have asbestos paper or linen insulation between the separate layers.

Electric Shocks.—At the recent annual meeting of the British Medical Association in London, Dr. S. Jellinek, of Vienna, described several cases of electric shock, and pointed out some of the conditions determining the effects. A pressure as low as 65 volts had been known to kill, while 10,000 volts had been successfully withstood. The path taken by the current through the body was of the utmost importance, and the unfortunate occurrences at some of the American electrocutions had been due to neglect of this fact. The physical and mental condition of the victims were also determining factors, and the shock was most dangerous when it came as a surprise. Death might occur through paralysis of the heart or through stoppage of the respiration. Dr. Jellinek considered direct-current more dangerous than alternating-current for equal voltages. Electrical burns resulted in special lesions of the skin, which were painless and quite different to ordinary burns. Electric shock commonly caused a rupture of fine blood-vessels in the brain, and consequently it was advisable to raise the head of the victim. He also advised, in first aid, the puncture of the spinal cord, artificial respiration, and venesection.

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PETROL-ELECTRIC CARS ON THE PRUSSIAN STATE RAILWAYS

THE first petrol-electric car of the Prussian-Hessian State Railways was set in operation in the year 1907, and since then has been running continuously on the sections Friemersheim-Menzelen and Trompet-Homberg. Such satisfaction has been given by the car, that the railway authorities last year ordered eight further cars of a similar nature, but with several improvements suggested by experiences with the original. An elevation and sections of the new design, which is described in a recent article in *Elektrische Kraftbetriebe und Bahnen*, are given in the accompanying figure. As in the original car, the engine, &c., is completely separated from the main body, and the use of the Ward Leonard control system has also been retained. The body is supported on two simple two-axle bogies. One carries the generating plant comprising engine, dynamo, exciter, and fan, and the other carries two motors. The placing of the engine by itself on the one bogie is claimed to have many advantages, including the minimising of vibration of the body, and the possibility of changing the whole generating plant without interfering with the rest of the car. It was found that the vibration of the engine was most unpleasant when the car was stationary, and means have been provided in the new cars to reduce the speed during halts from the normal of 700 r.p.m. to about 200 to 250 r.p.m. Each car has a seating capacity of 100 persons, and when fully loaded can attain a speed of thirty miles per hour on the level. The six-cylinder V-type engine is rated at 100 h.p., and is coupled to a 60-kw. dynamo generating at pressures up to 300 volts, according to the excitation. The 70-volt exciter supplies current for lighting the car also. Each of the two motors is rated at 82 h.p. on the one-hour rating, and is of the same pattern as those used on the accumulator cars of the Prussian State Railways (see ELECTRICAL ENGINEERING, Vol. IV., p. 522). The motors are of the A.E.G. Co.'s manufacture, and are provided with interpoles. The weight of the car fully loaded is 47 tons. The engine is started by compressed air. For heating the compartments, the cooling water of the engine is employed. The design is the combined product of the Allgemeine Elektricitäts-Ges., the Gasmotorenfabrik Deutz, and the railway carriage builders, the Düsseldorfer Eisenbahnbedarf, who have worked to the instructions of Oberbaurat Wittfeld, of the Prussian State Railways. The railway authorities of the Duchy of Oldenburg have also a similar car on trial.



ELEVATION AND SECTIONS OF PETROL-ELECTRIC CARS.

NEW SINGLE-PHASE LOCOMOTIVES

SHORT descriptions with outline drawings of some recent electric locomotives were given in ELECTRICAL ENGINEERING, January 20th, 1910, p. 44. These included two three-phase, one continuous-current, and one single-phase locomotive. The latter was of the New York, New Haven & Hartford Railway, and had four pairs of driving wheels coupled to four 350-h.p. Westinghouse single-phase motors through flexible gearing, and two pairs of guiding wheels. With this may be compared three single-phase locomotives, descriptions of which appeared recently in *Elektrische Kraftbetriebe u. Bahnen*.

A 2,000-h.p. standard gauge locomotive built for the Lötchberg Tunnel Railway by the Maschinenfabrik Oerlikon is illustrated diagrammatically in Fig. 1. The six wheels of each of the two three-axle bogies are coupled together and driven through spur gearing and coupling rods, the gear ratio being 1 to 3¼. The motors are of the Oerlikon W.B. pattern, each developing 1,000 h.p., and weighing 9·8 tons without gear. Of the total weight of 86 tons, the electrical equipment is responsible for

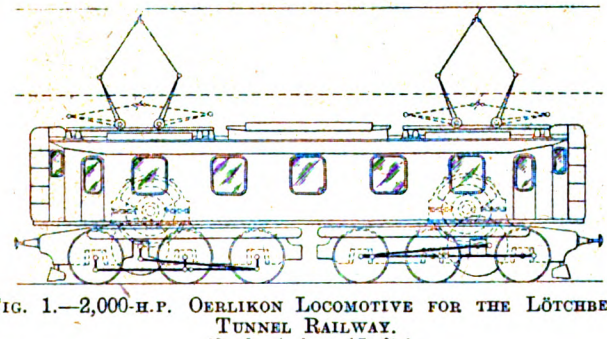


FIG. 1.—2,000-H.P. OERLIKON LOCOMOTIVE FOR THE LÖTCHBERG TUNNEL RAILWAY.
(Scale 1 in. = 15 ft.)

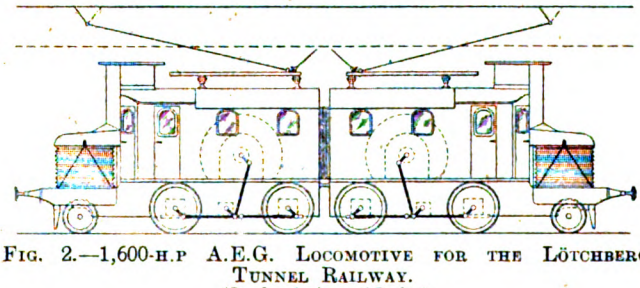


FIG. 2.—1,600-H.P A.E.G. LOCOMOTIVE FOR THE LÖTCHBERG TUNNEL RAILWAY.
(Scale 1 in. = 15 ft.)

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Sept. 22nd, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

20,057/09. **Electroplating.** S. O. COWPER-COLES (London). The articles to be plated are placed in a drum containing the electrolyte, and mounted on rollers so as to be capable of rotation. The stationary anodes are suspended inside the drum, and insulating screens are provided to prevent deposition taking place on the inside surface. Two figures.

20,230/09. **Wireless Telegraphy.** G. MARCONI and MARCONI'S WIRELESS TELEGRAPH CO., LTD. Aerials are made directive by arranging the antennae horizontally in a vertical plane passing through the stations. The antenna is brought very close to the ground, and to avoid the loss in efficiency, due to the high resistance of the surface of the ground underneath, wires are buried or laid at the surface underneath the antenna. Three figures.

22,715/09. **Arc Furnace for Treating Gases.** J. Y. JOHNSON (*Badische Anilin & Soda Fabrik*). In arc furnaces for fixing atmospheric nitrogen, as described and illustrated in ELECTRICAL ENGINEERING, June 3rd, 1909, Vol. IV., p. 515, the water-cooled iron electrode at the base of the tube where the gases enter is constructed in a tubular form, and the arc is caused to move about over the surface of this electrode so that it is not consumed. In one form of the furnace the gases enter through the hollow electrode. Two figures. Another specification by this firm (No. 20,129/09) describes forms of the above furnace, in which the air passes down the tube near the outer wall, and then reverses and returns along the centre in the path of the arc. In one case the air is fed in at the centre of the tube, and flows to the two ends. Five figures.

25,288/09. **Series Lamps.** E. and N. R. BOOTH (Halifax). In lamp groups comprising two or more lamps in series, a substitutional resistance is connected across each lamp through an insulating device, which breaks down when the full pressure of the circuit is across it, and this occurs when a lamp fails. To ensure the breaking down of this device and the connection of the substitutional resistance, a further shunt circuit containing an inductance is automatically made and broken directly a lamp fails. The inductive "kick" on breaking this circuit ensures the substitution of the resistance. Two figures. The "Stearn" lamp fitting embodying the original device was described in ELECTRICAL ENGINEERING, April 30th, 1908, Vol. III., p. 651.

29,953/09. **Wiring Conduit.** H. HIRST and T. TAYLOR (General Electric Co., London). To render metallic conduit electrically continuous, two longitudinal grooves are formed at each end of the coupling or fitting, and a long staple is driven into the grooves after the tube has been inserted, thus cutting through the enamel of both fitting and tube, and ensuring a good electrical connection. Three figures.

6,397/10. **Supports for Metal Filament Lamps.** WOLFRAM LAMPEN A.-G. A spring support allowing for vibration in all directions consists of a carbon filament fixed at one end to the central stem, and provided with a hook or loop for holding the metal filament at the other end. A larger loop or coil in the centre of the arm gives the desired elasticity. Two figures.

6,868/10. **Three-phase Arc Lamp.** E. KÖNECKE (Cologne). Each of the three electrodes is controlled by a separate eddy-current disc motor provided with current and pressure windings corresponding to that particular electrode, so that each electrode is controlled by the current in the corresponding phase. One figure.

7,318/10. **Motor Starter.** ADAMS MANUFACTURING CO., LTD. (*Cutler Hammer Manufacturing Co.*). This covers a starter for induction motors, in which two variable resistances are provided in two of the rotor phases, the third resistance being constant and only cut out when the motor is up to speed. Six figures.

10,054/10. **Cable Conduit.** J. and A. ETTLINGER (Karlsruhe). The cable is laid at the bottom of the trench, and is covered by a number of arched castings arranged so that alternate castings overlap the edges of the adjacent ones. The whole conduit is flexible and the cable is readily accessible. Sand or other loose covering may be placed under the castings. Two figures.

Opposition to Grant of Patent

16,076/09. **Metal Filament Lamps.** POPE'S ELECTRIC LAMP CO., LTD. (*C. Trenzen*). Opposition has been entered to the grant of this patent. It covers a method of joining metal filaments to their leading-in wires by cementing the joint with a paste of finely divided tungsten and a solution of ammonia, and afterwards reducing in an inert gas by means of an arc between iridium electrodes. About 2 per cent. of gelatinous silicic acid may be added to the ammonia paste, and this causes tungsten silicide to be formed which melts easily and forms a good electrical connection.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: METAL JOINTING CO. and HARDEN [Lead joints] 28,708/09; SATTLER [Cable-making machinery] 1,290/10.

Dynamos, Motors, and Transformers: A.-G. BROWN, BOVERI & CIE. [Starting machines] 20,827/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Transformers] 23,649/09; MAVOR & COULSON, LTD. [Ventilation of motors] 26,005/09; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [A.-C. commutator motors] 6,124/10; ALLGEMEINE ELEKTRICITÄTS-GES. [Control of induction motors] 8,621/10.

Electrometallurgy and Electrochemistry: ROMAN [Electroplating] 5,369/10.

Heating and Cooking: BERRY, 20,639/09; KENT, 22,997/09.

Instruments and Meters: WIMPERIS and ELPHINSTONE [Instrument for measuring acceleration, gradients, &c.] 20,231/09; SIEMENS BROS. DYNAMO WORKS and LYDALL [Meters] 20,815/09; CHAMBERS [Electrical acoustic instruments] 21,441/09.

Storage Batteries: TUDOR ACCUMULATOR CO. (*Accumulatoren Fabrik A.-G.*) [Plate separators] 25,273/09.

Switchgear, Fuses and Fittings: THOMAS and THOMAS [Current collectors] 15,682/09; IMER [Dust-proof globe reflectors] 19,949/09; SHAW [Ceiling-rose with plug connections] 20,435/09; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [A.-C. voltage regulation] 23,416/09; CAMPBELL and ROBINSON [Lamp-globe fittings] 5,368/10; RUSSELL and HUTSON [Lamp-holder] 15,933/10.

Telephony and Telegraphy: NEUHOLD [Automatic telephone exchanges] 8,228/10; RABINSOHN [Oscillation generator for wireless telegraphy] 9,539/10; HÖFERMANN [Disinfecting device for telephones] 15,318/10.

Traction: MITCHELL [Operating tramway points] 21,471/09; GRESHAM [Vacuum brakes] 27,803/09; WILLIAMS [Signalling] 29,525/09.

Miscellaneous: VENNER and GRIESBACH [Electric mechanism for writing and colour-changing signs] 18,583/09; BOWELL [Electric clocks] 20,496/09; WILLIAMS [Signs] 24,283/09; WILLANS & ROBINSON, LTD., and IZOD [Turbines] 25,673 and 26,847/09; ROSENBERG [Electric massage apparatus] 4,804/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: GRAVDAHL 19,625/10.

Electrometallurgy: THOMSON [Furnaces] 15,164-5-7-8-9/10.; FITZGERALD [Furnaces] 15,166/10.

Incandescent Lamps: MALACHOWSKI, 10,041/10.

Instruments: HARTMANN BRAUN A.-G. [High-frequency resonance measuring instruments] 14,925/10; ALLGEMEINE ELEKTRICITÄTS-GES [Maximum demand meter] 20,446/10.

Switchgear: KALLMANN [Resistances] 19,993/10.

The following amended Specifications can now be obtained.

PARSONS, STONEY and LAW [Electrical marine propulsion] 6,177/09; MAXANER [Combined centifugal fan and motor] 15,659/09.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: BRITISH THOMSON-HOUSTON CO. (*Union Elektricitäts-Ges. and A. P. Zani*) [Starting of induction motors] 11,843/99; C. H. PRÖTT [Bearings for vertical shaft motors] 12,658/03.

Electric Ignition: F. REICHENBACH [Magneto] 12,886/03.

Electrometallurgy, &c.: G. A. GOODSON [Plating wires] 3,798/05.

Switchgear, &c.: W. P. THOMPSON (*Chemische Elektrische Fabrik "Prometheus" Ges.*) [Silicon resistance units] 12,707/04; H. T. HARRISON [Street lamps and reflectors] 13,088/04.

Telephony, &c.: D. MURRAY [Operating keyboards by perforated tape obtained from telegraphic punching machine] 11,778/99; C. E. KELWAY [Determination of distance of ships by Hertzian waves] 12,124/99; P. M. JUSTICE (*Rowland Telegraphic Co., U.S.A.*) [Telegraph transmitters] 12,956/02.

Traction: H. DOLTER [Studs for surface-contact system] 11,776/99; H. W. SYKES [Station indicators] 11,877/05; C. H. ROBERTS [Third-rail insulators] 12,023/05; C. BRIGHT [Fare and position indicators] 22,897B/05.

Miscellaneous: W. J. PECKETT [Combined electric door-bell and knocker] 12,873/03; C. BRIGHT [Vacant seats indicator for hall and theatres] 22,897A/05.

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42 tons. A normal speed of 26 m.p.h. and a maximum speed of 44 m.p.h. will be attained. Current is supplied at 15,000 volts, 15 cycles.

Fig. 2 shows a 1,600-h.p. locomotive for the same railway by the Allgemeine Elektricitäts-Ges. This consists of two units closely coupled together, each unit having four coupled driving wheels and a pair of guiding wheels. Each unit is driven through coupling rods by an 800-h.p. W.E. 151 motor weighing 13·5 tons. The total weight of the locomotive is 93 tons, of which 50 tons is accounted for by the electrical equipment. It is designed for a speed of 47 m.p.h.

The third locomotive is one of 14 constructed for the St. Pölten-Mariazell narrow-gauge railway in Austria by the Osterreichische Siemens-Schuckertwerke-Ges. This is a 0·76 m. (2½ ft.) gauge 600-h.p. locomotive, and takes single-phase current from an overhead wire at 6,500 volts, 25 cycles. As shown in Fig. 3, it has two three-axle bogies with the three axles of each coupled together, and driven through spur gearing and coupling rods. The gear ratio is 1 to 3. The motors are Siemens-Schuckert commutator type W.B.M. 350. They are only semi-

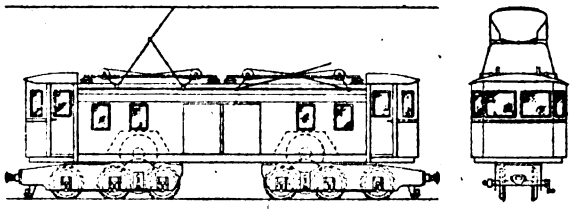


FIG. 3.—600-H.P. SIEMENS-SCHUCKERT LOCOMOTIVE FOR AN AUSTRIAN NARROW-GAUGE RAILWAY.
(Scale 1 in. = 15 ft.)

enclosed, and have natural ventilation. Each develops 300 h.p. at 700 r.p.m., and is supplied at 250 volts through a 490 K.V.A. transformer. The total weight of the locomotive is 48 tons. It is designed for a maximum speed of 31 m.p.h.

Wireless Telegraphy.—The third International Radiotelegraphic Conference will be held in Berlin in the early spring of next year. Invitations are now being issued to the delegates of the various nations who participated in the previous Conference.

According to the *Australian Mining Standard*, New Zealand is to have five wireless stations, including that at Doubtless Bay. The other four will be established at Gisborne, on the east coast of the North Island; Sumner (near Christchurch), on the east coast of the South Island; Cape Farewell, the north-west point of the South Island; and the Bluff, in the extreme south. The stations at Doubtless Bay and the Bluff will be high-power, with an effective radius of 1,250 miles, the others being medium-power and having an effective radius of 500 miles. Tenders are now being invited.

A British Consular report states that the wireless telegraph installation at Kiungchow (China), is so frequently out of action that it is of very little practical use, either for typhoon warnings or commercial purposes.

The new Marconi station at Glace Bay, Nova Scotia, now working the transatlantic service, covers, with its aerials, 150 acres of ground. The antennae of the fan-shaped aerial, which is about 1,000 ft. in width, are 6,000 ft. long, and these are supported by 30 masts, each 250 ft. high. The instruments have a working radius of 3,000 miles, although the distance to the Clifden station is only 1,700 miles.

With further reference to our note on the experiments carried out by H.M.S. *Bonaventure* and a flotilla of submarines at Torbay, we learn that submarine D 1 is equipped with wireless apparatus, and an aerial about as high again as the periscope, and it is stated that mutual communication was successfully established between the cruiser and the submarine when the latter was submerged to such a depth that the top of the periscope was just above water.

Mr. Marconi, who is now on board the Italian-Lloyd steamship, *Principessa Mafalda*, has received wireless messages from Clifden, Ireland, and Glace Bay, Canada, up to a distance of 3,500 miles in daylight. A kite was used for the support of the aerial wire. The previous longest distance over which wireless messages have been received is 1,750 miles.

The wireless telegraph station at Liverpool is to be removed inside the Seaforth Barracks. This move is in connection with the scheme for national defence. The *Liverpool Post* states that Portsmouth, as a wireless station, is to be abolished, and a new station erected at Ventnor. Since the Government took over all the coast stations, the policy has been adopted of removing them to Government land. It is expected that this work will be completed by the end of the year.

A commencement has been made with the construction of the Admiralty wireless telegraph station at Scarborough.

THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT

THE report of the Physikalisch-Technische Reichsanstalt, the German equivalent of the National Physical Laboratory, on the work of the year 1909, includes some matter of general electrical interest. Extremely high accuracy in calorimetric measurements has been rendered possible by the use of a mercury resistance thermometer, comprising a long capillary quartz tube containing mercury, and provided at each end with two platinum wire electrodes. This capillary tube is bent zig-zag, and enclosed in a larger sealed tube. Two such thermometers gave readings between 0° and 100° C. agreeing within a few thousandths of a degree. Comparative tests have been continued with Manganin resistance standards; and readings extending over 16 years show that the average obtained by comparison with five mercury standards was constant. Measurements with the silver voltameter are being continued. The work on standard cells has progressed considerably. It has been found that mercury sulphate preparations vary in their electrochemical activity after having been kept in a dry condition for some months, but that this alteration can be prevented by preserving the freshly prepared substance in a vacuum or in a cadmium-sulphate solution. Preparations with exactly similar electrochemical activity and time-constants can now be made up, and 67 cells have recently been constructed for the Laboratory, all of which agreed within a few parts in a hundred-thousand shortly after setting up. Preparations are being made for geometrical measurements in connection with the absolute determination of the ohm. A new method has been devised for the measurement of magnetic fields, with which relative magnetic measurements in fields up to 2 gauss with an accuracy of 0·1 per cent. can be obtained.

Experiments conducted with electricity meters of Siemens-Schuckert, A.E.G., and Aron manufacture have shown that on varying loads the readings are unaffected by the inertia of the moving parts. Other tests on ampere-hour mercury meters of the type in which an armature connected as a shunt across a resistance rotates in the field of a permanent magnet have shown that the inaccuracies frequently noticed are not due, as has been suggested, to the effects of mercury vapour. Experimental work has also been carried out with the mercury-vapour rectifier, and with electrometers for A.-C. measurements. Apparatus has been devised for generating alternating currents of invariable frequency for accurate measurements with the vibration galvanometer. This has been used with considerable success in connection with the comparison of inductance and capacity standards.

Tests on fuses have indicated that the structure of the metal undergoes considerable alteration during prolonged overload. A heavily loaded wire of 1 mm. diameter gradually increased in resistance to the amount of 20 per cent., and eventually melted after 12 weeks' continuous running. A testing apparatus for repeatedly opening and closing switches in a similar manner as would happen with manual operation has been constructed. A suggested method of measuring high liquid or gaseous pressures by means of a long fine wire wound over a tube has been investigated. The tube expands radially under pressure, and causes the wire to lengthen and show an increase in resistance. It is stated that the practical value of the method is doubtful owing to the very accurate resistance measurement necessary. Considerable progress has been made in the magnetic laboratory, where experiments at high induction by an improved Ewing's Isthmus method and other tests have been carried out. The influence of the chemical composition and treatment of iron stampings on the magnetic properties is still being investigated. Electrolytically produced iron, after expulsion of the contained hydrogen by annealing in a vacuum, was found to be so free from coercive force that the production of iron totally free from hysteresis seems more probable. It has been found possible to produce iron having almost any desired hysteresis loop by different treatment, and it appears that the permeability and retentiveness can also be fixed at will within certain limits.

In the section devoted to optical research, reference is made to the attempts of the English, French, and American authorities to establish an "International Candle" of the value of 1·11 Hefner candles. It is stated that this cannot be supported by Germany, as the definition is open to many objections. The name "International Candle" is protested against.

Turin Exhibition.—The Associazione Elettrotecnica Italiana is arranging an International Electrotechnical Congress in connection with the Exhibition at Turin next year.

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CATALOGUES AND PAMPHLETS RECEIVED

"SPOOKIE" SHADES.—The latest design of Spookie night watch lantern is illustrated on a card from Simplex Conduits, Ltd. The new pattern is square instead of round, and the use of glue, which might become soft owing to the heat of the lamp, in fixing the roof, has been avoided.

ELECTRIC COOKING.—An attractive folder is being issued by the British Prometheus Co., Ltd. (Salop Street Works, Birmingham), for distribution by the trade to private consumers, to call attention to the possibilities opened up by their heating and cooking apparatus.

PRESERVATIVE PAINTS.—An attractive booklet describing the properties and uses of the well known P. & B. preservative paints has been issued by the Ruberoid Co.. Ltd. (81-83 Knightrider Street, London, E.C.). These include a black waterproof paint for cables and conduits and water pipes; a special paint for boilers, steam pipes, and other hot surfaces; a flexible iron paint for metal work, such as the underframes of tramcars, trolley-poles, &c.; a damp-proofing paint for the interior surface of brick walls, and various roof paints. A price list is included.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

INSTRUMENTS.—Messrs. Everett, Edgcumbe & Co., Ltd. (117 Victoria Street, Westminster), have sent us a card containing humorous illustrations by John Hassall and advertising their instruments.

ELECTRIC RADIATORS, LIGHT AND HEAT BATHS.—The Dowsing Radiant Heat Co., Ltd. (24 Budge Row, Cannon Street, London, E.C.), have just issued new catalogues and price lists for the coming season. An attractive booklet illustrates thirty-six designs of luminous radiators at prices ranging from 25s. to £13. These include simple iron-frame radiators for general purposes, artistic patterns for sitting-rooms, and enclosed designs. Consumption, dimensions, and price are given in each case. A novelty is an eight-lamp radiator consuming two units per hour and arranged with the lamps in two tiers, with artistic metal collars round the ends, giving a very neat appearance. The latest patterns of the firm's "Solarium" light and heat bath are described and illustrated in another leaflet. A cheap portable pattern for home use, containing four lamps with special reflectors, is listed.

ELECTRIC BELLS.—Messrs. Siemens Brothers and Co., Ltd. (Caxton House, Westminster), have brought out a new catalogue of electric bells and accessories. The domestic bells range from the inexpensive patterns with japanned iron covers and wrought-iron frames stamped in one piece, to high-finished bells on walnut or teak bases. Watertight bells on the diaphragm principle, a large selection of pushes, switches, and special contacts and indicators are included.

HIGH-SPEED ALTERNATING-CURRENT MOTORS.—A leaflet from the A.E.G. Electric Co., Ltd., illustrates a three-phase motor, which has been designed for direct coupling to a turbo-blower. It is of 2,800 h.p. at 1,500 r.p.m., with a periodicity of 25. The motor is self-ventilating, and is fitted with air ducts secured to each bearing shield. The bearings have forced lubrication and are water cooled. The outlying slip rings can be totally enclosed.

INCANDESCENT LAMPS.—An advance copy of a comprehensive list of metal filament lamps is to hand from the Sunbeam Lamp Co., Ltd. (Park Road, Gateshead). It is important to notice that all these lamps are entirely British made, including the bulbs, which are made at the company's own glass works at South Shore Road, Gateshead. The firm also make their own tungsten filaments. A considerable number of sizes of metal filament lamps are listed, ranging from 8 to 400 c.p., for circuits from 25 to 200 volts. The special lamps include candle lamps for various voltages up to 135 volts, 24-volt train-lighting lamps, and the latest addition to the series is the group of patterns of 4, 6, and 8 volt battery lamps for motor car lighting, &c. A complete series of carbon lamps is also included. The firm have issued an attractive new show-card calling attention to these lamps.

LOCAL NOTES

Aberdare: *Tramways.*—A tramway scheme is under consideration by the Council.

Canada: *Electric Supply.*—A new company called the Pacific Exploration Company propose to erect a 25,000-h.p. plant on the Pend d'Oreille River, near Waneta. It is rumoured that the Canadian Pacific Railway Co. is interested in the project, and that should the scheme be carried through, the electrification of the company's Crow's Nest line will follow.

Canterbury: *Lighting of Infirmary.*—With reference to the recent decision of the Canterbury Board of Guardians to light the Infirmary by electricity, the secretary of the local gas company has written a letter complaining against this decision, and asks the Board to allow the company to test an incandescent inverted gas burner side by side with a metallic filament lamp. In this way he hopes to test the relative cost, and as he is under the impression that the Board of Guardians decided solely on this question, he has anticipations that the decision will be reversed.

Ceylon: *Telephone Exchanges.*—The Superintendent of Telegraphs refers in his report to the erection of telephone exchanges in planting districts. Planters are now allowed to put up their own lines and exchanges on payment of a nominal royalty as an acknowledgment to the Government monopoly. Telephone stores can be purchased from the Telegraph Department. At the end of last year provisional licences had been granted for four exchanges, the largest of which made provision for 25 lines.

Channel Islands: *Jersey Telephones.*—The Jersey Chamber of Commerce has requested the States to acquire the present telephone system. The matter has been referred to the Public Works Committee.

Coventry: *Purchase of Tramways.*—The Sub-Committee which was appointed a short time ago to consider whether the Council should purchase the undertaking of the Coventry Electric Tramways Co. now recommend that expert advice on the matter be obtained at an expenditure not exceeding £250.

Edinburgh: *Electricity Profits.*—A proposal by the Electric Lighting Committee that the surplus of £7,300 from the electricity undertaking last year should be applied to reducing outstanding loans, has been sent back to the Committee for reconsideration.

Greenock: *Electricity Accounts.*—The electricity accounts for the year to June 30th show a gross profit of £14,345. After meeting capital charges there is a balance of £3,248, of which £1,000 has been carried to reserve. The number of units sold was 5,096,128. The total maximum supply demanded was 2,590 kw.

Grimsby: *Advertising Electricity.*—At the last meeting of the Council, Alderman Pickwell said he doubted whether the return from so much advertising of the Electricity Department justified the expense of the issue of posters on every available piece of Corporation frontage. Mr. W. A. Vignoles, the Borough Electrical Engineer, in reply to a suggestion that there should be central premises to give demonstrations with electrical appliances, pointed out the great cost of this method. He also drew attention to the fact that the advertising already done this year had produced good results. More than twice as many consumers had been connected during the past five months than in the corresponding period of either of the previous two years. The engineer was given permission to continue his usual practice, and to have further posters printed in colours.

India: *Electric Power Scheme.*—In connection with the scheme for supplying electric power in bulk in and around Bombay, the *Financial News* states that an Indian company has just been registered in that town with a capital of £1,250,000. It is stated that the native Princes and Chiefs will provide £1,000,000 towards this amount. Our contemporary also states that one of the first schemes which the new supply will make possible will be the electrification of the Bombay, Baroda, and Central India Railway from Colaba to Virar and the Ghat sections of the great Indian peninsula. The scheme provides for the utilisation of two or three large lakes, and the plant will be erected in sections of 10,000 h.p. It is said that the operations of the Bombay Electric Supply & Tramways Co., Ltd., will in no way be affected by the new undertaking.

Italy: *Imports of Electric Lamps.*—The imports of incandescent electric lamps to Italy last year increased from four to five millions.

Keighley: *Trolley Omnibus.*—The Corporation are asking for the consent of certain outside districts for permission to erect the necessary standards and overhead wires for running trolley omnibuses. The Corporation have approved the Tramways Committee's recommendations to promote a Bill next session asking for powers to instal trolley omnibuses.

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Kilkenny: *Asylum Lighting.*—The Kilkenny District Lunatic Asylum is now lighted by electricity. The power-house contains two 37 h.p. Hornsby gas engines and dynamos. A storage battery is installed. The total number of lamps is about 700, varying from 8 to 65 c.p. each.

Leicester: *Wiring and Fitting.*—Although it has been common property for some time, the Leicester Gas & Electric Lighting Committee have formally recommended the Corporation not to appal against the injunction restraining the Corporation from wiring and fitting premises for electric supply. It will be remembered that the injunction in question was granted by Mr. Justice Neville in connection with proceedings instituted by a Mr. Utley, an electrical contractor of Leicester.

London: *City of London: Electric Ambulances.*—As indicating the usefulness of the electric ambulances installed in the City by the Corporation, it may be mentioned that last year the two vehicles now in use conveyed 1,607 persons to the hospitals.

New Thames Bridge.—A report is to be drawn up with regard to the Thames bridge which has been projected between Southwark and Blackfriars. The scheme includes a double line of tramways which, after crossing the bridge, will dip underground at Knightrider Street and come to the surface near Goswell Road. The estimated cost of the the whole undertaking is £1,646,988. The London County Council limit their contribution to £300,000, but the members of the City Corporation regard this as inadequate.

Margate: *Tramway Track.*—It is suggested that the track of the Isle of Thanet Lighting & Tramways Co. should be doubled in various parts.

Newport (Mon.): *Tramways Accounts.*—The tramway accounts for the past year show a net profit of £2,322, which is an increase of £700. The number of passengers carried increased from 7,958,760 to 8,134,845.

Oldham: *Electric Supply Boundary.*—The Chadderton Council have given the Oldham Council Corporation power to supply electricity to certain consumers in Chadderton. The Oldham Committee are asking for a general consent to supply, owing to the delays which occur in dealing with each consumer individually. On one occasion a number of applications for current were withdrawn owing to these delays. A sub-committee has been appointed by Chadderton to consider the question and with a view to safeguard the interests of the Council.

Perth (W.A.): *The Tramway Strike.*—A notice has been issued to the shareholders of the Perth Electric Tramways Co. regarding the recent strike of their employees. It appears that the motormen and conductors, after having certain grievances dealt with by arbitration, refused to abide by the award. The Courts refused to alter the award, and the men struck. The local Manager took up the position that he was bound by the award, and that the men were also bound by it. After a strike of a few days the men returned to work.

Plymouth: *Overcrowding of Tramcars.*—In consequence of recent complaints of overcrowding on the tramcars and the intervention of the Board of Trade, the Corporation have issued an instruction to their conductors, which has caused a good deal of amusement locally. They are warned not to allow in the interior of the cars any person or persons in excess of the number for which seating accommodation is provided, except to the number of seven only on the following occasions. The occasions include "Saturdays and Wednesdays from noon, Sundays and holidays throughout the day, every day from 12.30 to 1.30 p.m., 5 to 6 p.m., and 10.15 to 11.15 p.m., and also on the occasion of football and other matches, agricultural and other shows, races, regattas, and public entertainments, and during inclement weather."

Scarborough: *Tramway Service.*—It is stated that the tramway service of the Scarborough Tramways Co. will be suspended during the winter months, owing to the poor support which is given to it during this period.

Seghill (Newcastle): *Electric Lighting.*—Arrangements have been made with the Seghill Coal Co. for lighting the streets by electricity.

Taunton: *Position of Electricity Undertaking.*—As we recently announced, the Corporation have appointed Mr. A. J. Howard Borough Electrical Engineer. In addition, at their last meeting, the Corporation decided to consult an independent engineer to report upon the position of the undertaking generally.

Torquay: *Electricity v. Gas Lighting.*—At the half-yearly meeting of the Torquay Gas Co. last week, the Chairman referred to the lighting of the Torbay Road by arc lamps at a cost of £20 each per annum. He considered that this price compared with gas was simply ridiculous. There was no doubt, he said, that gas was better than electricity for street lighting purposes, and something should be done in order that the ratepayers should see the difference. As a matter of fact, an experiment with this object in view was to be carried out.

Tramway Arbitration.—Mr. Archibald Reed, the arbitrator appointed by the Board of Trade to consider the question of whether the Torquay Tramways Co., Ltd., shall be allowed to use the overhead trolley system in Torbay Road, has visited Torquay and inspected the route. In view of the fact that the Board of Trade's licence for the Dolter system expires on October 31st, the arbitrator's decision may be expected very shortly.

Truro: *Electric Lighting.*—Messrs. J. & W. Purves have received the Council's permission to apply for an Electric Lighting Provisional Order.

Turkey: *Electric Lighting.*—A concession for the electric lighting of Constantinople has been signed by the Minister of Public Works, and representatives of a group of Hungarian and French financiers. The concession is for 50 years. We understand that Messrs. Ganz & Co. will have the contract for the plant.

Watford: *Street Lighting.*—In granting a loan recently for street lighting, the Local Government Board made the following comment: "The Board have sanctioned the borrowing of the sum required for public lighting with some hesitation. The Council should continue to give the question as to the advisability of lighting the streets with electricity their careful consideration, as the Board would have considerable difficulty in sanctioning further loans for the purpose unless the position is materially improved."

Woking: *Electricity Showrooms.*—The Woking Electric Supply Co. have opened showrooms in the centre of the town, where a permanent exhibition of electric lighting, cooking, and heating apparatus will be maintained. On the occasion of the opening a demonstration was given in the use of the "Tricity" cooker.

Yeovil: *Electric Lighting.*—Messrs. J. & W. Purves propose to apply for an Electric Lighting Provisional Order, but the Council have replied that they have no intention of adopting electricity.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Austria-Hungary.—The Vienna-Neustadt Municipality contemplate the erection of a generating station at an expenditure of £23,600.

Bedford.—Mains are to be extended at an estimated cost of £200.

Dartford.—Electrical extensions to the value of £10,000 are to be carried out.

Dundee.—The Engineer has been instructed to report upon the installation of mechanical stokers.

Honduras.—It is stated that a twenty-year concession has been granted to the Puerto Courtez & Baracoa Electric Co. for the supply of electricity for all purposes, and for the construction of telegraph and telephone lines.

India.—The Secretary of State for India invites tenders for the supply of generating sets. Particulars from the India Office, Whitehall, London, and tenders by October 4th.

London: *Stoke Newington.*—A loan of £1,000 for mains is to be taken up.

Norwich.—An application is to be made for a loan of £18,790 (instead of £17,783, authorised by the Council in March), for mains and other plant.

Oldham.—At the last meeting of the Electricity Committee, Mr. S. W. Newington, the Electrical Engineer, foreshadowed that extensions to the generating plant, &c., will be necessary early next year.

South Africa.—According to the *British and South African Export Gazette*, three schemes are under consideration for the electric lighting of Klerksdorp. The estimated cost is £9,500.

It is proposed to form a company with a capital of £926,000 for undertaking the supply of electricity in Tweefontien.

A Government inquiry is being held into a proposal to introduce a supply of electricity into Potchefstroom.

Walsall.—A loan of £23,225 is to be taken up for electrical extensions.

Wigan.—The Local Government Board have sanctioned a loan of £30,083 for electrical extensions.

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MISCELLANEOUS

Argentine.—A concession has been granted to Messrs. Paquet y Cia. for constructing and working an electrically operated transporter bridge across the Riachuelo River.

Australia.—Tenders are invited by the Deputy-Postmaster-General at Melbourne by October 25th for the supply of electric lighting material (Schedule No. 311). Copies of specifications, &c., may be had from 72 Victoria Street, London.

Belfast.—A large scheme of tramway extensions was adopted at the last meeting of the Corporation.

Burma.—A concession has been granted to the Arracan Flotilla Co., Ltd., of London, for the construction of 17 miles of tramways in the Akyab district.

French Congo.—Tenders are invited by October 14th for the supply and laying of submarine cable between Libreville and Loango. Particulars from the Bureau de l'Ingénieur Chef des Etudes, Ministère des Colonies, rue Oudinot No. 27, Paris.

London: *Hackney.*—A supply of 90,000 pairs of white open-type arc lamp carbons is required. Particulars from the Town Clerk, and tenders by October 13th. The Electricity Committee recommend the purchase of a CO_2 recorder at an estimated cost of £55.

Mersey Railway Co.—Tenders are invited for the annual supply of stores, including incandescent lamps, fittings, and electrical sundries. Particulars from General Manager, Birkenhead.

Norway.—The Norwegian State Railways require two 35 ton electric cranes. Copies of specifications, &c., may be seen at 73 Basinghall Street, London.

Spain.—The August report of the British Chamber of Commerce in Spain states that there is an opening in Madrid for electrically-driven pumps. A large portion of the city is built on hills as high as the water reservoir, and there is at present not sufficient pressure in the mains to raise the water above the first floors.

Whitechurch.—A special meeting to consider the question of electric lighting is to be held on October 4th.

York.—Tenders are invited for the supply of arc lamp carbons, carbon brushes, electric light accessories, meters, time switches, motors, and starting rheostats. Particulars from the City Electrical Engineer, and tenders by October 7th.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Twenty-two houses, Norton Gardens; 40 houses, Newlands Road; 30 houses, Northborough Road; 20 houses, Tylecroft Road; electric theatre, 3 Brighton Road; electric theatre, Beulah Road; and 37 houses, Linden Avenue, Croydon.

Tenders are invited by the London County Council for the wiring of the Coroner's Court, Poplar, and the Hoxton House Schools, Shoreditch. Particulars from the Chief Engineer, and tenders by October 5th.

A site has been acquired for the proposed King Edward Jewish Memorial Hospital, London Jewish Hospital Association.

Swimming baths at East Ham.

Observation ward at Isolation Hospital, Hendon.

Enlargement and improvement of Marlborough Street Police Court.

Secondary school for girls at Romford.

Schools in Southbury Road, Enfield.

Two-story addition, 138-140 Lauriston Road, South Hackney.

PROVINCES.

Aberdeen.—Car shed extensions. Tramway Manager.

Accrington.—Electric theatre in Edgar Street.

Airdrie.—New Town Hall.

Bacup.—Additions to skating rink.

Blackburn.—Police station, sessions house, &c., at Blakey-moor.

Bradford.—Church at Lidget Green.

Burton-on-Trent.—Theatre and hippodrome at Swadlincote.

Camborne.—Construction of St. George's Hall. H. Barrow.

Coventry.—Three branch libraries.

Doncaster.—One hundred and forty houses and business premises.

Douglas (I. of M.).—Mission hall and Sunday school at St. Matthew's. Vicar, 2 Mount Havelock.

Glasgow.—Tenders are invited for the wiring for lighting and power of the various sections of the Scottish Exhibition. Particulars from Mr. A. C. Freeman, 499 Sauchiehall Street. —Workshops at Anderson's Close, Victoria Street. Architect, Mr. A. Robson, 60 Marchmont Road.

Gravesend.—Alteration to Milton Road school.

Greenock.—Two blocks of residential flats in Eldon Street.

Harrogate.—Bilton Council school and the new infants' school are to be wired.

Haslingden.—Workhouse and infirmary. Loan of £1,160 has been sanctioned.

Hereford.—Conversion of Corn Exchange to theatre and public hall.

Llanelly.—Theatre in Market Street.

Larne.—Completion of technical school, Victoria Street. Architects, Messrs. Hobart & Heron, 120 Scottish Provident Buildings, Donegal Square West, Belfast.

Leeds.—Divisional Police Station, Milgarth Street.

Liverpool.—Drill Hall. West Lancashire Territorial Association.—Church and schools, Crosby Road.

Manchester.—Art Gallery and Reference Library on Royal Infirmary site. The Libraries Committee invite tenders for electric wiring.

Middlesbrough.—Drapery establishment on site of King's Head Hotel.

Newcastle.—New Town Hall.

Northampton.—Congregational Church, Abingdon Avenue. Rev. C. S. Larkman.

Norwich.—Fish Market.

Paisley.—Alterations and additions to Working Men's Club, Cawthorne Court.—Alterations and additions to Mission Hall, 14 New Sneddon Street.

Perth.—Police Station at Bridge of Earn.

Pontypridd.—School at Millfields.

Portsmouth.—Nurses' Home at Hospital.

Pudsey.—Warping and beaming sheds at Brick Mills. Messrs. Jowett, Kendall & Sons.

Reading.—Alterations to Workhouse.

Southport.—Proposed school on Scarisbrook Estate.

Swansea.—Seven shops, Alexandra Road. Mr. Hy. Billings.—Six houses, Monterey Street, Manselton. Mr. Jas. Taylor.—Six houses, Chaddesley Terrace. Messrs. Marles, Jones & Thomas.—Three houses, Chaddesley Terrace, Messrs. Richards, Powell & Thomas.—Bank, Wind Street. The London & Provincial Bank, Ltd.—Motor garage and workshops, Oxford Street. The West Wales Motor Car & Engineering Co.—Eight houses, Neath Road, Hafod. Mr. H. Smith.—Five houses, Pentrechwyth Road. Mr. Thomas Howells.—New streets, Manselton. The Manselton Estate.—Six houses, Jersey Terrace, Danygraig. Mr. L. H. Brown.—Casual wards at Workhouse.

Wallasey.—New Town Hall.

Wrexham.—Church in Poyser Street.

Lectures on Electrical Engineering.—A course of twenty-four lectures on the design of D.C. and A.C. machines will be delivered by Mr. H. M. Hobart at University College, Gower Street, London, on Mondays at five p.m., beginning October 10th. The lectures will be followed by one hour's drawing office work, and are open to third-year students and also to engineers and others not studying at the college on payment of a small fee. The syllabus includes the design of rotary-converters, variable-speed motors, turbo-generators, single-phase motors and transformers. Mr. Hobart is also lecturing on "Electric Railway Engineering" to the third-year students at Faraday House, Southampton Row, London, where Mr. J. Rennie, of the Board of Trade Laboratory, is also lecturing on "Electrical Measuring Instruments."

Further Amalgamations of Continental Firms.—Following close on the news of the acquisition of the Lahmeyer Frankfort Works by the Allgemeine Elektricitäts-Gesellschaft of Berlin comes the announcement that the A.-G. Brown, Boveri & Cie., of Baden, Switzerland, have practically absorbed the Elektricitäts-Gesellschaft Alioth, of Basle, and the Isaria-Zählerwerke A.-G., of Munich. The A.-G. Brown, Boveri & Cie. will increase its capital to 28 million francs (£1,120,000) by a further issue of shares to the value of 8 million francs, and 4¾ million francs will be received by the shareholders of the Alioth Co. in exchange for the Alioth shares. The share capital of the Alioth Co. is 6 million francs. Further shares to the amount of 1½ million francs will be exchanged for shares of the same amount of the Isaria Co., and the remaining 1¾ million francs will be taken over by a bank. The immediate result of the transaction will be a pooling of interests on the part of the Brown, Boveri and Alioth companies, but a complete amalgamation of the two firms may follow shortly. The agreement with the Isaria Meter Co., however, will result in the combination of that concern with the Brown, Boveri Gesellschaft, of Mannheim. The agreement with the Alioth Co. will also result in a concentration of the financial interests represented by the Brown, Boveri and Alioth companies and the Schweizerische Bankverein, which is interested in both concerns.

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TENDERS RECEIVED AND ACCEPTED

Australia: *Sydney.*—The Corporation have accepted the following tenders: Coal and ash handling plant, Messrs. Babcock & Wilcox, Ltd., £5,887; 15 miles 11,000-volt cable, Messrs. W. T. Henley's Telegraph Works Co., Ltd., £4,495. It is also proposed to purchase a 5,000-volt feeder panel and two 5,000-volt transformer panels of the Frranti type at a cost of £230.

Adelaide.—Messrs. F. A. McCarty & Co., of Melbourne, have been given a contract for considerable extensions of the Adelaide electric tramway system.

Coventry.—The Corporation has placed a repeat order with E. Bennis & Co., Ltd. (Little Hulton, Bolton), for the supply of four sets of "Bennis-Miller-Bennett" patent chain grate stokers for B. & W. boilers at the Electricity Works.

India.—The Globe Electric Co., Ltd. (11 Farringdon Avenue, E.C.), have just received a further order for 24 "Multax" lamps for the Bengal Nagpur Railway, making the third repeat order during the year.

Kettering.—The Council has placed an order with E. Bennis & Co., Ltd. (Little Hulton, Bolton), for three independent coal elevators for feeding the hoppers of "Bennis" stokers on three Lancashire boilers at the Electricity Works.

London: *Hackney.*—The following tenders have been received for extensions of the main switchboard: Walsall Electrical Co. (£249 10s.); Ferranti, Ltd. (£340); Drake & Gorham, Ltd. (£353); British Thomson-Houston Co., Ltd. (£525); Bertram Thomas (£339 10s.); Electric & Ordnance Accessories Co., Ltd. (£305); Kelvin & James White, Ltd. (£900); British Westinghouse Co. (£786); and Johnson & Phillips, Ltd. (£422).

South Africa.—*The British and South African Export Gazette* states that the A.E.G. Electric Co., Ltd., of South Africa, are supplying 88 direct-current electricity meters to the Johannesburg Corporation. The same Corporation have ordered 2,277 A.C. meters from Messrs. Siemens Bros. & Co., Ltd. The A.E.G. Co. of Berlin have the contract for generators at the new Rosherville power station. The Chloride Electrical Storage Co., Ltd., are supplying a battery and Entz booster equipment to the Delagoa Bay Port and Railway Council.

South Africa.—*Commercial Intelligence* states that all the plant required for the Transvaal Hydraulic Power Syndicate's undertaking at Tweefontein is to be supplied by the British Electrical Federation.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith and Son, of 5 Philpot Lane, London, inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 15s. to £58 per ton (last week, £57 15s. to £58).

Bankruptcies.—An application will be made at Bankruptcy Buildings, London, on October 18th, for the discharge of F. Shepherd, Electrician, 4 Haslett Road, Kensington, London.

The trustee in the bankruptcy of W. T. Harris, electrical engineer, 460 Commercial Road, Portsmouth, has been released.

The statement of affairs of F. Peacock, Electrician, North Station Road, Colchester, shows liabilities of £228, and assets nil. The main causes of the failure are attributed to heavy doctor's bills and poor trade.

J. D. Morton, Electrical Engineer, Nettleton Road, Mirfield, Yorks, has been adjudicated bankrupt. The first meeting of creditors was held on September 27th at 11 a.m. at Bank Chambers, Corporation Street, Dewsbury, and the public examination will take place on October 4th at 2 p.m. at the County Court House, Dewsbury.

A conditional discharge has been granted A. J. Hollington, Electrical Engineer, 93 St. Martin's Lane, Charing Cross, London.

The last day for receiving proofs in the bankruptcy of Alan McAlpin (McAlpin & Co., electrical engineers, 44 Cank Street, Leicester) is October 4th. The trustee is Mr. L. V. Wykes, 24 Friar Lane, Leicester.

Notice is given of the release of the trustee of H. K. Barham (South of England Electrical Engineering Co., 60 Fratton Road, Portsmouth).

Liquidations.—Creditors of the Telewriter Syndicate, whose assets have been sold to the National Telewriter Co., Ltd., are requested to send particulars of their claims to the liquidator, John Craggs, 3 London Wall Buildings, London, E.C., by November 10th.

A meeting of shareholders of the Easton Lift Co., Ltd., will be held at Express Works, Short Street, Southwark, London, on Monday, October 31st, to hear the liquidator's account of the winding up. This notice does not relate to the present Easton Lift Co., Ltd.

The liquidator of Improved Electric Supplies, Ltd., 7 Great Newport Street, London, has been released.

New Factory.—The Ruberoid Co., Ltd. (81-83 Knightrider Street, E.C.) have recently completed an extensive factory at Brimsdown, Middlesex, for the manufacture of Ruberoid roofing, dampcourse, flooring, sarking felt, insulating papers, and the well-known P. & B. tapes, and insulating varnishes. These last materials have been continually employed in the industry for over a quarter of a century.

Diesel Engines.—On October 1st Messrs. Willans & Robinson, Ltd., of Rugby, will place Diesel engines on the market. During the past five years the firm have acted as manufacturers for the Diesel Engine Co., but under the new arrangements they will now place the engines on the market themselves, and deal direct with customers, both in Great Britain and for export. Messrs. Willans & Robinson, Ltd., will manufacture the engines in standard sizes, ranging from 120 b.h.p. to 600 b.h.p.

"Onewatt" Lamps.—Messrs. Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp Department, Tyssen Street, Dalston), inform us that they are placing on the market a range of low-priced 50-volt "Onewatt" lamps, with drawn tungsten filaments, for 10 and 16 c.p. in bell-shaped and spherical bulbs. They also list "Onewatt" battery lamps, 1·3 to 16 volts, 100-c.p. lamps, 200 to 250 volts, and 10- and 16-c.p. lamps, 20 to 50 volts. They are prepared to supply quantities of literature regarding these lamps upon receipt of application accompanied by trade card. Other patterns of "Onewatt" lamps are shortly to be placed on the market.

The Abbey Electric Co.—The telegraphic address and telephone number of the Abbey Electric Co. (17 Victoria Street, S.W.) have both been changed. The telegraphic address is now "*Lighthouse, London*," and the telephone number is now *Victoria* 4,027.

Holophane Shades.—Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.), inform us that they are in a position to take orders for the new holophane "Stiletto" reflectors. These are on the market in three types, known, respectively, as extensive or distributing, intensive or concentrating, and focussing or very strong concentrating. All these forms are supplied in various sizes at very moderate prices, and stocks are already held of all except the very largest sizes. The reflectors will be supplied with crinkled or plain edges, the crinkled being supplied unless the plain are specially ordered.

The Metropolitan Electric Supply Co.'s New Tariff.—In our issue of September 8th we referred to the Metropolitan Electric Supply Co.'s new tariff. The circular in which this new tariff is offered is badly worded, and the offer which the Co. makes is not precisely the same as we interpreted it. What the Co. is actually offering is to fix an annual charge, and, in addition, to charge the consumer 2d. per unit up to a certain consumption, and 1d. per unit above this consumption, the penny rate to commence when the charge for units at 2d. is equal to the fixed annual charge. Thus, with, say, a fixed annual charge of £10, the consumer consuming 600 units per year would pay £15, or if he used 1,200 units he would pay £20, and after that 1d. each additional unit.

Municipal Wiring Bill.—In addition to the names we have already published, Hounslow have decided to give "moral" support to the Bill and to consider the question of giving financial assistance when the Bill is drafted. At Manchester the question of financial support has been deferred for the present, but in this case also moral support will be given. At Blackburn the matter will be considered further when the Bill is drafted. The report of the Council and General Secretary of the Ironmongers' Federated Association (Incorporated) contains a reference to the Bill, in which it is said that it will be most detrimental to the trade of their members "if the provisions proposed are adopted—namely, to do free wiring, sell, or practically give away lamps and fittings." General instructions have been given to the Secretary to interview the Gas Companies' Protection Association, and to work in harmony with the Electrical Contractors' Association, as was done last year, in order that the Bill may be strenuously opposed.

OSRAM·LAMPS

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APPOINTMENTS AND PERSONAL NOTES

Mr. W. Rutherford has been appointed Managing Director of Messrs. Dick, Kerr & Co., Ltd.

Mr. J. E. Kingsbury, formerly General Manager in London of the Western Electric Company, has joined the Board of Directors of Western Electric Company, Ltd.

Mr. T. M. Nelson, Assistant Engineer to the Launceston (Tasmania) Tramways Department, ha been appointed Electrical Engineer to Christchurch (N.Z.) Tramway Trust. Mr. O. Clandsley succeeds him.

The late Mr. George Flett, Managing Director of Messrs. Dick, Kerr & Co., Ltd., and a director of a number of other electrical companies, left estate of the gross value of £111,653, with net personality of £88,755.

The Board of Trade has appointed Dr. Alexander Russell, Principal of the Electrical Training Institution, Faraday House, to be an Electric Inspector to Surbiton.

Messrs. W. V. Waite & Co., Ltd., engineers, contractors, &c., Gordon Chambers, 31 Queen Street, Cardiff, have just been appointed agents for the South Wales district for Messrs. Bruce Peebles & Co., Ltd., Edinburgh.

Mr. J. M. M. Munro has severed his connection with Messrs. Anderson & Munro, and is now devoting himself entirely to consulting work at 103 Douglas Street, Blythswood Square, Glasgow.

As the result of inquiry at Marconi's Wireless Telegraph Co., we are glad to be able to contradict the rumours that Mr. Marconi is seriously ill on board the *Princess Mafalda* and is returning to Italy. A telegram received on Tuesday from the Argentine states that Mr. Marconi is in very good health.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Northwich Electric Supply Co.—Particulars have been filed of £11,000 debentures, created December, 1904. The property charged is the Company's freehold and leasehold property and general assets. The trustees are Messrs. Brunner, Mond & Co.

Folkestone Electricity Supply Co.—Interim dividend of 4 per cent. per annum, less tax, on the ordinary shares for the June half-year.

Electrical Contracts & Maintenance Co.—Particulars have been filed of an issue of £200 debentures issued on August 4th.

Direct Spanish Telegraph Co.—Interim dividend at the rate of 4 per cent. per annum for June half-year.

Dundee, Broughty Ferry & District Tramways Co.—Dividend of 2 per cent. on the ordinary shares for the year to July 31st, carrying forward £296, after placing £600 to renewals and £600 to debenture stock redemption.

Madras Electric Tramways (1904).—Interim dividend of 4½ per cent. per annum, less tax, on the preferred ordinary shares for the June half-year.

United Electric Car Co.—At the annual meeting on Thursday, Mr. George Richardson, the chairman, prophesied that before long there must be a general improvement in the demand for electric tramcars, as many now in use have been running for nearly 10 years.

Anglo-Argentine Tramways Co.—Interim dividend at the rate of 7 per cent. for the June half-year.

Hobart Electric Tramways Co.—Dividend at the rate of 5 per cent. per annum for the year, carrying forward £1,997.

Kalgoorlie Electric Power & Lighting Co.—Six per cent. on the preference shares for half-year to September.

Eastern Extension Telegraph Co.—Interim dividend of 2s. 6d. per share for the June quarter.

Underground Electric Railway Company of London.—At the meeting on Thursday, Sir Edgar Speyer, Bart., who presided, said that although satisfied with the results which the company had achieved so far, the dividends paid on the share capital did not yet represent anything like a fair return. The income had increased by nearly £13,000, but this was due mainly to economies in expenditure and by the introduction of more efficient turbines. Everything pointed to a further increase in the traffic of the tube railways.

Babcock & Wilcox.—Interim dividend of 10 per cent. on ordinary shares.

National Electrical Manufacturers' Association.—The half-yearly general meeting of this Association will be held at the Midland Hotel, Manchester, at 2.30 p.m., on Tuesday, October 11th.

Fire at Johnson & Phillips' Works.—A slight outbreak of fire occurred at the cable works of Johnson & Phillips, Charlton, on Monday evening, and a quantity of jute was destroyed as well as a portion of a shed. Messrs. Johnson & Phillips inform us that the damage is of only very slight importance, however, and will have no effect on any work in hand.

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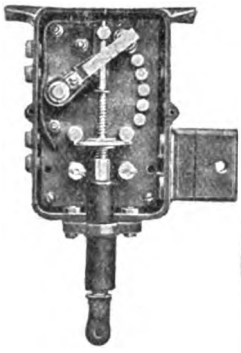
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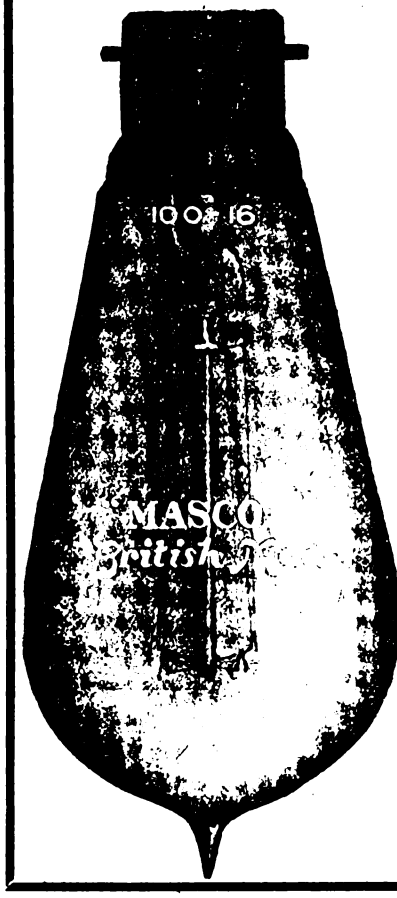
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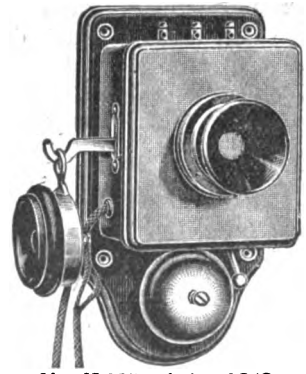
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Adams Watkin Co., Ltd., 36, Victoria St., S.W.
British Thomson-Houston Co., Ltd., Rugby.
Cowans, Ltd., 4, Queen Victoria St., E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne.
Spagnoletti, Ltd., Goldhawk Rd., Shepherd's Bush, W.
Bertram Thomas, Worsley St., Hulme, Manchester.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
Archibald Constable & Co., Ltd., 10 Orange St., Haymarket, W.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
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VENTILATION AND FANS.
Ozonair, Ltd., 96, Victoria St., S.W.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122-124, Golden Lane, E.C.

WATCHES (Non-Magnetic).
Batty (W.), & Sons, Ltd., Market St., Manchester.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

No. 197 [Vol. VI., No. 40] THURSDAY, OCTOBER 6, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 6d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

Official Notices and Technical College Announcements are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

Our monthly supplement on Electrical Engineering in Mines is included in this issue. It opens with an account of the electrical installation at the Broxbourne Oil Co.'s shale mines, and a special article on electric lighting in mines also appears. A report is given of a recent case in which the Home Office prosecuted a mine manager for contravention of the special rules, and a short article summarises a few of the most important electrical mining patents published in September. Another article describes examples of electric power installations at New Zealand gold mines, and some interesting experiences with an electric pumping plant are described, showing how various difficulties were overcome.

Successful experiments have been carried out on Salisbury Plain with an aeroplane fitted with a very small wireless transmitting apparatus. Signals have been received at a portable station with a Marconi magnetic receiver up to a distance of nearly a mile. Two balanced aerials, comprising wires strung over the frame, are employed. (Page 632.)

Two papers of interest to electrical engineers were read at the meeting of the Iron and Steel Institute last week. In one of these Mr. D. F. Campbell dealt with the possibilities opened up by the electric furnace for steel refining, and in the other Mr. J. J. E. Schuurman described some methods of economical speed variation of large three-phase motors for rolling-mill driving and other purposes. (Page 633.)

Some information is given with regard to a new "Stannos" wiring catalogue and show-cards. (Page 634.)

Some notes are given on the electrical equipment of the Wellman airship designed for an attempt to cross the Atlantic. (Page 635.)

A short article calls attention to a new series of mowing iron instruments with particularly open scales. (Page 635.)

Among the specifications published by the Patent Office on Thursday last was one by A. F. Berry for cooking apparatus, in which the heat is stored up in a metal block of large heat capacity. This block is enclosed in a heat-insulating cover and the heat is conducted away to the cooking utensil when required.—F. Lydall and Siemens Bros. Dynamo Works protect a meter for use in a proposed new system of charging, in which energy is charged for at a fixed rate per unit multiplied by a factor depending on the irregularity of the demand. The meter automatically measures this factor and indicates the total sum to be charged.—A method of regulating the pressure of A.C. circuits by two oppositely connected transformers is covered by the British Thomson-Houston Co.—A. H. Shaw describes a ceiling rose with a detachable plug for facilitating the removal of pendants. (Page 636.)

Particulars of the Osram lamp advertising arrangements for this autumn are published for the benefit of wiring contractors and agents. (Page 637.)

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Metal filament lamps are displacing gas for street lighting at Bath.—The profit from the Cardiff tramways last year was £11,000.—A dispute has arisen between the Finchley Council and the Postmaster-General regarding overhead telephone wires.—A horse was killed on the Dolter system at Hastings last week.—Arrangements are in hand for installing trolley omnibuses at Leeds.—Stepney Council refuse to sanction any further trolley lines in their district.—Discussions concerning trolley omnibuses have taken place at Watford, Rotherham, and Newport.—In spite of considerable opposition the tramway profits at West Ham have been transferred to relief of rates. (Page 638.)

Extensions are contemplated at Bexhill (£4,500); Stepney (£7,150); Walsall (£23,225); St. Helens (£10,206); and Hornsey (£6,000). Extensions are also contemplated at Oldham and York. West Hartlepool Council are considering the utilisation of waste heat from local furnaces for generating electricity. (Page 639.)

At the annual general meeting of the British Thomson-Houston Co., and of Dick, Kerr & Co., complaints were made of the low prices obtainable during the past year. A loss of £8,000 is shown by Messrs. Willans & Robinson for the June half-year. (Page 640.)

ARRANGEMENTS FOR THE WEEK

FRIDAY, OCTOBER 7th.

Association of Mining Electrical Engineers.

Annual meeting at Newcastle-on-Tyne.

SATURDAY, OCTOBER 8th.

Birmingham and District Electric Club.

7.30 p.m. Smoking concert at Colonnade Hotel, New Street.

Association of Mining Electrical Engineers.

Annual meeting at Newcastle-on-Tyne.

FRIDAY, OCTOBER 14th.

Institution of Electrical Engineers: Manchester Local Section.

7.30 p.m. Conversazione at Whitworth Institute, Whitworth Park.

Wireless Telegraph Notes.—The Marconi Wireless Telegraph Co. state that a message from Mr. Marconi, despatched just prior to his departure to Buenos Aires on Saturday, notifies that transmission has been effected direct between Europe and South America over a distance of some 6,000 miles. Mr. Marconi has received messages at Buenos Aires from Clifden and Glace Bay. The construction of a high-power Marconi station at Punta del Este, Uruguay, is to be proceeded with at once.

Experiments have been carried out on the Doncaster Race Common to ascertain the extreme range of the portable field stations supplied by the Marconi Co. The commercial range of these installations is put at 100 miles, but the experiments prove the possibility of transmitting over a distance of 180 miles with this apparatus. Masts 70 ft. high were used, and the experiments have proved of great value in demonstrating the increasing value of these portable installations for military purposes.

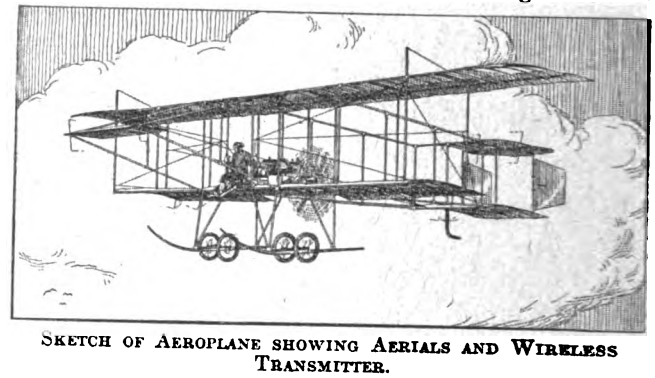
The steamers of the South-Eastern & Chatham Railway Co., on the Dover-Calais as well as on the Folkestone-Boulogne routes have now been equipped with wireless telegraph installations.

According to the report of the Royal Commission on Trade Relations between Canada and the West Indies, the National Electric Signalling Co. (Fessenden system) proposes to install a system of wireless telegraphy between Great Britain, Canada, and the West Indies. It is suggested that the rate will ultimately be reduced to ½d. per word, the company basing this upon the fact that a speed of 250 words per minute has been reached.

Law and Engineering.—The Council of the Society of Engineers (Incorporated), in conjunction with the Council of the Junior Institution of Engineers, have arranged for a course of six lectures on "The Law relating to Engineering," to be delivered by Mr. L. W. J. Costello, at Caxton Hall, Westminster, at 7.30 p.m., on October 10th and 25th, November 9th and 21st, and December 7th and 19th. Fee for the course: Members, 6s.; non-members, 12s. At the close of each lecture opportunity will be given for discussion. Applications for tickets should be made to the Secretary of the Society of Engineers at 17 Victoria Street, Westminster; or to the Secretary of the Junior Institution of Engineers, 39 Victoria Street, Westminster.

WIRELESS TELEGRAPHY AND AEROPLANES

Interesting experiments are being carried out on the Government flying-ground at Lark Hill, Salisbury Plain, by Mr. T. Thorne Baker, the photo-telegraphic expert of the *Daily Mirror*, and Mr. R. Loraine, the aviator. The large Farman-type biplane used by Capt. Dickson during the manœuvres has been put at the disposal of the *Daily Mirror* by the makers, the British and Colonial Aeroplane Co., of Bristol, and this has been fitted up with a wireless transmitter and an aerial especially designed for the purpose by Mr. Thorne Baker. The transmitter comprises a battery, a ¾ in. spark coil (which works with a ⅛ in. fat spark), a Leyden jar, and an inductance, the whole being compactly fitted into a wooden box, and weighing between 14 and 15 lbs. complete. The box measures 12 by 10 by 5 ins., and could be placed under the aviator's seat, but during the present experiments it has been strapped to the passenger seat (which is behind that of the aviator in the Farman machines), as shown in our sketch, prepared from a *Daily Mirror* photograph. The aerial has been drawn in distinctly, and the stay wires left out in order that the arrangement of the former may be clear. As no earth is available, the old arrangement of two balanced aerials, used by Hertz, must be employed. In the present case each aerial consists of three No. 16 phosphor-bronze wires, radiating out some



Sketch of Aeroplane showing Aerials and Wireless Transmitter.

30 ft. from one of the stay-rods at the side of the aviator's seat to the outer stay-rods at the tip of the wing, and then drawn behind and joined together to an insulated support at the tail. The wires are insulated from the stay-rods, to which they are attached by cat-gut. It has been suggested to use a long drooping wire as one aerial and the frame of the machine as the other, but this Mr. Thorne Baker considers would be most dangerous, as the wire could easily come into collision with the propeller in the event of a sudden drop or turn. For these preliminary experiments, the transmitting key has been a small push-button attached to the left side of the aviator's seat. A portable receiver, comprising a Marconi magnetic detector weighing only a few pounds, complete with head-piece telephone and aerial wires has been used. The wires were supported horizontally a few feet above the ground in the form of a star of about 16 yards radius.

The first experiments were carried out on Monday of last week in an exceptionally high wind, but signals were successfully received from Mr. Loraine at a distance of a quarter of a mile. On Friday further experiments were carried out, and communication was established up to a distance of nearly a mile. Mr. Barron, of Marconi's Wireless Telegraph Co., who was present, expressed the opinion that with the latest pattern of receiving apparatus, communication to a distance of 20, or even 50, miles could be effected with Mr. Thorne Baker's small transmitting apparatus. Trials will shortly be made with such apparatus, and experiments on exploding mines by wireless from the aeroplane will also be conducted. Receiving apparatus will also be tried on the aeroplane, and Mr. Loraine has stated that he thinks it will be possible for a passenger so to concentrate his attention as to hear the signals, in spite of the noise of the engine.

The Qualifications of Engineers.—In the course of a lecture before the Society of Engineers on "Current Professional Topics," Mr. H. C. Adams enlarged upon the importance of practical experience as well as theoretical training, and suggested the establishment of a central bureau where a register of the career of every engineer should be kept open to public inspection. Instead of applying for appointments as at present, a candidate would ask for a certified copy of his page in the register to be forwarded to a prospective employer. In the same way, before engaging an engineer, an employer would obtain a copy of his record.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "The Editor, Electrical Engineering, 203-206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

THE BROXBURN OIL COMPANY'S ELECTRICAL INSTALLATION

THE members of the Institution of Mining Engineers in Scotland paid a visit of inspection to the works and mines of the Broxburn Oil Company on Saturday, September 10th. Among the points of interest were the new mine of the Dunnet shale seam, and the electrical installation in connection with this mine. The works were described in Papers contributed by Mr. William Love, managing director, and Mr. Clark, the former describing generally the operations at the oil works, whilst the latter outlined the points of interest to mining and electrical men.

The generating plant at present is composed of one 575 h.p. Belliss & Morcom engine, working at 90 lbs. steam pressure, with 1 lb. back pressure for forcing the steam into the retorts for the production of ammonia water. This engine is direct coupled to a Siemens three-phase alternator, which gives 470 kilo-volt amperes at a pressure of 525 volts and 50 cycles when running at 300 r.p.m. The exciter has a capacity of 245 amperes at 110 volts. As this output is more than sufficient for the excitation of the alternator, the surplus is used for lighting the works during the day. Steam is supplied by two Stirling boilers and a battery of Lancashire boilers, all equipped with mechanical stokers. The steam from the boilers passes first through the engines and then to the retorts, thus saving fuel. The power station has been built to accommodate two further 575 h.p. generating sets.

The alternating current is taken to a remotely controlled switchboard, consisting at present of one generator panel, one 200 h.p. feeder panel for Dunnet mine pump (underground), one 200 h.p. feeder panel for Dunnet mine haulage, and one 200 h.p. breaker panel. All these panels are fitted with oil switches, the three feeder panels having maximum cut-outs, with time limit relays, ammeters, kilowatt meters, and integrating wattmeters.

The mine is lighted throughout by 25 c.p. incandescent lamps, spaced 120 feet apart. The main lighting of the works and mine is supplied by a 75 h.p. Belliss-Siemens direct-current set, giving 455 amperes at 110 volts when running at 525 r.p.m.

The underground panel in the Dunnet mine supplies current to one 185 h.p. Siemens-Sulzer pump, one 50 h.p. motor generator for electric drills, one 150 h.p. double drum haulage, one 25 h.p. dook pump, and one 7 h.p. hutch creeper.

The 185 h.p. Siemens-Sulzer pump is capable of delivering 400 gallons of water per minute when running at 1,470 r.p.m. against a head of 820 manometric feet. The motor generator is being used for transforming the current from 525 volts alternating current to 100 volts direct current, for working the electric drills. A small 25 h.p. Siemens-Sulzer dook pump is employed for sinking purposes, and is capable of delivering 150 gallons of water per minute against a head of 210 feet. The 7 h.p. hutch creeper motor is used for raising the empty hutches from the Downcast Mine, and causing them to run back to the top of the electric dook. The Dunnet mine haulage is driven by belts from two 110 h.p. motors, controlled by oil switches, each with a maximum cut-out, time relay, and no-volt release. This no-volt release is of a rather novel type, being so arranged as to stop the motors in case of a runaway hutch, and by push buttons situated at various points in the mine.

The breaker panel supplies one 110 h.p. motor for driving the shale breakers, one 50 h.p. endless rope haulage motor for hauling the broken shale on to the retorts, one 25 h.p. endless rope haulage for filling a 2,000 ton bunker with broken shale, and one 25 h.p. motor for hauling shale from the Stewartfield Mine to the breakers, and from the Dunnet Mine main haulage to the breaker.

All the motors on this work are of the slip-ring type, with liquid starters, excepting the motors driving the high speed turbine pumps, which are squirrel-cage wound, with star delta starting arrangement. All the electrical apparatus at the works and in the mine are earthed on to the armour of the main cables, and these are connected throughout to a common earth bar in the station.

ELECTRICAL MINING PATENTS OF SEPTEMBER

AMONG the patent specifications of electrical mining apparatus published during the past month was one by F. J. and W. A. Turquand, of London (No. 18,756 of 1909), for a miner's safety lamp, comprising a battery or accumulator enclosed in a cylindrical case with a gas-tight cover plate. The lamp is mounted inside a thick glass bell, the open end of which makes a gas-tight joint with the top of the cover plate, and the bell is held in position by a metal cage attached to the cover plate. Contacts are arranged on the top of the cover plate, and these engage with contact springs on the under side of a disc to which the lamp is attached. The lamp is switched off and on by rotating the glass bell, which carries with it the lamp mounting and the contacts.

F. Eckersley and W. Creswick, of Wakefield, describe in specification No. 22,432 of 1909 a new arrangement of the mechanism of an electrically driven coal-cutter with a swivel jib and an endless chain with cutters attached at intervals, driven by means of a sprocket wheel on a vertical shaft. The axis of this shaft usually coincides with the axis of the jib swivel, and the chain passes round a wheel at the opposite end of the jib. According to this invention, the axis of the vertical shaft and swivel is placed to one side of the axis of the armature shaft, and the second motion shaft, parallel and geared to the armature shaft, is placed to the side of the latter.

A supporting frame for coal-cutters of the Hurd bar type is described in specification No. 4,491 of 1910 by F. W. Hurd, of Bothwell, Lanark. In this machine the motor and gearing are contained in a vertical cylindrical casing from which the horizontal rotary cutter-bar projects radially. The frame described comprises a ring provided with an annular internal channel, in which runs a toothed flange fixed to the periphery of the machine, which is rotated in a horizontal plane by means of a handle and suitable gearing. The ring is fixed at one side to a horizontal rail rigidly supported by screw or hydraulic jacks. An adjustable skid or leg supports the ring at the opposite side. The machine can be moved along the rail by means of a rotary handle.

Fire at a Welsh Colliery.—A serious fire occurred on September 8th at the No. 2 Colliery, Llandradack. According to the *Daily Telegraph*, the electrical plant, the winding-engine, and two compressed-air engines were destroyed, the total damage being estimated at between £20,000 and £30,000. The fire originated, it is said, through a spark flung from the brake of the winding-engine and setting the woodwork on fire. Some 1,000 men were in the pit at the time, but all were brought out safely through the No. 1 pit.

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HOME OFFICE PROSECUTION

As the result of a fatal accident to a pump attendant last March in the Blackridge Colliery of the United Collieries, Ltd., a charge was brought against the manager, Mr. John Leckie, at the instance of the Home Office, of having failed to comply with Rule 11 of the Special Rules for electricity in mines adopted under the Coal Mines Regulation Act. This rule requires that a competent person shall be in charge of electrical apparatus and machinery in use in a pit. The case was brought before Sheriff MacLeod, at Linlithgow, in July, and a considerable amount of evidence was heard and much discussion took place between counsel for the opposing parties as to the definition of a competent person.

It appears that the man was killed by coming into contact with a faulty joint in a cable on a three-phase 500-volt system. The "oversman," who was in charge of the electrical installation had had only nine months' electrical training as an assistant to a pit electrician, and it was held for the prosecution that this was insufficient. The possibility of the supervision of the manager or under-manager being sufficient to satisfy the Rule was also brought up. Judgment was given on August 30th, the Sheriff holding the charge not proven, but application has been made on behalf of the Home Office for a stated case, with a view of taking an appeal to the High Court.

The following remarks in the Sheriff's written judgment are of interest. His Lordship states that it was known that the question of competence was the point at issue, and it was expected that the Court would be provided with full information as to what provision this particular manager had made for the discharge of this duty of electrical supervision; and also with the views of numerous experts as to their sufficiency in order that there might be obtained from the High Court an authoritative exposition of the term "competent person." The prosecutor, however, had very little information as to what had been done, and the defendants offered no further information, so the Court had not sufficient knowledge to form an opinion as to the sufficiency or insufficiency of the supervision. His Lordship considers that the prosecutor's case was weak, but that it was most difficult for him to obtain the necessary information, and suggests that the Home Office should make a rule that every manager shall set down in writing, in a book open to the inspection of the Home Officials, the exact provision made for the electrical supervision of each shift.

Electric Working in Indian Collieries.—The report by Mr. J. R. R. Wilson, Chief Inspector of Mines in India for 1909 states that the use of electricity is making some headway in Bengal mines. At 13 groups of mines there are installations of 10 h.p. up to 400 h.p. capacity, the power being used for hauling, pumping, screening and lighting.

The Association of Mining Electrical Engineers: Scottish Branches.—At the special meeting held on Glasgow on Sept. 17th for the purpose of forming Scottish branches of the Association, Mr. H. W. Clothier (Newcastle-on-Tyne) presided, and explained to the meeting the objects of the association. The total membership in Great Britain was, he said, about 700 at present. Mr. Glynn Williams (Whitehaven), who was also present, stated that there were already 41 members in the Western Division of Scotland and 25 in the Eastern Division. A branch for Glasgow and the West of Scotland was then formed; Mr. A. Anderson, of Motherwell, was appointed President; Mr. M. Brown, Castlecary, Vice-President; Mr. D. Martin (12 Waterloo Street, Glasgow), Hon. Secretary; and Mr. D. L. Frew (45 Hope Street, Glasgow), Hon. Treasurer. Twelve local council members were also appointed.

Temporary Pumping Plant.—An interesting example of the readiness with which electrical pumping plant can be installed is described in the *Colliery Guardian*. A serious fire occurred recently at the Stony Pit of the Consett Iron Co., Ltd., caused by the ignition of some waste used in connection with an oil engine driving a pump. After the fire was extinguished there was danger of the workings being flooded out unless within a week or so a new pump equipment was in commission. The Cleveland & Durham County Electric Power Co. came to the rescue by running a cable from their main transmission system, about half a mile away, to the pit head, where a step-down transformer was installed, from which about 350 yards of 440-volt cable was run inbye to a 60 horse-power motor, which, together with the necessary pump, had been hurriedly installed. This piece of work was completed in ample time to allow of pumping operations being resumed before the water had encroached to a dangerous extent. This instance affords an excellent example of the advantage of the existence of a network of mains throughout the colliery districts of the county of Durham, and emphasises one of the risks run by owners of private plants, which is absent where a supply is taken from a public source.

ELECTRIC LIGHTING IN MINES

By "Durham"

It will probably be agreed universally that for underground purposes the ordinary incandescent lamp is the most suitable illuminant, and that the requirements of surface lighting, colliery yards, coal sidings, &c., are best met by ordinary or flame arc lamps. Underground wiring can be carried out either in wood casing or in steel conduit. The former is only admissible if the wood be thoroughly dry and well impregnated with a waterproofing composition, and the capping substantially fixed by screws. There are, however, so many situations where casing does not offer anything like sufficient protection to the wires, that it is better to make a universal rule of adopting steel tubing throughout. This also removes the temptation to omit to replace the capping after carrying out repairs. The suspension of unprotected insulated wires from porcelain insulators, although possibly cheap, is, in the writer's opinion, too slovenly to be allowed in mining work. Another point which the writer would insist on is the total prohibition of "temporary" wiring in mines. It is a common occurrence for rough wiring intended only for a few days' service to remain in use for extended periods, with disastrous results.

All tubing should be of the screwed pattern, and where there is any possibility of the wiring being exposed to water, the joints should be carefully made with red lead or some similar substance. A draw in wire must always be used. Switches, &c., should be fixed on iron back plates bonded to the tubing, which in its turn should be connected to the earthed armouring of the power cables or to an independent set of earth rods let into the ground. Strong iron lamp fittings should be used. Many of the watertight patterns on the market will be found quite satisfactory. Care should be taken to have all the lamps protected by gas-tight outer globes, and these should be further provided with substantial metal guards screwed on to the fittings, so as to be efficiently earthed, and not merely clamped by small brass screws.

Where lamps are installed in engine rooms, pump rooms, &c., in-bye, the fuses should be enclosed in strong ironclad gas-proof fuse boxes. At the colliery where the writer is employed there are at the present time four haulage engine houses in-bye, which are illuminated electrically, and there are two more under construction. The lights are taken off a 220-volt circuit, which is supplied by means of a transformer from the 3,000-volt three-phase system. These engine houses are not usually very gaseous, but still they are not free from gas. The writer would recommend that the fuses themselves should be contained in tubes of asbestos or other fireproof material, packed with French chalk or dry sand. If this is done, the arc on blowing will be so effectively smothered that there will be no danger of explosion from this cause in gaseous pits.

Another matter to which attention should be directed is the construction of hand lamps. Risk of shock from these can be avoided by constructing them as completely as possible of non-metallic material, with a suitable lamp guard, and the use of more substantial plugs, sockets, and connections. Several of the new hand lamps on the market are eminently suitable. "Looping in" wiring should be adopted whenever possible, and except for surface work, distribution boards can largely be avoided.

Association of Mining Electrical Engineers: Annual Meeting.—The annual meeting of the association will be held on Oct. 7th and 8th, at Newcastle-on-Tyne. Special return tickets to Newcastle at the reduced rate of single fare and a quarter will be issued by the Associated Railway Companies on production of a certificate to be obtained by members from the general Secretary of the Association, Bank Chambers, London Road, Derby.

Colliery Fatality.—Late in August a collier, J. Jones, was killed at the South Rhondda Colliery by electric shock received from a 400-volt D.-C. system. The deceased and another were engaged in putting up iron girders in a main road, and the former took hold of a coil of old signal wire lying on the side of the roadway for use in supporting the girder temporarily. It appears that the wire comprised several pieces jointed together, and that a sharp end at one of the joints caught in a cable lying along the roadway at a place where a joint had been made. The cable was one of two very light rubber-covered 3/20 cables supplying a 5 h.p. pump. The wire pierced the insulation and reached the core, with the result that the man received a fatal shock. At the inquest, the jury returned a verdict of death by electric shock, and advised that the recommendations of Mr. R. Nelson (H.M. Electrical Inspector of Mines) that cables should be protected at points where repairs were being carried out, and that disused wires should not be left about, should be strictly carried out.

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ELECTRIC POWER IN NEW ZEALAND GOLD MINES

CONSIDERABLE progress is being made in the application of electric power to gold mining in Australia and New Zealand, and one or two installations of this nature are described in a recent number of the *Australian Mining and Engineering Review*. In the Waihi Mine (New Zealand), for example, the new extensions to the pumping plant now in course of installation preparatory to sinking further are all to be worked electrically. The new generating plant for this purpose consists of two 750-h.p. producers and two 368-h.p. tandem type Crossley gas engines. These will be direct-coupled to Siemens D.-C. generators, the current from which will be transmitted at 550 volts to two electrically-driven 3-throw ram pumps of a capacity of 1,500 gallons per minute. One of these pumps will be placed at the No. 9 or 1,000-ft. level, and deliver to the other at the No. 6 or 535-ft. level. This plant will work either independently of, or together with, the present pumps, and in the event of a temporary stoppage of either, there will be no occasion to abandon the lowest level.

At the neighbouring Waihi Grand Junction Mine there is a fine example of an electric winding plant, designed to hoist 1,000 tons in nineteen hours from a depth of 2,000 ft. The winding motor is D.-C., current being supplied by a synchronous motor generator, which develops enough power for the ordinary load. The excess power at starting is supplied by a fly-wheel generator working at 300 to 600 revolutions, and a motor and generator with 5-ton fly-wheel are provided to absorb excess power up to 100 h.p. This latter is not in use, as the present winding is only from the 1,000-ft. level, and only 200 tons per day are handled. The power station at this mine contains three Parsons turbines of 580 b.h.p. running at 3,000 r.p.m. and Brown-Boveri 550-volt 50-cycle alternators.

Another New Zealand mine where great use is made of electrical power is that of the Ross Goldfields, Ltd., which takes current from a water-power station drawing water from Lake Kanieri, about twelve miles from Hokitika. The water is conveyed about eight miles through tunnels, and flows to the head of the pressure pipes, where a fall of 250 ft. is available. The generating set in the power house are two 350-k.w 2,300-volt 60-cycle alternators by the British Thomson-Houston Co., and they are driven by Pelton wheels. Transformers step the pressure up to 24,000 volts, at which voltage power is taken up a twenty-three mile transmission line to a substation at Ross, where the pressure is reduced to 440 volts for use about the mine. A series constant-current transformer is in use for lighting both of the mine and the borough of Ross. In this substation are also erected two electrically-driven capstan winches for lowering the vertical pumps in the shaft. These winches are arranged to give a very slow motion to the pumps, about 1 to 2 ft. per minute. They are very powerfully built, and capable of lifting 75 tons. Each of them is driven through worm and spur gear reductions by a 6-h.p. Westinghouse motor, and is fitted with very powerful hand brakes. Behind these capstan winches is erected a large main double drum hoisting winch, which is built by Wantage Engineering Co., and is driven by a 75-b.h.p. Westinghouse motor. The controller for regulating speed is similar in outward appearance to the well-known type of tramway controller. Powerful brakes are fitted to each drum. The two pumps to be used in unwatering are the vertical type of Worthington multistage turbine high-lift pumps, direct-connected to British Westinghouse three-phase squirrel cage motors. These pumps are designed to run at a speed of 1,730 r.p.m., and are each of them capable of lifting 750 gal. per minute, to a height of 330 ft. They will be slung in the bight of a steel rope, one end of which is connected to the top of the poppet heads, and the other, after passing around the pump pulley and over the top of the poppet heads, goes to the capstan pump winches. The pumps are lowered in the shaft as is required by the subsiding water, and at the same time additional lengths of delivery piping are placed on the discharge end. The motors driving the pumps are 120 b.h.p. each, and take the current at 440 volts. This current is delivered by a three-core flexible armoured cable, which is wound round a cable drum. One end of this cable is, of course, attached to the pump motors, and the cable is paid out as the pump is lowered. The other end of the cable is connected to the autostarters, which take their current from the main switchboard. These two cable winches are made by the W. T. Henley's Telegraph Works Co., Ltd., England, and are erected in a shed at the top of the shaft, and the cable is raised or lowered as required by hand.

As soon as the mine is unwatered the pump chamber will be built at the bottom of the shaft, in which will be installed the permanent pumping equipment. This consists of two Worthington horizontal type turbine high-lift centrifugal pumps. These pumps will run at a speed of 1,160 r.p.m., and are designed to lift from 1,000 to 1,500 gal. per minute to a height of 400 ft. Each is direct-driven by a 200-h.p. British Thomson-Houston squirrel-case, three-phase induction motor. The controlling switchboard will be erected in this chamber, and a three-phase cable will be laid down the shaft, connecting this board with the substation. As soon as mining operations are started, it is proposed to employ an electric locomotive to do all the haulage between the working faces and the shaft.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during September.

September 1st.—Supplement on Electrical Engineering in Mines, opening with an illustrated article on the three-phase electric winder installed at the Abercwmboi Colliery of the Powell Duffryn Steam Coal Co., which is a fine example of the simplest form of electric winder without load-equalising fly-wheel plant. Some notes on electrical mining patents published during August are included in the supplement. A very complete switchgear catalogue is also reviewed.

September 8th.—Abstract of a report on motor and dynamo breakdowns.

September 15th.—Illustrated article on a tramway line where a double trolley system is used.

September 22nd.—A long article on the control of three-phase motors. Description of a new cooling tower.

September 29th.—Illustrated description of a cable works. Report on a boiler accident due to impure feed water.

Totally Enclosed Motors.—A leaflet from the A.E.G. Electric Co., illustrates two patterns of totally enclosed motors, one with the bearing shield and frame in one solid casting, and the other of normal construction with massive inspection plates. Both the forms are watertight, and are designed for installation in exposed positions.

Association of Mining Electrical Engineers: *Scottish Branches.*—At last Saturday's meeting in Dunfermline, a branch of the Association was formed for the East of Scotland. Mr. Weir, of Bowhill, was appointed secretary, and Mr. G. Andrew, treasurer. The election of a President and Vice-President was left to the Committee.

Iron-clad Switchgear.—An illustrated pamphlet issued by the Allgemeine Elektricitäts-Gesellschaft of Berlin. gives full particulars of a line of iron-clad switches and motor-starters combined with fuses, ammeter and cable boxes for A.C. and D.C. circuits up to 550 volts. A special form for outside portable mining and agricultural machines is described. All these switches have interlocked doors, and those for portable machines have interlocked plugs.

Transport of Coal and Ore by Electric Locomotives.—The July issue of the Transactions of the South African Institute of Electrical Engineers contains a Paper by Mr. W. C. Brown on "Transport of Coal and Ore by Electric Traction," in which a haulage system by locomotives is considered. Continuous-current motors are recommended, and the use of two small locomotives working in tandem is advised in preference to one large one on account of greater ease in rounding sharp curves, smaller spare locomotive necessary and lighter track, &c. Particulars of a system where 3,660 tons of coal and 103,260 tons of ore are hauled per month by 20-ton locomotives up a grade of 1 in 40 are given. With current at ½d. per kw.-hour, the working costs per ton mile worked out at 1·66d., and the maintenance costs at 0·66d. The locomotives consist of 10-ton units each, and each unit is equipped with two 45-h.p. 500-volt series motors fed by an overhead line, which is supplied from a three-phase transmission line through rotary converters.

Electrical Apparatus for Mines.—An illustrated catalogue of electrical apparatus and accessories for mines and collieries has been issued by the Adnil Electric Co., Ltd. (Adnil Building, Artillery Lane, London, E.C.). A 750 kw. exhaust steam turbine set, and several patterns of motors for pumps, &c., are illustrated. Iron-clad switchgear, high-pressure motor switch panels, and various patterns of oil switches are briefly described, and several pages are devoted to signalling apparatus. The system described in ELECTRICAL ENGINEERING, April 17th, 1910, Mining Supplement p. xlix., is included. A number of water-tight telephone instruments, bells, and hooters, loud-speaking telephones, a motor-driven bell, junction boxes, relays, fans, and lighting accessories, are listed. Particulars are also given of a dust-proof plug socket switch, with interlocking arrangements to prevent the plug being inserted or withdrawn while the switch is closed.

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SOME PRACTICAL DIFFICULTIES IN AN ELECTRICAL PUMPING PLANT

COMMUNICATED.

ALTHOUGH it is an easy matter to generalise upon the application of electricity to mines, troubles sometimes occur in parts, due to the fact that the operation of electrical plant in mines is associated with practical difficulties which are not experienced with other applications of electrical energy. As a consequence, a considerable amount of distrust appears to have been aroused as to the reliability of certain types of plant for the purpose of mine operation. Notwithstanding the fact that for every case of breakdown of electrical plant in collieries there can be shown hundreds of cases of continuously successful working.

As an example of difficulties due to particular circumstances, and not to defective design or workmanship, may be taken the case of an induction motor driving a turbine pump for unwatering a mine may be cited. This set was of medium capacity, running at high speed, and driven by a totally enclosed vertical shaft three-phase motor from a medium pressure supply. The first difficulty which occurred was found on trying to start up the set for the first time. Although the rotor was perfectly free when the current was switched off, so that the whole pump could be easily turned by hand, it was found that directly current was switched on, the rotor was pulled over against the core. The motor had been tested immediately after construction, but in that case it had been started up by running up on a separately excited generating set. Under working conditions, however, continuous current was not available for separate excitation, as the exciter was directly connected to the shaft of the alternator. Thus the pump only could be started by switching it directly on to the full supply pressure, and the momentary surge of current at starting exerted such a powerful torque that, owing to the small air gap, and, therefore, the liability of an unequal pull on one part of the rotor due to the slightest inequality between the width of one portion of the air gap and the other a side strain was put upon the shaft which it was too flexible to resist and the rotor was pulled over sideways on to the stator.

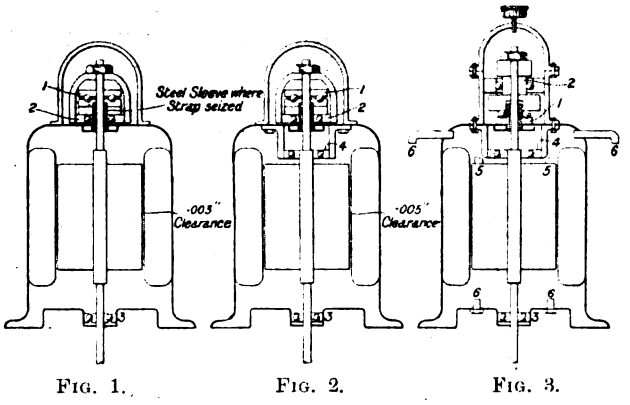


FIG. 1. FIG. 2. FIG. 3.

1. Thrust-Bearing.
2. Top-Registering Bearing.
3. Bottom-Registering Ball Race.
4. Extra Registering Ball Race.
5. Fan Blades
6. Inlet or Outlet Pipes for Ventilation.

In order to overcome this difficulty, an attempt was first of all made to modify the conditions of starting by introducing an auto-transformer, but although this means would have worked satisfactorily had the power been derived from a power in bulk supply system, it failed in this instance, owing to the fact that there was only a margin of about 5 kw. between the total available output of the generator and the running demand of the pump. It therefore at first appeared as if a larger generating plant would have to be installed to deal with the difficulty, but ultimately the trouble was removed by increasing the air gap between the stator and rotor by two mils.

After the pump had been got into operation, however, further trouble was experienced, owing to irregular governing of the gas engine driving the alternator. The effect of the periodic fluctuations was that the rotor was pulled over towards the core of the stator in the same manner that it had been pulled out of centre by the starting-current. The impulses in this case were, however, not quite so severe, and on account of the increase of the air gap the rotor was unable to touch the stator core. From Fig. 1, however, it may be seen that a steel sleeve was fixed in the top bearing, in which the shaft revolved with very little clearance, so that, when pulled over, the shaft touched on the steel sleeve and seized. This trouble was cured by adding an extra ball bearing as shown at 4, in Fig. 2 (B), fixed to the top of the motor casing, and holding the shaft at a point below the lowest portion of the steel sleeve.

A certain amount of trouble was also experienced on account of the wood bushes of the holes in the case where the stator leads entered becoming soaked with water, but this was cured by impregnating them with tar.

Yet another difficulty was experienced owing to the fact that the motor was liable to get out of step with the generator. The engine was driven by means of a suction gas plant, and if the quality of the gas varied unduly, the engine was liable to misfire. If this happened too frequently, the motor was liable to fall out of step, and as the motor would not of its own accord come up to speed again unless all the resistance in the shunt circuit of the exciting dynamo was taken out, the starting-current, which was considerably in excess of the normal current-carrying capacity of the rotor windings, was liable to remain on the rotor. The running temperature of the rotor was supposed to be not more than 90° F. above the atmosphere; but, owing to the fact that a considerable amount of water was constantly coming down the main shaft, all accessible parts of the motor were so effectually cooled that any rise in the internal temperature of the motor would escape observation until considerable damage had been done. The result of this was that the solder became melted out of the short-circuiting rings of the rotor, and, owing to the resistance of the rotor being considerably increased from this cause, a burn out of the stator ensued. It was therefore decided to re-wind the stator and to braze all the rotor bars into place, and as this occurrence indicated possibility of a highly increased internal temperature in the motor without an adequate external indication of trouble, it was resolved to convert the motor from a totally enclosed system to a partially ventilated arrangement. This was effected by adding ventilating inlets and outlets, as shown at 6, Fig. 3, and a series of fan blades fixed at the top of the rotor to the spider. With this arrangement it was found that the pump operated perfectly satisfactorily, and the whole installation has been running for a lengthy period without further trouble.

In narrating the series of events described above, there is no intention of attributing any fault of design or workmanship in any part of the plant described which could have been foreseen or guarded against before the plant was actually put into commission, and without the light of knowledge acquired by actual experience in the working of the plant. It is, however, intended to show that conditions arise in mining engineering which are not usually present or at any rate so prominent in other branches of electrical applications which have been more thoroughly investigated, and it is therefore evident that the mining electrical engineer, far from being an unskilled attendant only equal to attend to routine duties, must have an experience which will fit him for coping with most unexpected difficulties. The necessary corollary of such a proposition is that the status of the mining electrical engineer should be considerably in advance of what it is at present, and his pay should in many cases be considerably improved in order to secure men who can do justice to the machinery placed under their charge.

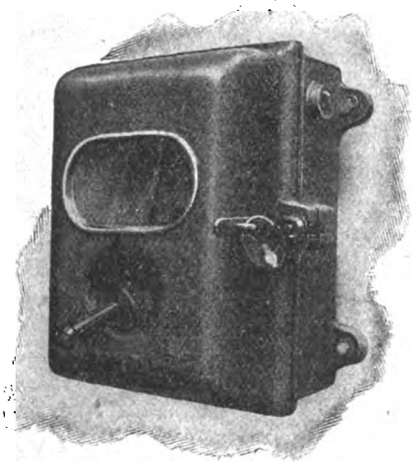
Harton Coal Co.'s Collieries.—According to the *Yorkshire Post*, the Harton Coal Co., Ltd., are proceeding with the electrification of their Bent House, Boldon, St. Hilda, and Whitburn Collieries, all of which are near South Shields. The Harton colliery is already completely equipped.

The Fisher Protective System for Mines.—One of the most interesting systems that has been proposed for ensuring safety from risk of electric shock in mines is that devised by Mr. H. J. Fisher, and fully described in ELECTRICAL ENGINEERING IN MINES, February 3rd, page xviii. The equipment for this system is manufactured by Messrs. W. T. Glover & Co., Ltd. (Trafford Park, Manchester), who have just issued a pamphlet containing a technical description. The gate end box contains a three-pole oil switch, with solenoid release operating on no-voltage and overload, and fitted with variable time limit attachment. The principal feature of the system, however, is that the switch is also released when the continuity of the earth circuit is interrupted. An indicating lamp shows if the supply voltage is on or off the box or trailing cable. The special plug, which also provides contacts for the trailing cable, is arranged to trip the switch when it is withdrawn, and is also interlocked so that the switch can only be closed when it is inserted. A special form of trailing cable is provided.

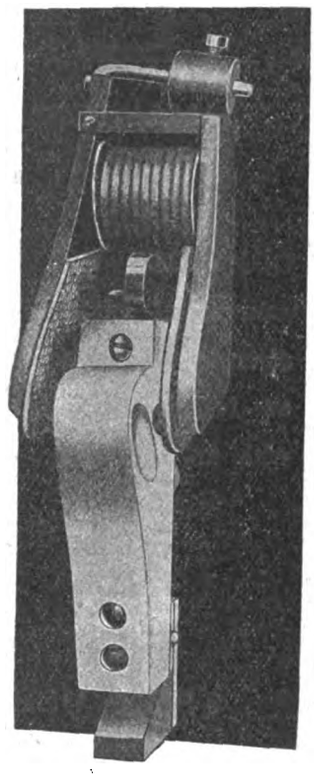
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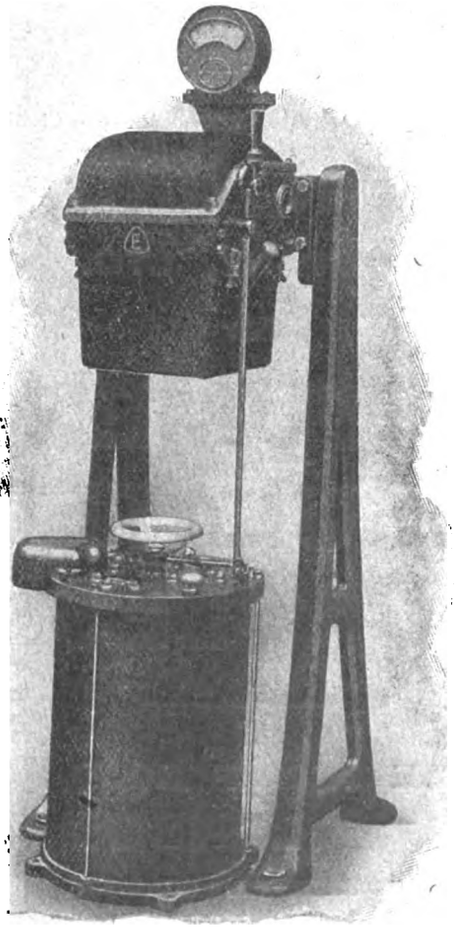
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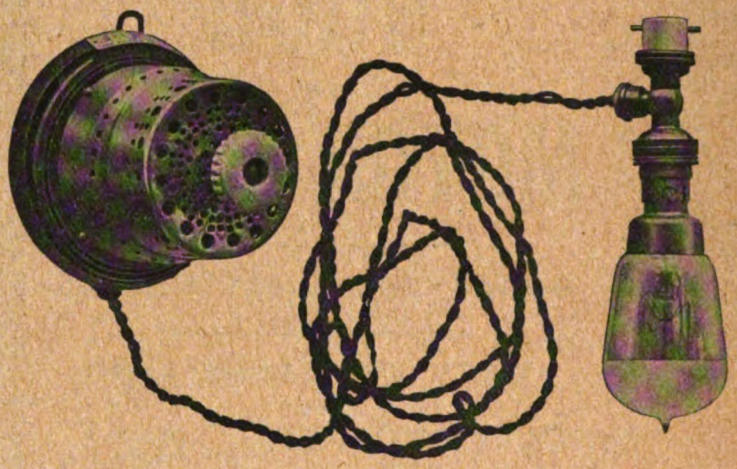
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ELECTRICITY IN THE IRON AND STEEL INDUSTRY

AMONG the numerous papers presented at the autumn meeting of the Iron and Steel Institute at Buxton, which was held on Tuesday, Wednesday, and Thursday of last week, were two of special interest to electric engineers, dealing respectively with refining of steel in the electric furnace and with the utilisation of electric power in the iron and steel industry, with special reference to the economical speed regulation of alternating current motors. Abstracts of these papers are given below:—

Electric Steel Refining.

Mr. D. F. Campbell in his paper on this subject said that the efficiency of the electric furnace was acknowledged in America, Germany, and France for the refining of steel from the Bessemer converter in the manufacture of rails, railway material, &c., in connection with the basic open-hearth process for the production of tool steel and intermediate qualities, and to a less extent for melting and refining charges of cold scrap. Single furnaces had been producing 200 tons of steel per day for over 16 months, and already several were under construction and at work in this country.

A wider application for rails and sections might occur in connection with the Talbot furnace, for the charge could be taken to the electric furnace as soon as the carbon was down, and the necessity of removing the sulphur and getting a teeming heat avoided, as this is done in the electric furnace both economically and completely. Similar conditions, he said, occur when working in conjunction with an open-hearth plant for making castings. Even in the case of foundries engaged in ordinary open-hearth casting work, in which the margin of profit is now exceedingly small, the electric furnace is considered necessary for an improvement in quality, while in a small foundry making light and intricate castings from crucible steel, an economy of several pounds per ton may be expected to result from the adoption of the electric furnace, judging from the reduction of the costs in works in Germany, where crucible furnaces were replaced by this process.

There is little doubt, continues the author, that crucible steel, Swedish billets, and products of intermediate quality, such as are used for the Sheffield trade and by tube-makers of Staffordshire and South Wales, can be economically replaced by steel refined by electricity, and made in Middlesbrough, Cumberland, or the larger steelworks in the Sheffield and Rotherham districts.

The use of the electric furnace is not likely to become general for rail-steel manufacture at the present time, except under exceptional conditions.

In the electric furnace, almost any degree of refining can be economically effected, and the removal of sulphur, phosphorus, and oxygen is especially easy. The steel is particularly free from blowholes, and the quality of the steel is better than that of a material of a similar chemical composition made in an oxidising furnace, owing probably to the reducing condition under which it is finished.

In considering the cost of applying the process, the following aspects of the matter must be considered:—The possibility of saving in cost of raw materials, since the best qualities of steel can be made from impure raw materials; the possibility of increasing the output of present furnaces by the addition of electric furnaces, with improvement of product; the possibility of using power derived from waste heat; the possible reduction of capital expenditure at works where the present products are not sufficiently good for modern specifications.

The author, on the whole, favours the Heroult furnace, as embodying more of the desirable features of electric-furnace design than any other, which, in the author's opinion, are:—(1) The best basic open-hearth design should be followed as closely as possible. A bottom homogeneous and solid, and banks free from embedded electrodes, is important. (2) All electric mechanism should be entirely separate from the furnace, and should be of standard design, so as to avoid all unnecessary risks and complications. (3) A high-power factor must be maintained. (4) To avoid excessive cost of refractory materials, the roof should be protected from the direct radiation of the arcs by the electrodes themselves, and the intensely heated area of slag should be as large as possible, to increase the surface of refining action. (5) The temperature of the slag should be maintained above that of the steel, and the conditions in the furnace should be oxidising, neutral, or reducing at will.

From the electrical engineer's point of view, he continued, the electric furnace is an attractive load, as it is more or less in continuous operation. In the case of the Heroult furnace the power factor is 0·88 to 0·90, though less with induction furnaces. Single, two, or three-phase current of any frequency from 20 to 60 has been used without difficulty. The load factor will be most favourable, the usual practice when refining, for example, in a 15-ton furnace, being to use 2,000 kw. for 20 minutes after charging, while the steel is being heated. The current is then reduced to about 1,500 kw. for 45 to 75 minutes, until the steel is ready for teeming. There is then an interval of 10 to 15 minutes, during which the furnace is teemed, fettled, and charged, which allows the transformers or generators time to cool before the period of overload commences. Current fluctuations occur for a few minutes, while there is an evolution of gas from the steel which makes the bath boil up and touch the electrodes. This, however, is not sufficient to be objectionable.

Variable Speed Three-phase Motors.

At the outset of his paper on "Electric Power in the Iron and Steel Industry" Mr. J. J. Elink Schuurman (Baden, Switzerland) remarked upon the economy to be obtained by the utilisation for power purposes of blast-furnace gas in large gas engines, and also said that in steelworks where there were no blast-furnaces in the immediate vicinity steam turbines had nearly entirely been adopted for the generation of energy. Most of the older equipments employed continuous current, but on account of its advantages as regards transmission, alternating current was now more usual. It suffered until recently from the disadvantage that economical motor-speed variation could not be made, but it was the object of the paper to show ways in which this difficulty had now been overcome.

For the driving of rolling-mills it is often necessary to obtain different no-load speeds, depending upon the rolling programme. The sort of mill used will determine whether these speeds should remain constant from no-load to full-load, or whether a drop of speed is required. The latter will be the case for blooming or similar mills, with which

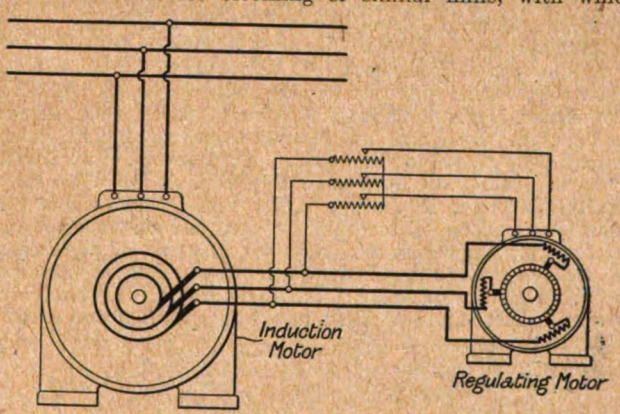


FIG. 1.—THE SCHERBIUS SYSTEM OF SPEED REGULATION.

considerable peak loads are experienced, which must be taken up by the use of rotating masses. For wire mills and the like, where the load remains fairly constant, a drop of speed is not necessary. Speed regulation is also essential for motors driving rotary blowers.

When the speed is constant, the high-speed rotary blower produces a pressure which is practically independent of the volume of air delivered, the volume depending only upon the section of the tuyeres. A change of pressure can be obtained by varying the speed, and as the pressure increases approximately with the square of the velocity, comparatively small alterations in the speed will suffice to produce the pressure-variations necessary for the operation. Besides the principal operations above mentioned, various small drives requiring regulation of speed come into account, such as live roller-beds, cranes, transporting apparatus, hoists, hydraulic pressure-pumps, &c. Most of these drives must also be reversible.

After a few words as to the wasteful nature of speed regulation of induction motors by rotor or slip resistance, and the disadvantage of this method of regulation that for a once-adjusted slip resistance the speed changes to a very great extent with variations of the load, and rises to practically its normal value at no-load, the author proceeded to

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describe the system of regulation which had been devised by Dr. A. Scherbius.

In this system, instead of the slip-rings being connected to a variable resistance, they are connected to an auxiliary motor (see Fig. 1) of the three-phase commutator type, so that the energy can be utilised. The auxiliary motor is shunt excited, and, possessing little inductance, can be regarded practically as running like a continuous-current machine. Speed regulation of the main motor is obtained

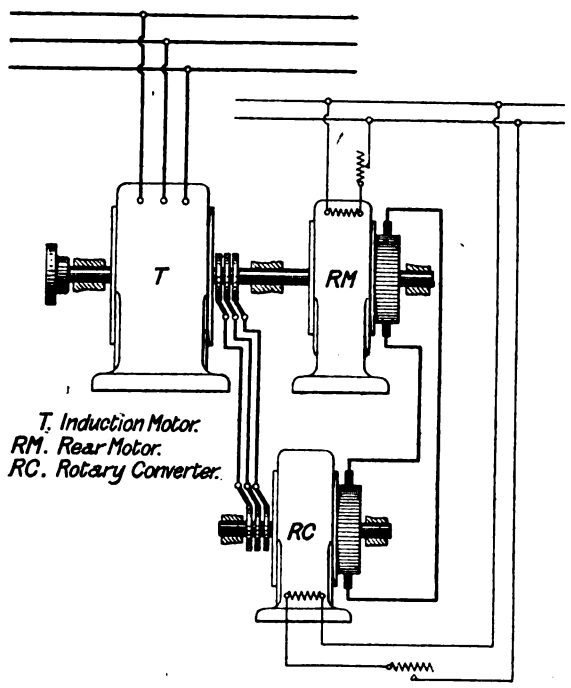


Fig. 2.—The Krämer System of Speed Regulation.

by adjustment of the excitation of the auxiliary motor, and thus controlling the motor voltage. A compound winding on the auxiliary motor can produce a drop of speed of the main motor, so that the energy of a fly-wheel may be drawn upon automatically if required. The auxiliary motor can either be coupled directly to the main motor, so that the slip energy is given back mechanically to the main driving shaft, or it can drive an induction generator and return power electrically to the line. In general, the former arrangement is the more desirable, but it is not always possible, as with it the regulating motor must follow the speed fluctuations of the main motor, and on this account becomes too expensive for very wide ranges of regulation. In such cases the regulating set, which runs at constant speed, is preferable. Another point about the Scherbius system is that it can be used to obtain speeds above as well

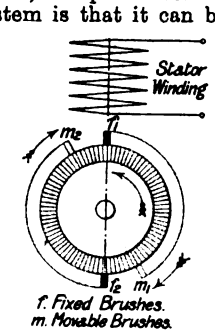
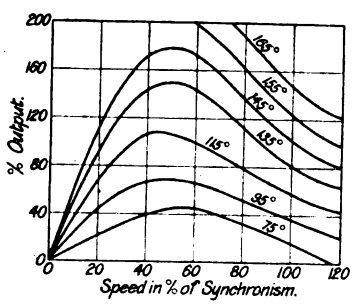


Diagram of Connections.



Characteristic Curves.

Fig. 3.—The Déri Variable-speed Single-phase Motor.

as below synchronous speed. It also permits of power-factor compensation.

The system due to Mr. C. Krämer was then described. In this case (see Fig. 2) the slip energy is converted by a rotary converter to continuous current, which is fed to a continuous-current motor assisting the main motor, and the speed is regulated by varying the resistance in the shunt field of the auxiliary motor. When resistance is cut out, the armature voltage, and the continuous-current voltage of the rotary converter, will increase. At the same time the alternate-current voltage at the slip rings must increase, as the continuous-current and alternate-current voltage of a rotary converter stand in a fixed relation to each other. The speed of the main motor will thus decrease. The system is capable of very wide ranges of regulation, but is rather more complicated than the Scherbius system; also it cannot be used so easily with existing motors.

The Déri single-phase repulsion motor offers a third solution to the problem, particularly in the matter of output It is shown diagrammatically in Fig. 3. The speed regulation and reversal is effected entirely by alteration of the position of the movable brushes.

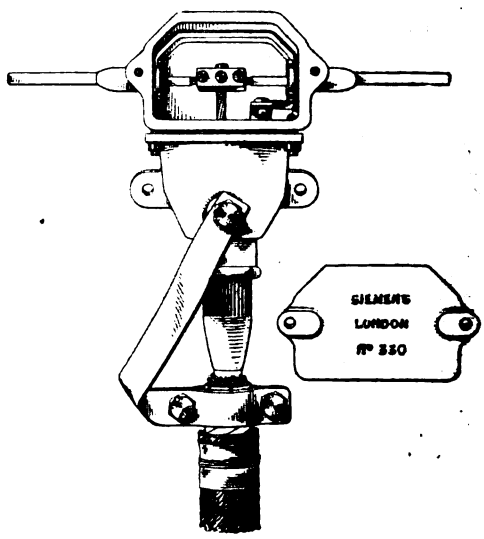
The motor has a series characteristic, or, more exactly, an infinite number of such characteristics, each being for a certain position of the brushes (see Fig. 3). By moving back the brushes over the zero position during running, regenerative control can be obtained.

The great advantage of the Déri motor is its simplicity. When the output is small, the single-phase Déri motor will hardly affect the even distribution of the load on the three phases of the system, especially if there are several such motors which can be divided over the different phases. But when large motor outputs come into question, it is better to make use of a double commutator motor, which electrically consists of two Déri motors, mechanically built into one.

Examples are mentioned in the paper of motors up to 2,000 controlled by the Scherbius system. The Krämer system is also in use in a few rolling-mills. Déri double commutator motors of 250 h.p. are under construction for a corrugated tube mill in Germany. The Déri motor is also suitable for cranes and other auxiliary machinery.

THE "STANNOS" WIRING SYSTEM

MESSRS. SIEMENS BROS. & CO., LTD., Carton House, Westminster, S.W., have sent us a new catalogue of their "Stannos" wiring system, and also a new showcard relating to this. The showcard, which is reproduced on a small scale on the second page of our cover this week, is lithographed in nine colours and measures 20 ins. by 15 ins., and it clearly emphasises the neatness with which the "Stannos" system can be erected. In addition to this, the firm have published a picture post card of this design in three colours, with a communication to the public on the front half which the wiring contractor can sign. Messrs. Siemens Bros. & Co. inform us that both showcards and post cards will be sent free on application to all



House Service Box.

who are willing to exhibit and dispatch them respectively, and if post cards are ordered in quantities of a hundred and upwards, the customers' names and addresses will be overprinted free of charge.

The new catalogue contains a complete description of the "Stannos" and allied systems of house wiring, and is brought completely up to date. "Stannos" wires are now made in five sizes, from 1/18 to 7/20 with ordinary sheathing, and in seven sizes from 1/18 to 7/16 with heavy sheathing. The latter is intended for ship lighting, railway coaches, or other places where a stronger protection is desirable. We illustrate a house service box specially designed for supplying a row of contiguous houses. It takes a low-tension concentric service cable up to ·05 sq. ins., and out-going "Stannos" mains up to 7/16 S.W.G., which can be run along the front of the house and branched off to similar "Stannos" wires by means of special water-tight T-joint boxes.

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THE WELLMAN AIRSHIP

SOME notes on the Wellman-Vaniman dirigible balloon *America*, with which an attempt to cross the Atlantic is projected, are given in the *Electrical World* (New York). The airship, which is 228 ft. long and is propelled by two 80 h.p. engines, is provided with an electrical equipment designed by Mr. B. R. Whelan, of the Buckeye Electric Company, and includes a ¼ kw. shunt wound 25 volt generator, arranged so that it can be connected to either of the two propelling engines or to the smaller auxiliary engine which is provided to work the air-pump for filling the ballonet and certain winches. There is also a 12-cell storage battery, a special Marconi wireless telegraph outfit, and eight 25-watt tungsten lamps with holophane steel reflectors are placed at various points. The wireless set is situated in the lifeboat, which is slung under the car-body of the balloon, and contains also the accumulator battery. The installation has a range of 75 miles, and uses about 250 watts, and the sending and receiving apparatus is connected between the steel car-body, which virtually forms the aerial, and the steel trail rope, which will be earthed by dipping in the sea. A very loose coupling is used to minimise the effect of the variations of length of the trail rope. The wireless apparatus will be in charge of Mr. J. R. Irwin, who received the famous C.Q.D. message from the *Republic* when stationed at Siasconset. The fact of the frame of the nacelle being used as part of the wireless aerial necessitated particular care in the insulation of other electrical circuits, and a special stranded cable was used, covered with a fine asbestos shield and immersed in rubber solidified to a coating of ⅛ in. thickness. This was then spun with jute to give tensile strength and the strands woven, encased in fabric, and treated with fireproofing solution. On puncture test this insulation withstood 26,000 volts.

A special bed plate and pulleys are provided in connection with each engine, so that the generator can be attached to any one and driven at the proper speed, and permanent wiring is brought to each position with a multiple switch for the circuits from each engine position. The wireless apparatus and the lights are usually run in parallel from the battery, but either or both can be supplied direct from the generating plant if necessary. All connections between the lifeboat and the nacelle can be broken by withdrawing a single plug in case the boat has to be lowered rapidly.

The lamps are arranged as follows:—One each for the binnacle and the log, one over each of the three engines, two at the observation cabin at the stern, and one in the lifeboat for the wireless operator. The lamps are run above their rated voltage, as their brilliancy is of more importance than their life, considering the anticipated length of the trip.

The cable, where exposed, is carried in porcelain cleats screwed to large wooden blocks which are lashed to the nacelle with insulated cordage. Where it is necessary to run along the framework or through the steel tank covers, the cable is encased first in flexible duct and then in ⅛ in. fibre tubing. The switchboard also is well insulated from the frame of the ship by wood, rubber and heavy fibre between each connection and the steel tubing to which it was lashed.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to The Editor, ELECTRICAL ENGINEERING, *203-6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

R. J. S.—A letter sent to the Puerto Cortez and Baracoa Electric Company, Puerto Cortez, Honduras, will be sufficiently addressed.

EALING informs us that on replacing his kitchen switch, which had become mechanically defective, the light in adjoining scullery was affected. Before replacing the switch the scullery light flickered when the wires to the kitchen switch were pulled in and out, although the looping-in wire was twisted up tightly, and on replacing the switch he found that the scullery light would not light at all.—In all probability the looping-in wire, which runs from the kitchen switch to the scullery switch, has got broken either at the back of the kitchen switch or else at the scullery switch by having been pulled. We should recommend him to take out the kitchen switch again and examine the wires behind, and then do the same with the scullery switch. If he can discover nothing wrong, he should connect up a new looping-in wire from the kitchen to the scullery temporarily, and if this restores the light in the scullery, as it probably will, it will show that the looping-in wire is broken.

NEWPORT'S question in our last issue has aroused some interest, and we have heard of a recent case in which the deduction, by a firm of consulting engineers, of their subscriptions to the Institution of Civil Engineers, and other professional institutions in their income tax returns, has been allowed, as it certainly should be.

BLACKFACE.—"Electrical Practice in Collieries," by Professor D. Burns (third edition, published last year), post free, 7s. 10d. "Electricity as Applied to Mining," by Professor A. Lupton, G. D. A. Parr, and Herbert Perkin (second edition, published 1906), post free, 12s. 5d.

ENQUIRER writes us that the "Cricket Pitch Rule" is mentioned in the City and Guilds of London Institute's prospectus of examinations in Electric Wireman's Work, and asks us what it means.—There is one volt drop on a *20 yards run* at 1,000 amperes per square inch. We do not know who invented the name "Cricket Pitch Rule" for the benefit of the City and Guilds examiners; the name is unfamilar to the majority of wiring contractors and consulting engineers.

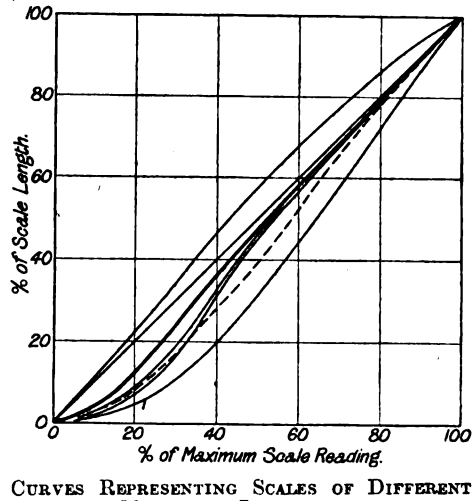
SCALES OF MOVING IRON INSTRUMENTS

THE most perfect scale from the point of view of even division is that of the moving coil instrument. This, unfortunately, is not available for alternating current. The nearest approach to it is the induction instrument, but its expense is too great to justify its use in many cases, and



MOVING IRON AMMETER.

recourse must be had to the moving iron instrument. The British Westinghouse Co. have recently brought out a line of such instruments, which, although differing but little in general construction from other instruments of its class, possesses an exceptionally good scale owing to the special shape of the armature, the result of lengthy experiments.



CURVES REPRESENTING SCALES OF DIFFERENT MAKES OF INSTRUMENT.

An ammeter of this series is illustrated here, and a diagram is also given showing the relation of scale length to scale reading for this instrument compared with an ideal straight-line scale, and the scales of a number of instruments of well-known makes. The thick line represents the new Westinghouse scale, and a dotted curve has been added to show the scale of an induction instrument.

The Municipal Wiring Bill.—Barking and Tynemouth have promised to support this Bill and contribute to the cost of its promotion. Stepney has promised "moral" support, and will consider the question of giving financial support when the Bill has been deposited.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 29th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

18,583/09. **Automatic Sign Switches.** R. F. Venner and R. C. Griesbach (London). The slowly rotating contact-drum of a changing illuminated sign is combined with an intermediate quick-acting carbon-break switch, which comes into action immediately before the actual lamp contacts are operated. The intermediate switch is worked by a compound cam consisting of a slotted disc on a rotating shaft and a spring-controlled cam loose on the same shaft. Seven figures.

19,949/09. **Lamp Fitting.** E. Imer (Geneva). This specification covers a totally enclosed dust-proof fitting comprising an upper reflector, an inverted translucent bowl, and an intermediate cylindrical cover of clear glass, as was described and illustrated in Electrical Engineering, December 2nd, 1909, Vol. V., p. 1040. Three figures.

20,435/09. **Ceiling Rose with Detachable Plug.** A. H. Shaw (Blackburn). To facilitate the removal of pendants suspended by flexible from ceiling roses, the flexible is secured to a plug, which is fixed into the ceiling rose by a side screw. Contacts on the plug engage with corresponding contacts in the ceiling rose. Four figures.

20,639/09. **Heating and Cooking Apparatus.** A. F. Berry (Ealing). This specification describes apparatus in which a large mass of metal of great heat capacity is heated up continuously or at times when power can be obtained cheap, and the heat utilised at intervals. Blocks of suitable material are enclosed in heat-insulating covers, and when the heat is required the covers are either taken off or a metal plate is put in contact with the block in order that the heat may be transferred by conduction. Various arrangements with self-contained transformers for A.C. circuits are also described. Ten figures.

20,815/09. **Meter and Method of Charging.** Siemens Bros. Dynamo Works, Ltd., and F. Lydall. A meter is described which records at a rate depending upon the irregularity of the demand. It thus retains the essential feature of the maximum demand system with the advantage of only one instrument and a direct reading. The system consists in charging at a fixed rate per unit multiplied by a variable factor representing the degree of irregularity. This factor is the ratio of the root mean square value of the current over a long period, such as a quarter-year, to the average current. The speed of the meter is made proportional to the square of the current, and it records the mean square of the amperes flowing over a predetermined period multiplied by the square of the supply voltage, and the square of the number of hours in the period, divided by one million. The construction of the instrument is described. Four figures.

22,997/09. **Heating Apparatus.** H. A. Kent (London). Heating elements are constructed by enclosing tungsten in a granular form in silica glass tubes having electrodes fused in at each end. The tubes are exhausted, or many contain a residue of an inert gas.

23,416/09. **Voltage Regulation.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). In order to produce a compounding effect in A.-C. circuits, two transformers are connected with their primaries in series with each other and in shunt to the supply, and their secondaries in series with each other and with the load. One transformer has a saturated and the other an unsaturated core, and the relative connections are reversed so that the secondary voltages are in opposition. At no load the voltages are equal and opposite, but as the load increases, the magnetisation of the unsaturated transformer is increased. This increases its voltage, and thus raises the main voltage. One figure.

25,273/09. **Wood Separators for Storage Batteries.** Tudor Accumulator Co., Ltd. (*Accumulatoren Fabrik A.G., Berlin*). In order to remove acids and other constituents from wood separators for storage batteries, they are treated by a solution of sulphuric acid or of caustic potash, and afterwards washed in water. They are then soaked in a 10 per cent. solution of glycerine before drying, in order to prevent warping or cracking.

26,005/09. **Ventilation of Motors.** H. A. Mavor and Mavor & Coulson, Ltd. When a fan is fitted to a motor for ventilating purposes, it does not always co-operate with the natural ventilation due to the radial passages in the armature, and eddy currents are produced. To prevent this, two radial type fans are arranged at the same end of the motor; one supplements the action of the armature passages, and the other forces air through the field system in the opposite direction. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Rustige [Vapour lamps] 20,853/09; Cibie, 21,008/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Anderson, Russell and Gray [Distribution system] 21,219/09; Highfield [Manufacture of cables] 22,287/09; W. T. Henley's Telegraph Works Co., and Penning [Cable connectors] 25,449/09; Witzenmann [Cable armouring] 28,178/09; Woodward [Cable armouring] 28,291/09.

Dynamos, Motors, and Transformers: Fitz [Dynamos] 30,333/09; W. A. Stevens, Ltd., Stevens and Lambert [Brushes] 1,145/10; Farny [Machines] 4,907/10; Siemens Bros. Dynamo Works (*Siemens-Schuckertwerke Ges.*) [Armature windings] 8,410/10 and [Polyphase motors] 10,172/10; Allgemeine Elektricitäts-Ges. [A.-C. commutator machines] 10,692/10.

Instruments and Meters: Cambridge Scientific Instrument Co. and Whipple [Radiation pyrometer] 21,369/09; Van Driel [Instrument for recording audible signals] 855/10; Oehring [Switch for prepayment meters] 4,883/10; Siemens & Halske A.-G. [Receiving and recording devices for signals] 13,985/10.

Storage Batteries: Taylor [Charging systems] 18,636/09.

Switchgear, Fuses, and Fittings: Cowper-Coles [Lamp reflectors] 16,304/09; Wakefield [Hand-lamps] 20,764/09; Walters [Automatic voltage regulator for machines in parallel] 20,869/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Selective switch systems] 21,303/09; Schultz and Holt [Switches] 25,278/09; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Switches] 2,748/10; Hanwell [Anti-vibration lamp-holders] 5,384/10; Newton (*Kelly*) [Switches] 7,276/10.

Telephony and Telegraphy: Ball and Readman [Telegraph insulators] 22,878/09; Burney and Sterling Telephone & Electric Co. [Intercommunication telephones] 28,951/09; Deutsche Telephonwerke Ges. [Automatic telephone systems] 7,851/10; Thompson (*Arco and Rendahl*) [Variometers for electrical oscillations] 8,018/10; Lee [Automatic telephones] 10,162/10.

Traction: Hadfield [Tramway points] 24,516/09; Metcalfe [Vacuum brakes] 27,802/09; Bate [Signalling] 29,978/09; Patterson [Electric cab signalling] 3,637/10; Windhoff [Brake mechanism] 11,057/10.

Miscellaneous: Winter [Vacuum tubes] 29,143/09; Wallis [Electrical apparatus for perforating designs] 3,825/10; Lugard [Electromagnetic clutch] 12,259/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: Specialfabrik für Aluminium Spulen und Leitungen Ges. [Production of insulating oxide film on wire of bare aluminium wire coils] 20,634/10; Allgemeine Elektricitäts-Ges. [Starting machines] 20,759/10.

Electrometallurgy, &c.: Gibbs [Electrolytic manufacture of wire] 19,593-4/10; Levoz [Electrical production of steel] 20,594/10; Consigliere [Electro-deposition] 20,776/10.

Instruments, &c.: Strelow [Ferraris meters] 21,240/10.

Traction: Cooper [Gear for electric vehicles] 18,850/10.

Miscellaneous: Molière [Electromedical apparatus] 20,760/10.

The following amended Specification can now be obtained.

Salpetersäure Industrie-Ges. [Arc furnace for treating gases] 19,466/09.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: Johnson-Lundell Electric Traction Co. (*J. G. V. Lang, Germany*) [Control of traction motors] 13,564/04; W. O. Duntley [Breast-drill motors] 13,724/04.

Electrometallurgy, &c.: W. Elworthy [Ozone generator] 12,612/99.

Incandescent Lamps: S. Horvath and Utility Co., 12,598/05.

Instruments, &c.: S. H. Holden and Chamberlain & Hookham [Electrolytic meters] 13,223/04.

Storage Batteries: F. T. Kelly, 12,253/05.

Switchgear, &c.: J. N. Goodall [Wiring conduit] 12,242/05.

Telephony, &c.: J. Gell [Tape mechanism for telegraph instruments] 13,109/03.

Miscellaneous: E. Lytton [Electric scenery-raising gear] 13,364/03.

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OSRAM LAMP ADVERTISING

"OSRAM Lamps make electricity cheaper than gas," is the keynote of the General Electric Company's advertising for the autumn season. The company has prepared a very large assortment of advertisement folders, price

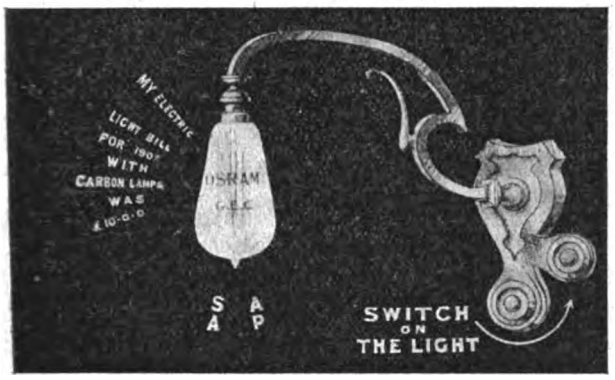


Fig. 1.

lists, picture postcards, novelty cards, picture albums, leaflets, invoice forms, adhesive labels, showcards and window bills, all of which are offered to the trade printed with the contractor's name and address on free of charge, and we recom-

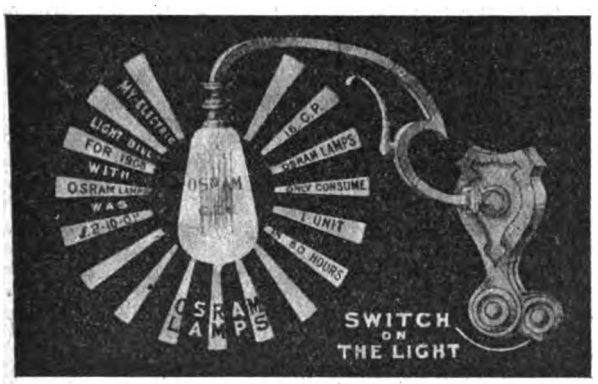


Fig. 2.

mend our readers to make early application for these. A dozen different designs have been sent us as specimens, most of which are extremely effective. These include some new matter, and the best of the older designs which have done



Fig. 3.

such good service hitherto. One of these is illustrated in Figs. 1 and 2. It is a card representing a lamp on a bracket, with the words seen in the figure appearing on a black background. On moving down the little cardboard switch handle at the left of the card, the appearance of the card is changed to that shown in the second figure, emphasising the gain in replacing carbon lamps by Osram lamps. Fig. 3 is a reproduction of a large poster which is being displayed in selected towns through the United Kingdom in well selected and prominent positions. The size of the poster is 120 in. by 80 in., and it is printed in eight colours. Copies are offered to all contractors who care to display it on their premises, with an additional slip to place underneath, bearing the words, "Sold here," and picture postcards with the same illustration are also available. So far as street lighting is concerned, the Osram lamps have made great progress, and we are informed that over 140 towns in this country use Osram lamps for street lighting, in most cases in replacement of gas lighting.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

HARDENING FURNACES.—A leaflet from S. N. Brayshaw, 2 Mulberry Street, Hulme, Manchester, contains particulars of the latest improvements that have been made in the well-known Brayshaw gas- and oil-heated salt bath furnaces for hardening steel. An entirely new form of burner is used, without air blast and the arrangement of the melting-pot has been somewhat altered so that it is impossible to splash the salt on to the outside. The scaling of the pot, and the emission of the salt fumes are thus avoided. The new burner also consumes much less gas.

BOILER FITTINGS.—A leaflet from the Crosby Steam Gauge & Valve Co. (147 Queen Victoria Street, London, E.C.) describes the Crosby feed water regulator, and illustrates its use on the main feed pipe, and as a control valve for the feed pump. It is drawn up by the Engineers' Standardised Publications Association, and an index card is sent out with it.

BATTERY LAMPS.—Another list issued by the Engineers' Standardised Publications Association describes the "Thomson" patent lamps for inspection, police, and pocket use, also cycle lamps. The sole agents for these are H. E. Wilson & Co. (20 Cross Street, Manchester).

METERS.—A new pamphlet from the Allgemeine Elektricitäts-Gesellschaft. enumerates the various types of electricity meters constructed by that firm, and discusses the applications and special features of each pattern.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

D.C. MOTORS AND GENERATORS.—An illustrated booklet just issued by Crompton & Co., Ltd. (Salisbury House, London Wall, London, E.C.) gives particulars and prices of five different types of standard enclosed D.C. motors. These are manufactured in fourteen sizes of from 2 to 125 B.H.P., a large number of windings giving a wide range of speed being standardised for each size. The five types are protected, semi-enclosed, dust-proof, pipe-ventilated, and totally-enclosed, respectively. Geared motors with various ratios up to 4·5 to 1, field regulators, starters and a line of series reversible crane motors, are also listed. A table of outputs of the above motors when used as dynamos is also given.

MERCURY-VAPOUR CONVERTERS.—A leaflet from the Westinghouse Cooper Hewitt Co., Ltd. (151 Great Saffron Hill, Holborn Circus, London, E.C.) describes the latest design of mercury-vapour converters for supplying direct current for battery-charging and other purposes from an A.C. supply. These have capacities ranging from 3 to 30 amperes, and the largest size (7—30 amps.) is listed for three-phase as well as single-phase circuits. A table of comparative charging costs with mercury-vapour converters and motor-generators shows a considerable margin in favour of the former. We understand that the Post Office and the National Telephone Co. are using these converters.

BLUE-PRINTING.—Another leaflet from the Westinghouse Cooper Hewitt Co., Ltd., describes a blue-printing outfit, comprising two mercury-vapour lamps mounted in a special reflector.

ARC LAMPS.—The Gilbert Arc Lamp Co., Ltd. (Chingford, Essex), have issued a new catalogue of arc lamps and accessories illustrated with photographs of the various types of lamps and different patterns of cut-outs, switches, resistances, &c. The lamps listed include the "Flamme" four converging carbon pattern, the "Beacon" flame lamp recently described in Electrical Engineering, and enclosed lamps. A useful feature of the catalogue is a group photograph of the spare parts of each lamp, each part being numbered and priced in a key list.

ARC LAMPS.—An illustrated list is to hand from the A. E. G. Electric Co., Ltd. (Pembroke House, 133 Oxford Street, London, W.). The general features of the A. E. G. lamps are described, and brief particulars of the "Sunshine" and "Blondel" flame lamps are given. The latter has vertical carbons. Transformers and resistances are also listed.

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LOCAL NOTES

Aberdeen: *Bonus Scheme.*—The proposal of the Borough Electrical Engineer to institute a bonus system for the encouragement of employees has been rejected by the Council.

Bath: *Electric Tramways.*—The Bath Electric Tramways Co. are applying to the Board of Trade for an extension of time for the construction of the light railway to Saltford, authorised under an Order granted in 1906.

Street Electric Lighting.—Metal filament lamps are gradually displacing gas, and in some cases arc lamps, in the streets of Bath. The 100-c.p. Osram lamp is being adopted, and already 112 have been installed. As the Gas Company's contracts expire, the new method of lighting is being substituted.

Bedford: *Electricity Accounts.*—The loss on the electricity undertaking to March, 1910, of £1,007 was the subject of some comment at the last meeting of the Town Council. It was pointed out that the estimates for 1909–10 show a loss of only £369, and it was suggested that the estimated loss of £110 for the present year might be equally wide of the mark, but the Chairman of the Electricity Committee stated that a sub-committee is investigating the working of the electricity department, and will report to the Council later on. At present it seemed that there would be a profit at the end of March, 1911, instead of a loss as estimated.

Belfast: *Cavehill and Whitewell Tramways.*—An arbitrator is to be appointed to determine the price to be paid by the Corporation for the undertaking of the Cavehill & Whitewell Tramways Co.

Cardiff: *Tramways Accounts.*—Mr. Arthur Ellis, the Tramways Manager, reports a profit of £11,000 from the tramways in the past year, against £5,954 in the previous year. In July, 1909, the receipts began to fall off considerably, but since the inauguration of a new system of fares the whole of the lost ground has been recovered with the satisfactory results shown above.

Dartford: *Electricity Accounts.*—The accounts for the year to March 31st show a net profit of £628 after meeting capital charges, compared with £57 in the previous year. The power supply shows an increase of 73 per cent., compared with 1909. All the Nernst lamps which have been used for street lighting hitherto have been replaced by Tantalum lamps.

Derby: *Tramway Accounts.*—There was a net profit of £3,649 on the tramways for the year to March 31st, compared with £3,733 in the previous year.

Dundee: *Peters Electrical Engineering Laboratory.*—Professor Ernest Rutherford will formally open the new Peters Electrical Engineering Laboratory at the University College to-day.

Finchley: *Underground Telephone Wires.*—A difference between the Postmaster-General and the District Council with regard to the erection of overhead telephone wires, which the Council insist should be laid underground, has been referred to the Barnet County Court for hearing.

Gateshead: *Tramway Extensions.*—Some extensions of the Gateshead & District Tramways Co. were inspected on behalf of the Board of Trade on Friday. The additions bring the total length of the system up to 18½ miles.

Halifax: *Proposed Tramway Extensions.*—Deputations from the Elland, Barkisland, Soyland & Rishworth District Councils have waited upon the Tramways Committee asking for the extension of the tramways to that district.

Hastings: *Live Studs.*—A van horse was killed last week through coming into contact with a "live" stud on the Dolter system running along the front.

Leeds: *Trolley Omnibuses.*—Arrangements are being made for an early commencement of the work of equipping the route from City Square to Farnley for trolley omnibuses.

Leek: *Electric Supply.*—It is proposed to ask the Stoke County Borough to allow their Chief Electrical Engineer, Mr. C. H. Yeaman, to report upon some proposed extensions of the Electricity Works at a fee of 10 guineas.

Llanelly: *Electric Lighting.*—A start has been made with laying the cables for the local electric supply company's undertaking. The District Council have given the Gas Company six months' notice to discontinue the street lighting. Electricity will be adopted for the whole of the streets of the borough from January 1st.

London: *Hampstead: Electrical Exhibition.*—An exhibition of electrical appliances was opened at the Finchley Road Baths on Tuesday, and continues until Saturday. We hope to publish a fuller account of it in our next issue.

Chelsea: Tramways.—The Council have refused their consent to the proposal of the London County Council to construct tramways to link up the Borough with Kensington and Battersea.

Kensington: Tramways.—The Council have also refused their consent to the tramways connecting up Kensington and Battersea.

Marylebone.—The June quarter's report on the working of the electricity undertaking shows an increase in units supplied of 113,447, or 6·3 per cent., compared with the corresponding period last year. This does not include public lighting. The accounts show a trading profit for the quarter of £15,48[illegible] to meet capital and special charges, compared with £15,18[illegible] the previous June quarter. There was a loss on the [illegible] department of the quarter of £509.

Poplar: Electricity Accounts.—The net profit on the electrical undertaking for the year to March 31st was £4,42[illegible]

Stepney: Objections to Trolley System.—The Works Committee recommend the Council to refuse consent to the [illegible] of the overhead trolley system by the London County Council in Burdett Road and Grove Road. The County Council draw attention to the heavy cost of the conduit system and the fact that the trolley is already used in Stepney, but the Borough Council reply that at the time they consented to the introduction of the trolley system, they did so on the understanding that it was not to be regarded as a precedent.

Middlesbrough: *Noise of Tramcars.*—The Borough Engineer has reported to the effect that the noise from the tramways, which has been complained of recently, is due both to the wet condition of the track and of the tramcars. A copy of the report is to be sent to the Tramway Company.

Newport (Mon.): *Trolley Omnibuses.*—The Borough Electrical Engineer has reported upon the adoption of trolley omnibuses in the town, and recommends the Tramways Committee to keep the possibility of this method of traction in mind. The Committee will no doubt, he says, have to go to Parliament in the near future for powers to construct additional tramways, and that would be an opportunity for obtaining powers to adopt trolley omnibuses as feeders.

North Middlesex: *Electric Supply Mains.*—The North Metropolitan Electric Power Supply Co. are laying trunk mains through Enfield, Southgate, and Wood Green.

Paisley: *Price of Tramway Energy.*—An Arbitration under the Paisley District Tramways Order Confirmation Act, 19[illegible] to settle the price to be paid for the electrical energy for the next seven years by the Paisley District Tramways Co. to the Paisley Corporation, will start on Friday next, October 7th, at the Westminster Palace Hotel. The arbitrator appointed is Mr. Robert Hammond, and the engineers engaged in the case are Messrs. Mordey & Dawbarn on behalf of the Paisley Corporation, and Mr. Horace F. Parshall on behalf of the Paisley District Tramways Co.

Rotherham: *Trolley Omnibuses.*—After a long discussion the recommendation of the Tramways Committee to apply for powers, to run trolley omnibuses in a large number of districts, has been carried.

Southampton: *Tramways.*—The Council have decided to apply for Parliamentary powers to construct tramways in High Street, Town Quay, and Royal Pier, to Southampton West Station, and *via* The Avenue to the Borough boundary.

South Wales: *New Works.*—It is reported that two large schemes for the establishment of industrial works at Port[illegible] are in contemplation. These will include coke ovens, steel works, and tinplate and galvanising works, which will have their own power station.

Watford: *Trolley Omnibuses.*—A long discussion took place at the last meeting of the Council with regard to the proposal of the Hertfordshire County Council to seek powers to run trolley omnibuses through Watford, opinions being somewhat divided on the point, but no resolution was carried.

West Bromwich: *Electrical Extensions.*—At a recent Local Government Board inquiry into a loan of £11,386 for electrical extensions, Mr. H. R. Hooper, the Inspector, suggested that it would have been wiser to adopt an alternating current system instead of direct current. The Borough Electrical Engineer has prepared a report upon this proposal. He sees no reason to spend an additional £2,000 in putting down alternating current plant in view of the fact that direct current supply has effectually met the demand for power purposes in the past.

West Ham: *Tramway Accounts.*—The net profit on the tramways undertaking during the past year, after meeting capital charges, is £3,757. This amount the Council have decided to devote to relief of rates, although a large number of the members desired that it should be placed to reserve fund.

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TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Aberdeen.—A loan of £55,000 is to be applied for, for extensions to the refuse destructor in order to supply additional steam to the electricity works.

Bexhill.—Extensions are contemplated at the Electricity Works at an estimated cost of £4,500.

Chester-le-Street.—Tenders are invited for the installation of electric light and power at the Infectious Diseases Hospital and for 600 yards of overhead transmission line. Particulars from the Clerk, and tenders by October 19th.

Dundalk.—A loan of £20,000 for electric lighting has been sanctioned.

Halifax.—Tenders are invited for a 1,500 kw. turbo-alternator; two 750 kw. rotary converters with transformers; and switchboard. Particulars from the Borough Electrical Engineer, and tenders by October 17th.

Hornsey.—A loan of £6,000 for mains and services is to be applied for.

London: *Hampstead.*—Mains are to be laid in Gainsborough Gardens and Fairfax Mews at an estimated cost of £91.

Marylebone.—The Electricity Committee recommend an expenditure of £1,000 upon mains.

Stepney.—The Electricity Committee recommend a further expenditure of £7,150 upon plant for the Blyth's Wharf generating station.

Mains are to be extended in Mile End Old Town, Whitechapel, and Spitalfields.

Oldham.—The Electrical Engineer reports that the maximum load last winter was 3,318 kw., and the total plant capacity 3,160 kw., and suggests the installation of a 1,200 kw. mixed pressure turbine.

St. Helens.—Sanction has been given to a loan of £10,206 for buildings, switchgear, transformers, rotary converters, water softening plant, &c.

Stoke-on-Trent.—The Chief Engineer has been instructed to report upon the financial position of the electrical undertaking with special reference to over-expenditure and prospective borrowings.

Walsall.—An inquiry was held last week concerning a loan of £23,225 for electrical extensions. Some time ago the Town Council applied for a loan of £35,000, but to this the Local Government Board withheld their sanction, and certain suggestions then made by the Inspector have since been under consideration. The Town Clerk stated that an offer had been made by the Shropshire Power Co. to supply energy in bulk at 0·75d. per unit, subject to a minimum supply of 2,500,000 units per annum; but the Borough Electrical Engineer had satisfied the Committee that he could, with the new plant proposed, generate at 0·52d. per unit, a claim which was supported by the fact that during the past six months he had, with the existing plant, been generating at 0·62d. per unit.

West Bromwich.—An additional feeder at an estimated cost of £480 is to be laid.

West Hartlepool.—The Council are considering a proposal to utilise the waste heat from the furnaces of the Seaton Carew Iron Co. for the purpose of generating electricity. If the scheme is adopted, a new generating station will be erected at an estimated cost of £20,000.

York.—Extensions to the generating plant are to be carried out.

MISCELLANEOUS

Australia.—Tenders are invited by November 23rd, by the Deputy Postmaster-General, Brisbane, for phosphor-bronze wire and galvanised iron wire, cable, telephone and telegraph instruments, switchboards, measuring instruments, &c. Particulars from 73 Basinghall Street, London, or the Australian Commonwealth Offices, 72 Victoria Street, London, S.W.

Brazil.—The sum of £25,500 has been allocated by the Government for the construction of a telegraph line from the State of Matto Grasso to that of Amazonas.

Japan.—A British consular report states that a concession has been obtained for a tramway to Sahai, a prosperous city six miles to the south of Osaka. A number of other schemes are also being considered.

South Africa.—The Johannesburg Corporation are inviting tenders for five electric tramcars. Specifications, &c., may be seen at 73 Basinghall Street, London.

Wolverhampton.—Extensions are to be made to the refuse destructor in order, among other things, to be able to supply steam more regularly to the Electricity Department.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Church in Salusbury Road, Kilburn.

Tenders are invited by the West Ham Union for the wiring of the Receiving Homes at Aldersbrook Road, Wanstead. Particulars from Mr. W. Jacques, 2 Fen Court, London, E.C.

Building in Henrietta Street, Marylebone. Architects, Messrs. Belcher & Johass.

Additions to restaurant accommodation at Charing Cross Hotel.

Assembly Hall and Electric Theatre, Finchley.

Central Cooking Depôt at Tottenham. Education Committee.

Extension of Hammersmith Workhouse buildings.

It is stated that Mr. Oscar Hammerstein has now arrived in London in connection with his scheme for an opera house in Kingsway, and that an architect is engaged on the plans.

Block of schools in Southbury Road, Enfield. Architect, G. E. T. Laurence, 22 Buckingham Street, Adelphi, London.

P.O. Sorting Office, Deptford. H.M. Office of Works.

Enlargement of Census Offices. H.M. Office of Works.

Extension of Territorial Headquarters, Chiswick. War Office.

PROVINCES.

Aberdeen.—Lending Library. Libraries Committee.

Barnard Castle.—Alterations to Workhouse.

Bournemouth.—New Workhouse Infirmary.

Brighouse.—Proposed erection of public baths.

Carnarvon.—Council Chamber and Offices.

Chelmsford.—Additions to Grammar School.

Chester.—Annexe at Upton Asylum. Architect, H. Beswick, Newgate Street.

Coventry.—South Street Council Schools.

Doncaster.—Theatre of Varieties in Silver Street.

Dudley.—Alterations at Holly Hall School.

Galway.—Proposed sanatorium. Town Clerk.

Glasgow.—Theatre in Govan Street.—Three-storey building at 250 Crown Point Road. Architect, John Burnside.—Extension of offices, boiler house, &c., at Ruchill Oil Works. Architects, Messrs. Kyle, Dennison & Laing.—Rebuilding John Anderson's Royal Polytechnic. Architects, Messrs. Clark & Bell.—Labour and telephone exchange, College Street. Clerk of Works, G.P.O., Hanover Street.

Govan.—Electric theatre, Park Street. Architect, Mr. N. C. Duff, 115 Wellington Street, Glasgow.

Isle of Thanet.—Electric theatres at Margate, Broadstairs, and Ramsgate. Margate, Broadstairs, and Ramsgate Electric Theatres, Ltd.

Liverpool.—Additions to workhouse, Ruthin.

Peterborough.—Additional accommodation at Infirmary.

Reigate.—Conversion of existing buildings into disinfecting station. Borough Surveyor.

Southampton.—Proposed new college at Highfield. Hartley University.

St. Albans.—Parochial Hall and Institute. Abbey parish.

Sunderland.—Alterations to Bede Collegiate School. Education Committee.

Swansea.—Buildings for the Glamorgan County Territorial Force Association. Capt. C. J. Wilkie, 20 Dumfries Place, Cardiff.

Swindon.—Branch of London & Provincial Bank, Wind Street.

Warrington.—Elementary school, Lower Wash Lane.

Watford.—Additions to Printing Works, Bushey Grove Road. Messrs. André & Sleigh.—New science and art rooms, Royal Masonic Schools.

Wolverhampton.—Twenty-six houses, Woden Road. H. Stocking.—Extension to Star Engineering Co.'s Works, Dobs Street.—Additional workshops, Sunbeam Motor Car Co.

OSRAM·LAMPS

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TENDERS RECEIVED AND ACCEPTED

Aldershot.—The Council have decided to purchase a Bennis mechanical stoker at £205.

Argentine.—According to the *Review of the River Plate*, the tender of Messrs. Winby & Co. for the installation of electric tramways in Santa Fé is recommended for acceptance. It is expected that a contract will shortly be signed with Messrs. Agar, Cross & Co., the South American representatives of the British Westinghouse Co., for the construction of electric tramways in Mar del Plata.

Blackpool.—The Council have accepted the tender of Messrs. David Rowell & Co., London, for five new tramway shelters; and the Brush Electrical Engineering Co., Ltd., for a new 40-h.p. motor for use at the Refuse Destructor.

Chelmsford.—The tender of the Electrical & Motor Co., Banbury, has been accepted for the electric lighting of the Trinity Road School at £175.

Bury.—The tender of Messrs. G. Freeman & Sons has been accepted for condenser pipes for the new power house.

London: *Hampstead.*—The Council have renewed their contract with the Aron Meter Co. for the maintenance of their Aron meters at 2s. per meter per annum.

Marylebone.—A second coal grab for the electricity works is to be supplied by Messrs. S. Williams at £85.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. G. Potts, at present on the staff of the Bury Electricity Works, has been appointed Clerk of Works in respect of the electrical plant at the Corporation's new power station, at a salary of 50s. per week.

Mr. C. H. Yeaman, Chief Electricity Engineer to the County Borough of Stoke-on-Trent, has been presented with a case of pipes and a book on "Higher Mathematics" by the staff of the Hanley Electricity Works.

Mr. W. A. Turnbull, at present Chief Assistant Electrical Engineer to the city of York, has been appointed Resident Engineer at the Stoke-on-Trent Electricity Works under Mr. C. H. Yeaman, Chief Electrical Engineer to the County Borough of Stoke-on-Trent.

On the occasion of the conversazione and dance of the Robertson and Osram Social and Athletic Club next Saturday, a portrait of the chairman, Mr. H. Hirst, which has just been completed by Prof. Sir Hubert Von Herkomer, R.A., will be presented to Mrs. Hirst by the shareholders of the Company.

A Laboratory Demonstrator is required in the Electrical Engineering and Allied Physics Department of the Northampton Polytechnic. Commencing salary £100 per annum. Also junior demonstrator, £80 per annum. (See an advertisement on another page.)

A General Manager or Works Manager is required by a leading manufacturer of magneto machines. (See an advertisement on another page.)

An Assistant in the Ipswich Corporation mains department is required. (See an advertisement on another page.)

O. B. Richardson, engineer in charge at Whiston Street, Shoreditch, has resigned. A successor is to be advertised for.

A correspondence clerk is required in the Swindon Electricity & Tramways Department. Salary £50 per annum. Applications to the Town Clerk by October 10th.

A collector is required in the Sheffield Electricity Department. Salary £120 per annum, rising to £150. Applications to the General Manager by October 8th.

Mr. B. Waite, district manager of the National Telephone Co., at Cardiff, has been presented with a silver cigarette case and matchbox on the occasion of the taking over of the exchange by the Post Office.

Next Year's Exhibition at the White City.—It has been decided to hold a "Coronation" Exhibition next year at the "White City," Shepherd's Bush, at which all parts of the British Empire are to be represented. A portion of the receipts, guaranteed not to be less than £5,000, will be devoted to the Mansion House Fund for a national memorial to the late King Edward VII.

Ventilation on Board Ship.—A decision given recently by Judge Rentoul in the City of London Court will be of some interest to the suppliers of electric fans. In this case Mr. Justus Eck (of the Union Electric Co.) recovered damages from the Union-Castle Steamship Co. to the extent of a charge that has been made for extra accommodation, rendered necessary by the insufficient ventilation of a cabin originally allotted to his wife. It was held by the Judge that the advertising literature of the steamship company led one to expect electric fans in every cabin, and that had a fan been provided the company would not have been liable, however bad the ventilation.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 5s. (last week, £57 15s. to £58).

Foster Engineering Co., Ltd.—Owing to increase in the variety of manufactures, the name of the Foster Arc Lamp & Engineering Co., Ltd., has been changed to the Foster Engineering Co., Ltd. The Company have now amalgamated with the Brockie Pell Arc Lamp Co., and will in future supply all apparatus made under the patents and rights of both Companies. Both Companies' offices, stores, works, &c., have been removed to new works in Morden Road, Wimbledon, London, S.W.

The Abbey Electric Co.—The new telegraphic address of the Abbey Electric Co. was given incorrectly in our last issue. It should have been "*Lightsome, London.*"

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Dick, Kerr & Co.—The annual meeting was held on Thursday. Mr. J. Kerr, who presided, expressed the extreme regret of the Board that the unfortunate accident which resulted in the death of Mr. George Flett in July. With regard to the business prospects, he stated that after three years of dull times, a period seems to be at hand when there will, in many directions, be a great expansion of electrification in this country and abroad. The past year was a disappointment to them all, but the directors were of the opinion that the work at present in hand, and in prospect, made the outlook distinctly encouraging. The financial position of the company was one of comfort. In conclusion, mention was made of the company having taken up the manufacture of Bergmann steam turbines.

Willans & Robinson.—There is a loss of £8,001 on the June half-year's trading, making a total debit of £15,269. This unsatisfactory result is attributed to the low prices prevailing, and the scarcity of orders obtainable during the whole of 1909. There has, however, been a steady improvement in the number of orders booked during the present year, although the prices are on even a lower scale than in 1909, and the report states that until there is a material improvement in the prices, it will not be possible to show a profit.

Mexican Light & Power Co.—One per cent. on the ordinary shares for the September quarter.

Cleveland & Durham Electric Power Co.—The net profits for the year to June 30th were £2,906, compared with a loss of £3,657 in the previous year.

British Thomson-Houston Co.—The report and accounts were adopted at the meeting on Wednesday last week. Mr. J. F. Nauheim, who presided, said that whilst the accounts showed a distinct improvement on the previous year, the directors did not consider they warranted payment of a dividend. It was only by the strictest economy that the directors had been able to cope with their difficulties. It was hoped that the shareholders would reap the benefit of the large extensions to the works which had been carried out during the year.

British Westinghouse Electric & Manufacturing Co.—It is stated by the *Stock Exchange Gazette* that the results of the year's trading so far have exceeded anticipations, and that the accounts for 1910 are likely to show a working profit of well over £100,000.

NEW COMPANIES

NUNEATON ELECTRICAL CONTRACTING CO., Abbey Gate, Nuneaton.—Capital £1,000. Dealers in electrical fittings, appliances, &c.

ALLMANA SVENSKA ELECTRIC CO.—Registered by Bristowe, Cooke & Carpmael, 1 Copthall Buildings, London, E.C. Capital, £5,000. Dealers in electrical and other machines and appliances. The subscribers are S. Busch, Norfolk House, Cannon Street, London, and J. L. Fuller, of the same address.

Telegraph Traffic.—The line between Rome and Constantinople broke down on the 27th ult., but was put right on the same day. On Oct. 1st the cable of the Compagnie Française des Cables Télégraphique, in the West Indies, between Paramaribo (Dutch Guiana) and Cayenne (French Guiana), was interrupted. —The El Arich route broke down on the 3rd inst. between Adana and Lattaquil.



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ELECTRICAL ENGINEERING

No. 198 [Vol. VI., No. 41] THURSDAY, OCTOBER 13, 1910. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** *weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.*

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

A standard specification for lamp holders has been published by the Engineering Standards Committee. (Page 643.)

The arbitrator in the recent proceedings between the Torquay Tramway Co. and the Torquay Corporation has declared that the latter have unreasonably withheld their consent to the adoption of the overhead trolley system on the Torbay Road. He gives costs against the Corporation. The majority of the members of the Corporation are in favour of accepting the award. (Page 643.)

An article from "The Wiring Contractor's Point of View" discusses the status of the Wiring Contractors' Association, and reviews Mr. G. F. Ratcliff's suggestions for improving it; it incidentally quotes some of the Wiring Rules of the Institution of Electrical Engineers which are frequently contravened in practice. (Page 644.)

The first news of the Portuguese Revolution was transmitted to the rest of the world by wireless telegraphy. (Page 644.)

The attention of the Newport Corporation has been called to the fact that the payment of interest upon bank overdrafts in respect of the Electricity Department is illegal, as laid down in the recent decision in the West Ham case, and the solicitors of the Ratepayers' Association request that certain sums paid for interest in this way should be refunded. The Electricity Committee have the matter under consideration. (Page 644.)

Our monthly article on new electrical supplies and accessories contains illustrated descriptions of two new forms of mercury vapour lamp. Some accessories for interior conduit wiring, including a new water-tight switch, are also described. Several heating and cooking appliances are illustrated, among which is a new towel drier. (Page 645.)

A letter from the Diesel Engine Co. refers to the business announcement made by Messrs. Willans & Robinson in a recent issue with regard to the manufacture of this class of engine. (Page 647.)

Among the specifications published by the Patent Office on Thursday last was one by L. D. Cibie for a flame arc lamp of the stop pattern, with the vertical negative carbon held in a guiding socket pivotted in the base plate.—A two-battery train-lighting system, in which both batteries supply the load when the dynamo is running slowly, is covered by the India Rubber & Gutta Percha Telegraph Works Co.—J. S. Highfield patents a method of manufacturing cheap wiring cable of the strip type with the conductors embedded in the two edges.—The provision of a notch or recess in the sides of carbon brushes for enabling the finger lever to hold them up temporarily is covered by W. A. Stevens, Ltd. (Page 648.)

An arbitration is being held to determine the price

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which the Paisley District Tramways Co. shall pay the Corporation for the electrical energy for working the trams. Mr. Robert Hammond is acting as arbitrator. The company at present pay 1·4d. per unit, but the Clyde Valley Electric Power Co. offer to supply at 0·78d. per unit. (Page 649.)

The new generating station of the Northampton Polytechnic Institute contains two 100-kw. gas-engine sets generating at 220-volts D.C. and 2,200 volts three-phase. The oil switches of the A.-C. circuits are controlled from a modern desk-type board equipped with the latest instruments and auxiliary appliances. A 45 h.p. synchronous motor-generator set, a 30 kw. rotary converter, and a 600 ampere-hour battery with a Turnbull-McLeod reversible booster-balancer, are also installed. (Page 649.)

Among the lawsuits during the Michaelmas term will be an action by Marconi's Wireless Telegraph Co. against the owners of the Balsillie system for infringement of patent. Another action will be in respect of the formation and subsequent liquidation of Messrs. Mountain, Gibson & Thornewill. The National Electric Construction Co. are appealing against the decision of the Kent County Court that an electric lighting Provisional Order does not entitle a local authority to enter into a "free wiring" agreement. Other appeals will be in respect of the Ilgner patent and the "Z" Co.'s metal filament lamp patents. (Page 650.)

An article describes some of the exhibits at a successful exhibition at Hampstead. (Page 650.)

The Acton Council have decided to transfer their electrical undertaking to the Metropolitan Electrical Supply Co.—The price to be paid by the Tramways Committee at Brighton for electrical energy is being inquired into by a sub-committee.—Hove ratepayers are protesting against the proposed introduction of tramways.—It has been decided to revise the charges for electricity supply at Leith in order to prevent large profits.—The Board of Trade have been referred to in connection with the proposed stoppage of the Scarborough tramways during the winter.—West Ham electricity accounts show a small loss for the past year, but rates have increased by over £5,000. (Page 652.)

The Manchester Corporation have placed an order for 8,000 yards of aluminium conductor.—Electrical extensions are proposed as follows:—Darlington (£1,400); Felixstowe (£3,000); Horsham (£1,850); Ipswich (£6,000); South Shields (£9,410); Tonbridge (£1,441); and Wednesbury (£4,000).—Twelve double-deck tramcars are required at West Ham.—Street lighting is to be carried out at Kettering and Frodingham.—A power station is to be erected at Bispham. (Page 652.)

At the half-yearly meeting of Messrs. Willans & Robinson, Ltd., it was suggested that the remedy for excessive competition in the manufacture of electrical machinery is amalgamation.—Norwich Tramways Co. show a net profit of £6,107 for the past year. (Page 654.)

ARRANGEMENTS FOR THE WEEK

FRIDAY, OCTOBER 14TH.

Institution of Electrical Engineers: Manchester Local Section.

7.30 p.m. Conversazione at Whitworth Institute, Whitworth Park.

WEDNESDAY, OCTOBER 19TH.

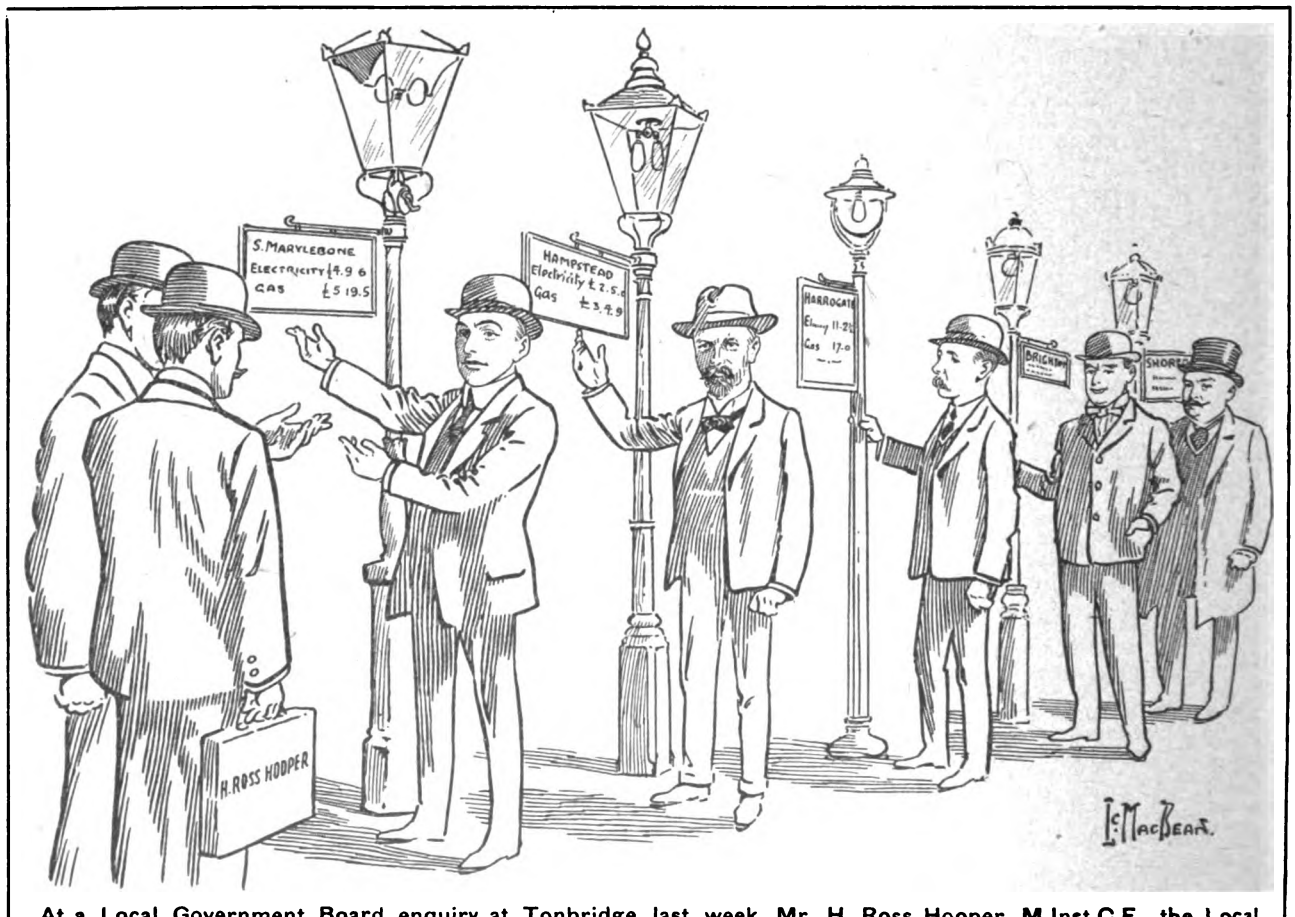
"Dynamicables."

7.30 p.m. Dinner at Trocadero Restaurant.

FRIDAY, OCTOBER 21ST.

Electro-Harmonic Society.

8 p.m. Smoking Concert at Holborn Restaurant (King's Hall).

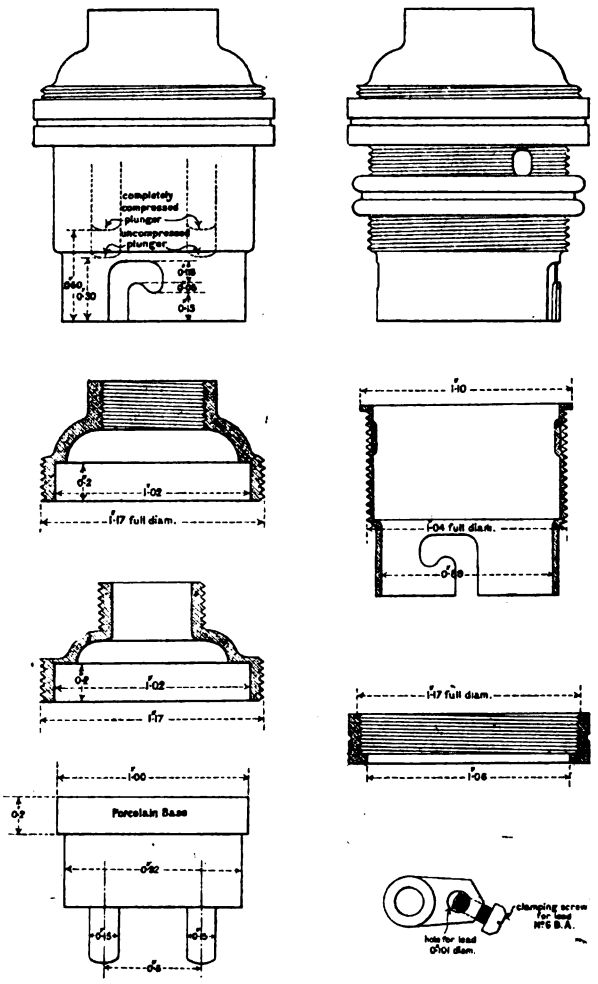


At a Local Government Board enquiry at Tonbridge last week, Mr. H. Ross Hooper, M.Inst.C.E., the Local Government Board Inspector, asked whether there would be any saving to the ratepayers by substituting electric lamps for gas lamps for street lighting.

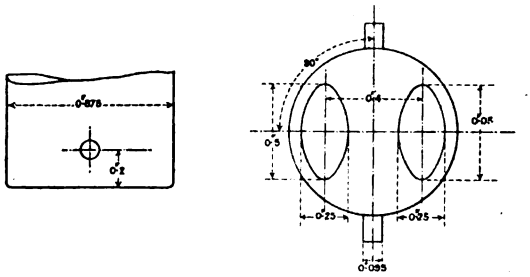
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STANDARD LAMPHOLDERS

THE Engineering Standards Committee have now issued a standard specification for bayonet socket lampholders and caps, which has been drawn up by the sub-committee on Physical Standards, adopted by the sectional committee on Electrical Plant, and approved by the main committee. It is worthy of note that the actual committee responsible for the drafting of the specification includes two well-known station engineers and representatives of the Government departments. Only two of the members can in any way claim to represent manufacturing interests, and the firms with which these gentlemen are connected do not either of them, so far as we know, manufacture either incandescent lamps or lampholders.



BRITISH STANDARD LAMPHOLDER DIMENSIONS.
(*Full size.*)



BRITISH STANDARD LAMP CAP.
(*Full size.*)

The question of interchangeability of lamps and holders is of paramount importance, and the question is indeed an international one. No indication is, however, given in the report as to whether the standards agree with those in use in the other principal lamp-making countries.

The dimensions, angles, and relative positions of the metal parts of the standard lampholder and cap are defined in the specification, but some freedom is left as to the exact form and material of the insulator. These dimensions are shown in the drawing reproduced here. Very full particulars are also given of a series of gauges for testing manufactured lampholders with full drawings. We reproduce also a drawing showing dimensions of the standard lamp cap, which is in conformity with the British standard specification No. 33 for carbon filament lamps. A gauge for testing lamp caps is also described in the new specification.

The lampholders described are intended to be for voltages up to 250 volts, but no pronouncement has been made as to maximum current or watts for which they are suitable. It is stated that experiments in this direction are in progress.

The specification deals with holders for lighting purposes only, but it is understood that the effect of heat on the ordinary lampholder is being investigated experimentally at the National Physical Laboratory, so we may shortly expect to see an addendum to the present report, dealing with lampholders for use with radiators.

The price of the report is 5s. 2d. post free, and it may be obtained from any bookseller, or direct from the offices of the Committee, 28 Victoria Street, Westminster. It is published for the Committee by Messrs. Crosby, Lockwood & Son, 7 Stationers Hall Court, Ludgate Hill, E.C., and 121A Victoria Street, S.W.

THE DOLTER SYSTEM AT TORQUAY

MR. A. REED has now issued his award in the arbitration held recently to decide whether the Torquay Corporation had unreasonably withheld their consent to the introduction of the overhead system of electric traction on the Torbay Road. The proceedings were reported in our issues for September 15th, p. 595, and September 22nd, p. 609. It will be remembered that the Torquay Tramways Co. have decided to substitute the overhead system for the Dolter system throughout Torquay, a right which they claim they have under their Act of Parliament, but which is disputed by the Corporation. With regard to the Torbay Road, however, a special clause applied to this—hence the arbitration. The arbitrator finds that the Corporation have unreasonably withheld their consent, and awards the Company costs.

At the commencement of the arbitration proceedings it was contended on behalf of the Corporation that the Board of Trade had no power to appoint an arbitrator under the Company's Act of Parliament in respect of Torbay Road, and the proceedings went on under the protest of the Corporation. The whole question was discussed at the meeting of the Corporation on Friday, and according to the local papers it was referred back to the Tramways Committee, on the understanding that there are to be no further legal proceedings against the Company, and that an endeavour will be made to enter into an amicable arrangement with the Company for the benefit of the borough as a whole. Apparently the general feeling of the Council is in favour of accepting the award.

Robertson & Osram Works Conversazione.—On Saturday last the members of the Robertson & Osram Social and Athletic Club run by the employees of the Roberson & Osram Lamp Works, Brook Green, Hammersmith, held their annual conversazione and dance at the Works. There were some four hundred present, including guests among whom were Mr. Hugo Hirst (Managing Director, General Electric Co.), Mrs. and Miss Hirst, Mr. J. Fraser, Mr. and Mrs. C. Wilson (Brook Green Works), Mr. and Mrs. M. Railing (Manager, Witton Works), Dr. Railing (London), Mr. J. Spence (Newcastle), Mr. E. Wilson (Witton), Mr. Fletcher (London), Mr. L. Dunnere, and others. An excellent musical entertainment was provided, and the evening was a great success. Incidentally, we heard that the Osram Lamp Works will very shortly be extended to some 50 per cent. of its present size, the plans having already been passed. The output of Osram lamps manufactured at these works has now reached a figure of 60,000 per week, which, of course, is only a small fraction of the total number handled by the General Electric Co.

Telegraph Traffic.—The chief event during the past week has been the interference with telegraphic communication with Lisbon, due to the Revolution. Censorship has added to the delay of messages, which are still many hours in reaching London. The land lines are, however, being rapidly repaired, and, as the cables of the Eastern Telegraph Co. are uninjured, the usual order will soon reign. Code telegrams are still prohibited. The Spanish Government, on the 8th inst., stated that direct communication between Lisbon and Madrid had been reopened.

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THE WIRING CONTRACTOR'S POINT OF VIEW

A PAPER by Mr. G. F. Ratcliff, Chairman of the London Section of the Electrical Contractors' Association, which is to be discussed at the November meeting of the Association, contains suggestions for raising the status and efficiency of that body. In the course of it the author frankly calls attention to the possibility of bad work being done by members. He suggests that all members should be "pledged" to a standard of work—say that defined in the Wiring Rules of the Institution of Electrical Engineers—and that consulting engineers, central station engineers, architects, and builders should be invited to report to the Association any "real or supposed default" on the part of any member. He also advocates that the Association should offer to have an installation inspected and reported on by a consulting engineer of repute at a fixed charge.

This suggestion is certainly worthy of consideration, but it appears to us that Mr. Ratcliff is setting to work at the wrong end of the job. It appears that he actually suspects the presence as members of the Association of unqualified men—"drapers, furnishers, builders"—who succumb to the temptation of carrying out work "with low-priced labour, poor materials, ignoring all rules, thereby bringing discredit on electrical contracting . . . not giving the public what they expect or require." We should be sorry if this is the case, but if Mr. Ratcliff's suspicions are well founded, the error lies in admitting such men to membership at all. If membership of the Association is to imply the equivalent of possession of a certificate of efficiency, this can only be effected by inquiries about the work and status of candidates before they are admitted, not by weeding out the undesirables gradually as their work is complained of. It is also open to question whether the Association is entitled by its rules to expel members for carrying out bad work. The whole subject bristles with difficulties, but the first step to be taken is to ensure that—whether there be already a certain number of black sheep among the members or not—no new members should be admitted without some sort of inquiry, or, better still, a guarantee by two or three old members of good standing. Difficulty would also be found in setting up a standard in accordance with any existing code of rules. For instance, if this standard were the Institution rules, what would be the position of firms who worked to specifications that did not follow these rules implicitly? Rule No. 83 specifies that switch lampholders must be controlled by a wall switch. Rule 45 specifies that the connection between flexibles and hard wires may only be effected by means of screw-down terminals. Rule 51 specifies that metal staples must not be used for fixing unarmoured conductors. Rule 57 specifies that the dielectric of conductors must not be bared back further than to allow the conductor to enter the terminal properly. Rule 60 specifies that conductors larger than 7/18 must be soldered to proper lugs for connection. Rule 76 specifies that wall and floor sockets must be independently controlled by a switch on the live side of the plug, and recommends that the portable fittings themselves should not be provided with switches. Finally, rules 94 and 95 specify that the case of each cell (of accumulators *or primary* batteries) must stand on insulators. All these are excellent rules; but if every member of the Association were asked to resign who could not conscientiously aver that he or his men had not contravened any of the above rules during the past twelve months, the Electrical Contractors' Association would dwindle down to a few members of the unemployed.

THE PORTUGUESE REVOLUTION

THE Revolution in Portugal has directed attention to wireless telegraphy in connection with its political value in a manner that has hardly been appreciated up to the present. The first message reporting the outbreak of the Revolution was only received by the aid of wireless telegraphy; and it is curious to note that this is the second occasion in which this particular system employed (the Telefunken system) has helped to make history. Owing to the fact that the land telegraph lines had been cut by the Republicans, the correspondent boarded the s.s. *Cap Blanco* of the Hamburg South American Line in the harbour at Lisbon, as this ship is fitted with a Telefunken wireless station, and transmitted the message in the following manner:—

The *Cap Blanco* had arrived at Lisbon during the night of October 4th and 5th on its return trip from Buenos Ayres. The wireless telegraph equipment is worked by officials of the Telefunken Company, who called up the sister s.s. *Ypiranga*, which was lying at Santander in the Bay of Biscay, and communicated to her the first news of the outbreak of the Revolution. The *Ypiranga* transmitted the news to Paris. In the meantime, however, other correspondents had arrived on the *Cap Blanco*, and the operator was asked to forward other messages to Berlin. For this purpose he was required by his instructions to call up the nearest wireless ship or coast station which it was possible for him to reach with his apparatus. Amongst the ships which, according to the time-tables at his disposal, appeared to be within reach of the ether waves of his apparatus, there were none which would reach any coast within a reasonable time. Hence, the operator attempted to communicate with the nearest land stations. These were either Algiers or St. Marie de la Mer, near Marseilles. The route to the former involved greater expense, so the operator attempted to call up the St Marie station about 10 times. This station is equipped with a receiving apparatus for specific wave-length. The operator on the *Cap Blanco*, therefore, gave the call which set the receiving apparatus at St. Marie in operation, whereupon St. Marie returned the call. The operator on the *Cap Blanco* then transmitted his message. As the waves spread in all directions, this message could also have been picked up at Algiers, but as the call signal given by the operator was the one belonging only to St. Marie, the Algiers station, in accordance with the International Agreement, could not accept it. The messages were retransmitted from St. Marie in the usual manner.

The performance of the wireless apparatus on the *Cap Blanco* must be characterised as quite exceptional, as the distance to St. Marie is about 850 miles, with fairly high mountains intervening. As the range of the apparatus is dependent on the height of the masts of the ship, and the *Cap Blanco* is not fitted with specially high masts, the performance of the Telefunken apparatus is all the more noteworthy. As a matter of fact, the oscillating energy of the apparatus is 1·5 kilowatts, and the masts are 32 and 41 metres high.

It is of interest to note that the Telefunken system is being developed at their Woolwich Works by Messrs. Siemens Brothers & Co., Ltd., to whom we are indebted for this information.

FINANCES OF THE NEWPORT ELECTRICITY DEPARTMENT

THE Newport Ratepayers' Association have taken up the position of the Newport electricity undertaking in the light of the recent decision regarding the West Ham Electricity Department, in which it was declared that the borrowing of money from a bank to meet the temporary wants of municipal electricity departments and the payment of interest thereon is illegal. Messrs. Elvy Robb & Welch, the solicitors who had the West Ham case in hand on behalf of the India Rubber, Gutta Percha, & Telegraph Works Co., Ltd. have been consulted in the Newport case, and they have requested the Corporation to give an undertaking that any interest paid upon loans from the bank in respect of the electricity revenue account should be refunded at once, and that no further sums should be paid for interest in this way. They further ask that the Corporation will not make or enforce any rate for the purpose of paying off the bank overdrafts or interest thereon, and also that no rate shall be enforced for paying off the sum of £3,500 standing to the debit of the electricity capital account.

The Electricity Committee state that the question is receiving their serious consideration, but they do not intend to avoid any of their just liabilities in the matter. The levying of a rate to meet the sum of £3,500 was made at the express request of the Local Government Board. It is recognised that the decision in the West Ham case involves a serious charge in the relations between the Corporation and their bankers.

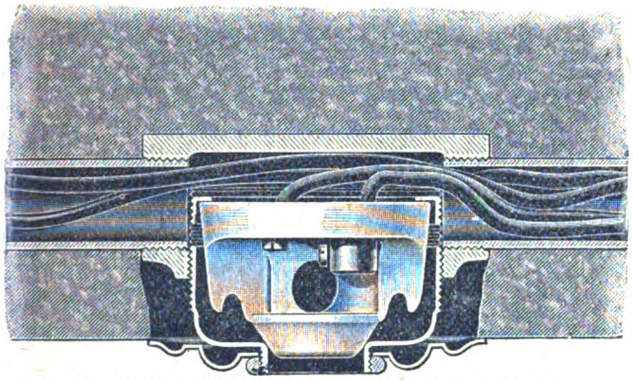
The Trackless Trolley in America.—The *Electric Railway Journal* describes a trackless trolley line that has been constructed near Los Angeles. The cars accommodate 16 passengers, and each is equipped with two 15 h.p. motors. Two separate trolley poles are used, supported on standards on the roof of the car. The poles permit of a lateral range of 11 ft. on either side for passing vehicles.

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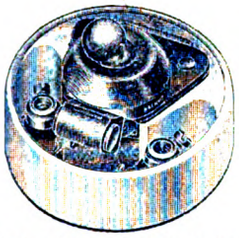
NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Switches and Accessories.

In addition to the materials for their well-known "Kalkos" system of wiring, the Sun Electrical Co. (118–120 Charing Cross Road) have put on the market a series of accessories for ordinary screwed tube work, which include an iron box with several interesting features and a new watertight switch. The malleable iron box, which can have various arrangements of outlets, is shown in the figure, which also shows the adjustment ring upon which the porcelain base of the switch ceiling rose or other accessory rests. The object of this is to obtain an adjustment of the level of the switch after the wall is finished, to allow for variations in the thickness of the plaster. It is shown in use in the top figure. A large variety of covers are made which screw into the body of the box. The special watertight switch made for this system is also illustrated. The cover is coned to fit watertight over the collar round the dolly, and the latter is further packed by a packing ring P, making a gland joint when the collar C is pressed on. Another important feature of the switch is the way in which the moving current carrying parts are enclosed in marmorite, so that it is impossible to draw out an arc between a terminal and earth. The earthing of the dolly is also complete and automatic without making extra connections. The switch, which is particularly compact for a watertight switch, can be used either with the "Kalkos" or the screwed tube system. Attention may also be drawn to the three-pin plug in this new series of accessories, the socket of which is provided with a spring earth contact E, which makes contact with the adjusting ring immediately the socket is dropped into the box.



"Sun" Adjustable Box as supplied to Flush Ceiling Rose.



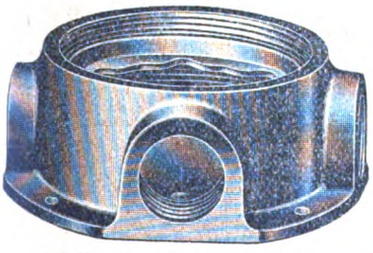
Body of Watertight Switch.



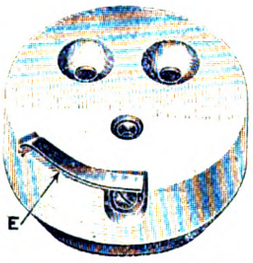
Detail of Packing of Dolly.



Adjusting Ring.



Malleable Three-way Box.



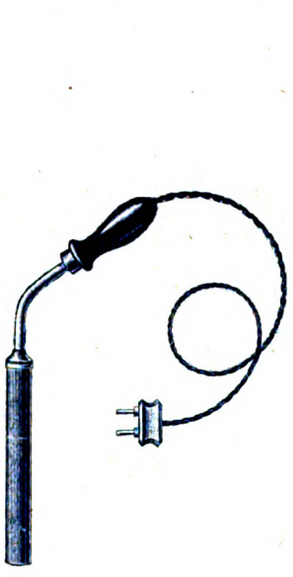
Three-pin Wall Plug, with Earthing Device.

New Fittings for Screwed Tube System. (Sun Electrical Co., Ltd.)

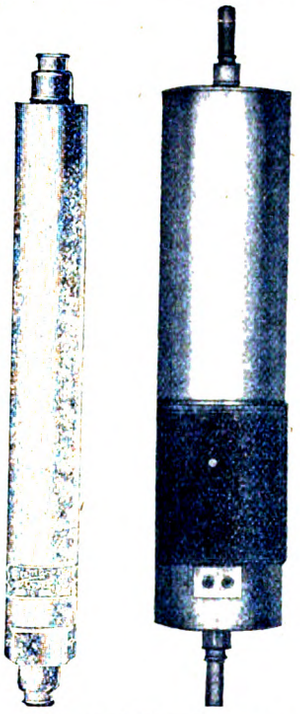
A further novel advertising device has been introduced by Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.), in the form of opal shades, on which are sand-blasted the words "Tantalum lamps." These will be supplied to contractors free of charge, and are known to the trade as Shadolite "Tantalum" reflectors. These specialities are offered in conjunction with the main advertising scheme mentioned in a previous issue. Shadolite "Tantalum" shades are lettered on the inner surface for interior lighting, but for outside lighting they are supplied lettered on the upper surface, and form a most effective advertisement.

Heating and Cooking Apparatus.

The Armorduct Manufacturing Co., Ltd. (Farringdon Avenue, London, E.C.) have recently introduced several novelties on the "Therma" system. The heating element in these devices consists of a spiral or zig-zag of a special nickel-steel alloy strip of very high resistance, which is plated with a non-oxidising metal. The strip elements are laid between sheet mica, or wound on earthenware slabs or cylinders. One of our illustrations shows a heating stick for warming up any liquid in a glass or jug. It consists of a nickel-plated tube containing the heating element, and provided with a handle and connecting leads. It will boil a pint of water in from 14 to 16 minutes, and consumes only 200 watts. A simple water-heater for placing "in series" with the ordinary water-pipe is also illustrated. This consists of a straight metal tube surrounded by a heating element. The smaller size takes 1,000 watts, and by letting the water run through slowly will heat 2¼ gallons to 120° Fahr. in 30 minutes. A 5,000-watt size will bring 11 gallons to the same temperature in the same time. The third illustration shows an automatic device called the "Auto-cistern," for providing a constant supply of hot water at about 160° Fahr. When the water in the cylinder has reached this temperature, the heating element is cut out automatically with the exception of a small heater consuming between 50 and 100 watts, to keep the water hot. When hot water is drawn off, cold water enters, and the heater is switched in automatically. The cylinder has a double copper case to reduce the loss by radiation. Various sizes of these are made, and particulars will be furnished on application to the



"Therma" Glass or Jug Heater.

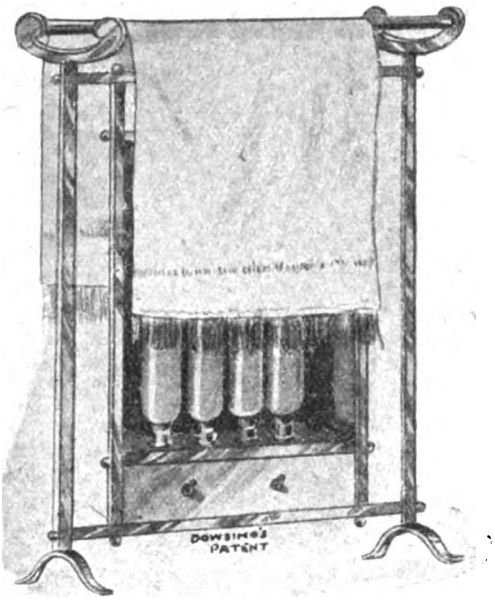


"Therma" Water Heaters.

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Amorduct Co. A large variety of electric kettles, hot-water jugs, egg-boilers, hot-plates, and other domestic appliances are listed in a new list issued by the company, and a line of electric cookers and ovens will shortly be placed on the market.

Among the novelties for the coming season introduced by the Dowsing Radiant Heat Co., Ltd. (24 Budge Row, Cannon Street, London, E.C.), is a useful luminous radiator for bed- and dressing-rooms, bathrooms, &c. As shown in the illustration, the radiator is supported on a polished-brass frame in the form of a towel rack, and can be used for airing

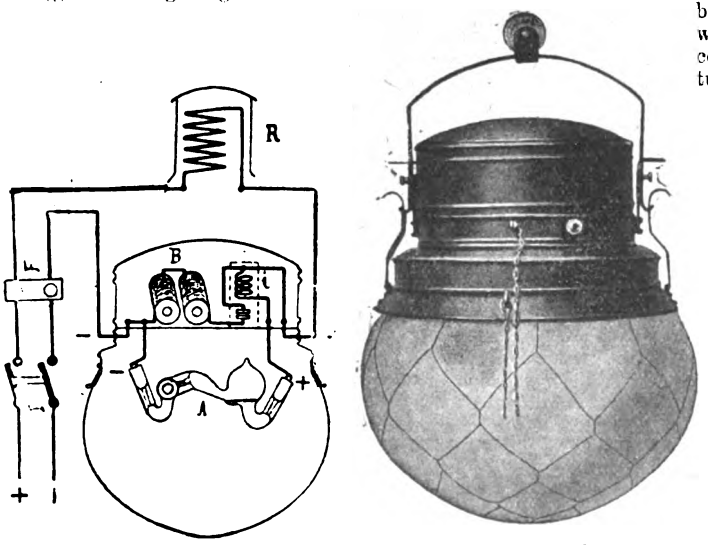


Radiator for Airing Clothes, Drying Towels, &c.

linen, drying clothes, &c., besides giving the luxury of warm towels in the winter and keeping them dry. The radiator consumes one unit per hour, and is thus also sufficient to heat quite a large room. It comprises four heat lamps controlled by two switches. The dimensions of the whole are 29 in. by 22 in., and the price is only a few shillings more than that of an ordinary radiator.

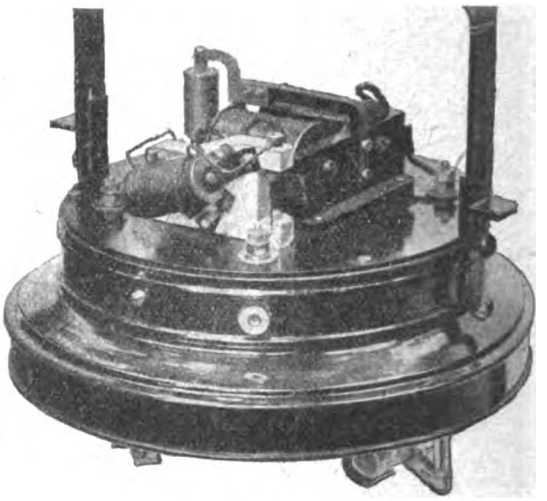
Lamps.

A quartz-tube mercury-vapour lamp has been introduced by the Westinghouse Cooper Hewitt Co., Ltd. (151 Great Saffron Hill, Holborn Circus, London), for direct connection for general lighting on 200-250-volt continuous-current



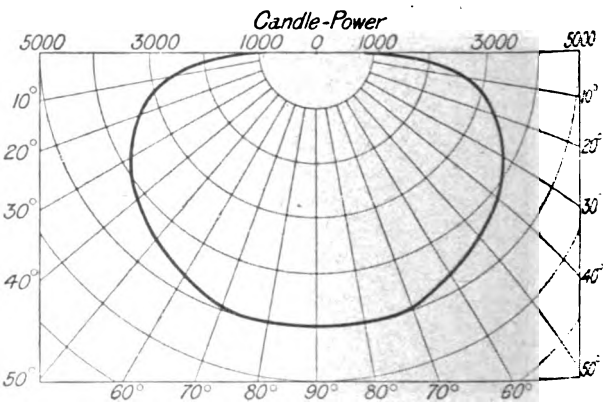
Connections and Exterior View of Silica Lamp.

circuits. The use of quartz instead of glass enables the tube to be only a few inches long, whereas a glass lamp for the same pressure would have to be several feet in length, as with a short arc a very high temperature is reached. As shown in the illustrations, the lamp is similar in appearance to an arc lamp, but neater and shorter, and is especially adapted for the lighting of large and lofty shops, factories, yards, &c. The lamp consists of a quartz tube *A* of a special shape, exhausted to a high degree of vacuum, and containing mercury at each end. The luminous portion in the smaller capacity lamps (1,200 hemispherical candle-power, 4 amperes, 100–130 volts) is about 1¾ in., and in the larger (3,000 hemispherical candle-power, 3½ amperes, 200–240 volts) about 4 in. The tube is mounted within the globe on the underside of the base, and is arranged that it can be tilted so that the mercury may be free to run to and from each end to strike the arc. A solenoid *B*, whose plunger is connected to one end of the quartz tube, and an automatic cut-out *i*, are mounted on the top of the base. The clear or opal globe is metal-flanged and arranged to fit securely on the underside of the totally



Tilting Mechanism of Silica Lamp.

enclosed metal case. It lowers at will to the extent of the length of the chains, leaving the inside open for inspection, &c. An external resistance *R* is mounted in any convenient place. The action is as follows:—On putting the lamp in circuit, the current passes from the positive main through the resistance *R*, the cut-out *i*, and the solenoid *B*, back to the negative main. The solenoid causes the positive end of the tube to be lifted, and the mercury to flow along the tube to the opposite end, thereby completing the tube circuit. As the cut-out coil is in series with the tube, this now comes into operation, and immediately breaks the solenoid circuit. The quartz tube then falls back to its original position, and continues alight until the lamp is switched off. The vapourised mercury alone constitutes the conducting medium in the tube, and is the sole source of light, there being a continual process of vapourisation and condensation whenever the lamp is alight. As it is essential that the correct polarity should be observed to prevent damaging the tube, means are provided in the lamp itself which automatically ensure this, and with reversed connections the lamp will fail to light up.



Light Distribution Curve of Silica Lamp.

The Silica lamp is claimed to emit a light of uniform quality with no flickering, and very little attention is required. No fumes are given off, and consequently no troubles with corrosion are possible. The distribution curve

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shows an even illumination in all directions, and owing to the length of the arc, no sharp shadows are produced. The curve is for a 220-volt lamp taking 3·64 amperes. The mean hemispherical intensity is 3,630 c.p., which corresponds to a specific consumption of 0·22 watt per mean hemispherical candle-power. A 100–130-volt lamp takes 4 amperes, and has a mean hemispherical candle-power of 1,200. This size is usually suspended at a height of from 20 to 30 ft., and the larger lamp at from 30 to 50 ft. above the floor-level. The quartz tube has a guaranteed minimum life of 1,000 hours, and is said usually to last about 2,000 hours. A total running cost for a 250-volt lamp is stated to be under 1d. per hour, with current at 1d. per unit.

The Westinghouse Cooper Hewitt Co. have also introduced a water-steriliser, in which the essential part is the above-described quartz lamp, the ultra-violet rays from which are utilised to destroy any bacteria which may be present in the water. The tube is fixed in the inside of a metal case, and is tilted for striking the arc by hand. A shallow basin is supported immediately under the lamp, and the water is caused to flow up into it, and circulate under the rays round a system of cones before leaving. The consumption of the device is 4 amperes on 220–250-volt circuits (direct-current), and a maximum-delivery of 130 gallons per hour is obtained. Tests on these sterilisers by Dr. Roux, of the Pasteur Institute, Paris, have shown that the rays of the lamp are effective whether oxygen is present or not, and that all the more frequent types of bacilli were destroyed in exposures of from 10 to 60 seconds, which length of time is ensured by the circulating arrangements. As the ultra-violet rays are harmful to the eyes, and to some extent to the skin, the quartz tube in either this device or the lamp described above must not be looked at *closely*, but the absorption of the dangerous rays by the glass outer globe and the atmosphere is so great that there is absolutely no danger of harm from the use of the lamp as an illuminant.

The Brush Electrical Engineering Co., Ltd. (1 Kingsway, London, W.C.) have introduced an entirely new design of quartz mercury vapour lamp for general illumination, embodying several novel features. One is that the use of a quartz tube in place of glass renders it possible to construct a tube only a few inches in length, suitable for running direct on 250-volt continuous-current circuits. The lamp itself consists of a simple straight tube of quartz about ¾ in. diameter and 6 ins. long. During working the tube is inclined downwards slightly towards the negative end, which terminates in a large bulb filled with mercury. At the positive end is a tantalum button about ⅜ in. diameter, the stem of which dips into a second, but smaller, bulb of mercury. When the lamp is switched on, the tilting mechanism causes mercury to run along the tube from one end to the other, and start the arc, which then plays between the tantalum button at one end and the surface of the mercury at the other. As the button is raised to a bright red heat, it furnishes a certain amount of red rays, but the light has still the weird colour of the ordinary mercury arc. But the fact that the arc does not play from the mercury at the positive end appears to give more important advantages than this, in that no mercury is carried by the arc along the tube, and the character of the arc is modified to some extent. The mercury at the positive end is kept comparatively cool and vaporisation goes on chiefly at the other end. Owing to the large quantity of mercury at the negative end, the heat is rapidly radiated, and no special radiating surfaces are required. An aluminium reflector is placed above the lamp. The mechanism comprises a shunt tilting magnet, and a coil in series with the tube, to cut out the shunt magnet when the arc is struck. This mechanism is enclosed with the necessary series resistances in the metal case. The large opalescent globe diffuses the light and absorbs the harmful ultra-violet rays. These rays act on the air in the globe and cause the formation of ozone, and as there is a continual circulation of air through the globe, the atmosphere of a room in which a Quartzlite lamp is working is continually purified. The rays themselves are also destructive to bacterial life.



BRUSH "QUARTZLITE."

The Quartzlite lamp is particularly adapted for textile mills, warehouses, workshops, railway yards, docks, &c. but, as yet, the colour is hardly suitable for ordinary interior house or shop lighting. At present it is made in two sizes, 1,800 c.p. and 3,000 c.p., for 100 and 250-volt circuits respectively, the consumption being 360 and 875 watts respectively. Including the cost of renewal (the lamp tube lasts some 2,000 hours), the total costs per hour with current at 1d. per unit are 0·51d. and 1·025d. respectively. We understand that a 10,000 c.p. lamp is being developed, and that small lamps with colour rectifying devices are being experimented with.

Other new fittings and accessories are mentioned in our article on the Hampstead Exhibition on p. 650.

CORRESPONDENCE

DIESEL ENGINES.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—With reference to the paragraph in your issue of September 29th last, in which Messrs. Willans & Robinson, Ltd., of Rugby, advertise the fact that they have been for five years manufacturers of Diesel engines for the Diesel Engine Co., we beg to state that this firm has only manufactured a very small proportion of our orders, viz., 28 engines in all, over a period of five years, and that it was at our instigation that the contract was terminated.

As holders of the original Diesel Patents in this country, the Diesel Engine Co. have an exceptional advantage, and are able to offer a very large range of sizes and types of Diesel engines, both for marine and stationary purposes, from 5 h.p. up to 4,000 h.p., in four-stroke and two-stroke engines, also slow-speed and high-speed, the design of which has been the outcome of years of experience.

179 Qn. Victoria St., London, E.C., October 5th, 1910.

Yours faithfully,
DIESEL ENGINE CO., LTD.,
W. T. BATHO, Manager.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to The Editor, ELECTRICAL ENGINEERING, 203-6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.

BERT.—The motor you mention is rather large for the ordinary lever type starter. You could, however, use a multiple switch type starter, such as is made by the Adams Manufacturing Co., of Bedford, as these ensure the motor starting up slowly while the switches are closed in succession. They can be fitted with no-voltage and overload releases. Motor starters of the drum type resembling controllers, with some excellent features, are also made for motors of large size by Messrs. A. Reyrolle & Co., Hebburn-on-Tyne.

CHARLES LAMB.—Your friend will find what he wants on pages 34 and 210 of "The Electrician" Wireman's, Mains Superintendent's, and Linesman's Pocket Book (post free 5s. 3d.). This includes diagrams of connections for three-phase motors, and formulæ for the calculation of current for different h.p. power factors and voltages, and also conductor tables giving the current-carrying capacity of conductors and the voltage drop.

COUNTRY HOUSE LIGHTING

THE General Electric Co. have just issued a Bulletin (No. 4 of their series) dealing with the subject of country house lighting with self-contained generating plant; a system to which great impetus has been given by the introduction of low voltage metal filament lamps, which, owing to their economy in current consumption, have considerably reduced the size of the plant required. Useful information is given regarding the arrangement of the plant, and every portion of the equipment required is listed in a convenient way.

The generating plant consists of single cylinder paraffin engines directly coupled to 25 or 50 volt continuous-current dynamos, and they are listed from 1·5 h.p. for 40 10-c.p. lamps to 12 h.p. for 720 10-c.p. lamps, or an equivalent number of lamps of larger size. Complete switch panels are standardised for each size, and prices are given for complete 14- or 28-cell storage batteries. A few representative designs of fittings are included in the list, and the possibility of using the electrical supply for ventilation as well as lighting is provided for by electric punkahs and fans.

Municipal Wiring Bill.—Stretford has promised financial support. Handsworth and Clacton-on-Sea will give moral support, but Crewe has decided to take no action.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published October 6th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

18,636/09. **Battery Plant.** A. M. Taylor (King's Heath). In order to reduce the cost and increase the efficiency of battery plant, arrangements are made for connecting two or more booster armature windings in series and in parallel, and an auxiliary or "bucking" booster is employed during charging with the object of increasing the number of cells in the battery and reducing the output of the main boosters. Instead of a bucking booster, a number of additional cells may be employed in conjunction with suitable switchgear. This enables the battery to float on, or discharge lightly into, the main 'bus-bars, without the boosters. Two figures.

20,869/09. **Voltage Regulator.** W. J. Walters (Rugby). An automatic apparatus for regulating the voltage of an alternator is described. It consists of two windings supplied from the two sources which are to be kept at equal pressure, and acting on a disc or armature which works a variable resistance in the field circuit of the alternator exciter. When the pressure of the machine varies from the normal, the disc is rotated and the voltage corrected. Five figures.

21,008/09. **Arc Lamp.** L. D. Cibie (Paris). This is a flame arc lamp of the supported carbon pattern. The negative carbon is vertical and central, and is held and guided in a socket having a spherical bearing in the base plate of the lamp. Attached to this socket is a stop on which the carbon rests, and after each feed, the socket swings slightly and wedges the carbon. The positive carbon is only very slightly inclined to the negative, and is swung for striking and regulating by means of a lever. Eight figures.

21,219/09. **Train-Lighting System.** W. F. Anderson, S. A. Russell, and W. E. Gray (India Rubber, Gutta Percha, & Telegraph Works Co., Ltd.). This is a two-battery system, in which current can be supplied to the load by both batteries when the dynamo is running below a certain speed. Above this speed, the load is supplied and one battery charged simultaneously. A current proportional to the charging current passes through a demagnetising winding on the field magnets of the dynamo to prevent charging at an excessive rate. When the load circuit is open the two batteries are charged in parallel. Automatic change-over switches for use in this system are described. Six figures.

21,369/09. **Radiation Pyrometers.** Cambridge Scientific Instrument Co., Ltd., and R. S. Whipple. A pyrometer for measuring very high temperatures comprises a closed tube with a thermo-electric element at one end. The other end is subjected to the temperature to be measured, and the heat is radiated down the tube to the sensitive element. Means for increasing or reducing the proportion of heat radiated on to the element are described. Four figures.

22,287/09. **Cheap Wiring Cable.** J. S. Highfield (London). This specification relates to the manufacture of wiring cable comprising a flat strip of insulating material with the conductors embedded in the two edges. The two wires are passed parallel to each other through a die, which may be rectangular or consist of two circular openings connected by a narrow slot. A rubber or other insulating compound is squirted on to the wires so that it forms a coating round the wires of the shape of the die. The strip thus formed is covered longitudinally with tape, or braided. A final coating of insulating compound is given to produce a smooth surface. Two figures.

22,878/09. **Telegraph Insulator.** J. Ball and C. F. Readman (Hanley). A pole insulator for telegraph and telephone lines consists of two porcelain cups fitting one over the other, and supported by means of a collar on the iron pin. A metal cap coated with enamel screws on to the pin, and the cups are clamped between this cap and the collar of the pin. One figure.

25,278/09. **H.-T. Switchgear.** H. R. Schultz and F. B. Holt (Manchester). In an enclosed iron-clad H.-T. oil switch, the overload tripping coil and an ammeter are mounted directly upon the H.-T. conductor to which they are electrically connected. The trip mechanism is placed in a separate casing on one side of the main switch box, and is entirely isolated from the live parts, so that it can be inspected or adjusted while the switch is closed. One figure.

25,449/09. **Cable Clamp.** W. T. Henley's Telegraph Works Co., Ltd., and S. H. Penning. A clamp for connecting a conductor to any one core of a multiple-core cable without removing the insulation consists of a divided metal ring which clamps round the insulated cable, and which is provided with radial tapped holes. A set-screw passed through one of these holes into one core of the cable holds the ring in place and connects it electrically with the one core. A socket terminal on the branch conductor is screwed to the ring by a second set-screw. Two figures.

1,145/10. **Carbon Brushes.** W. A. Stevens, Ltd., W. A. Stevens and A. T. Lambert (Maidstone). In order that a carbon brush may be readily held away from the commutator when holders of the box type are employed, a notch or recess is made on the surface of the carbon facing the finger lever. When the carbon is lifted up, the point of the finger lever drops into this notch and holds the carbon up. Other means of obtaining the same end are described. Nine figures.

8,410/10. **Armature Windings.** Siemens Bros. Dynamo Works, Ltd. (*Siemens-Schuckertwerke Ges.*). Overcrowding at the bends in composite armature coils is avoided by making the inner conductor change to an outer conductor at the commutator end of the coil only, the bend at the other end being merely a kink to change the level of the top and bottom halves of the coil in the usual manner. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Dynamos, Motors, and Transformers: William Beardmore & Co and Sykes [Automatic control of reversal of electrically-driven machine tools] 21,803/09; Barker (*Welch and Parkman*) [Motor control] 25,205/09; Siemens Bros. Dynamo Works (*Siemens Schuckertwerke Ges.*) [Regulation of frequency transformers] 4,263/10; A.-G. Brown, Boveri & Cie. [Train-lighting dynamo] 11,024/10; Allgemeine Elektricitäts Ges. [Machines] 14,125/10; Meirowsky [Insulation of armatures] 14,961/10.

Electric Ignition: Royer, 21,191/09.

Electrometallurgy and Electrochemistry: Hartmann [Electrical process for the purification of liquids] 1,459/10 and 1,460/10; Härdén [Furnaces] 3,739/10.

Storage Batteries: Luckow [Regenerating cells] 29,706/09.

Switchgear, Fuses, and Fittings: Heap [A.-C. switches] 21,357/09; Ellison [Time-lag devices for circuit-breakers] 24,115/09; Myer [Metal wiring conduit] 25,822/09; Hunt (*Swan*) [Ceiling fans] 28,333/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Control of electrically-operated switches] 1,146/10; Lundberg [Switches] 8,080/10; Kohler [A.-C. solenoids for electrically-operated controllers] 15,417/10.

Telephony and Telegraphy: Anderson and Anderson [Photo-telegraphic apparatus] 30,188/09.

Traction: Th. Goldschmidt [Welding rail joints] 21,750/09; Rietsch [Interlocking points and signals] 730/10; Grimme [Rail-joints] 8,340/10.

Miscellaneous: Pearce and Evershed & Vignoles, Ltd. [Acoustic apparatus] 21,394/09; Metal Jointing Co. and Harden [Lead joints] 27,482/09; Bambridge [Flexible shafts] 29,740/09; Anderson, Boyes & Co. [Coal-cutters] 29,762/09; Rietkötter and Kühn [Magnetic separator] 5,684/10; Davies [Advertising signs] 12,693/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Miscellaneous: Schuh [Driving of submarine boats] 17,962/10; Soc. Anon. Ateliers H. Cuénod [Automatic electric regulators] 20,957/10.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: G. E. Heyl-Dia [Rubber and bitumen insulated cables] 11,217/00.

Dynamos, &c.: H. Leitner and R. N. Lucas [Train-lighting dynamos] 14,202/02; C. A. Parsons [Cooling of armatures] 13,108/05.

Heating and Cooking: H. S. Riddle [Electrically heated vulcanising apparatus] 13,969/04; W. Taylor [Therapeutic air heater] 12,807/05.

Storage Batteries: H. Leitner [Formation of Planté plates] 14,128/04.

Switchgear, &c.: Stothert & Pitt and P. K. Stothert [Electric crane gear] 12,835/01; J. W. Mackenzie (*C. K. Manufacturing Co., U.S.A.*) [Flush wall and floor plugs] 14,342/02; G. M. Pinkerton [Magazine fuse-box] 13,984/04; A. J. Boult (*W. O. Duntley, U.S.A.*) [Push-buttons switch for portable drills] 13,093B/05.

Traction: E. von Planta [Sanding gear] 25,217/04.

Miscellaneous: L. Daft and A. Williams [Electrical detection of metallic ores] 14,124/02; E. Guess [Electrical cash checking machines] 14,062/03; W. C. Mitchell [Reversing gear for planing machines] 1,839/04; A. J. Boult (*W. O. Duntley, U.S.A.*) [Electric portable drills] 13,093-3A-3B/05.

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PRICE OF ELECTRICITY FOR TRAMWAY PURPOSES

An arbitration was commenced in London on Friday to determine the price which the Paisley District Tramways Co. shall pay the Corporation for electrical energy. Mr. Robert Hammond is acting as arbitrator, whilst Mr. H. F. Parshall and Mr. W. M. Mordey appear as chief witnesses for the Company and Corporation respectively. The general complaint of the company is that whereas when the tramways first started some four years ago, the price for tramway energy was considerably lower than that for lighting and power, the reductions made in the latter, which it is contended have only been made possible by the tramway load, now leave the price for tramway energy the highest. The Company take about 1,300,000 units per annum, at an average price of 1·4d. per unit. In respect of a certain section of their lines, the Clyde Valley Electric Power Co. supply at 0·78d. per unit, and offer, if it were legally possible, to supply at a similar price for the whole undertaking. The case against the Corporation includes allegations that high salaries and the payment of too high a price for coal, tend to keep up the price charged to the Company. Further, according to some average figures put in, the rating of the undertaking would appear to be excessive, according to the Company's witnesses. In repudiating a suggestion that the Company have not laid a sufficient feeder system for dealing with the tramways, it was pointed out that there are 2½ square inches of copper on the positive side, and 2 inches on the negative side for a load of 600 kw. The case for the Company was concluded on Saturday and the proceedings were adjourned. Mr. D. A. Slain, General Manager of the Clyde Valley Electric Power Co., and Mr. F. E. Gripper, of Edmundson's Electricity Corporation, were among the Company's witnesses. Mr. Hammond will visit Paisley in connection with the arbitration next week.

NORTHAMPTON POLYTECHNIC INSTITUTE
New Generating Station

The latest addition to the engineering equipment of the Northampton Polytechnic Institute, Clerkenwell, London, is a very complete generating station, which has been installed at a cost of about £6,000. It was formally opened yesterday afternoon by the Chairman of the London County Council, but has been supplying the lighting and power of the building for some weeks. The station is situated in the basement of the north-east corner of the main building, but is excellently lighted and ventilated.

The generating plant comprises two six-cylinder Gardner gas engines, rated at 108 b.h.p., 500 r.p.m., and each coupled to two Siemens generators in tandem. Two gas producers are installed in a yard adjacent to the engine-room, and either engine can be run off either producer. The two producers can work together to supply one or both engines, and for this purpose a mixing chamber is being erected. Provision is also made for working one or both engines off the town gas supply. One of the two generators on each engine is a 50 kw. 220 volt, D.C. machine, and the other is a 50 K.V.A., three-phase, 2,200-volt, 25-cycle alternator. There is nothing unusual about these machines except that the terminals of the alternator stator winding are made readily accessible, and provision is made for star or mesh connection. A small motor is installed with change-over belt gear for driving either the air-compressor for starting the engines, or a centrifugal fan, which draws air down outer pipes surrounding the exhaust pipes, and from other parts of the engine-room, to keep the atmosphere cool and fresh.

In the engine-room are also a motor-generator set and a battery booster-balancer. The former consists of a 45 b.h.p., three-phase, 2,200-volt synchronous motor, coupled to an 110-volt, 27½ kw., D.C. generator on one side, and a 220-volt, 25 kw., D.C. generator on the other. The latter is used for starting the set up from the D.C. 'bus-bars. A three-motor, three-ton travelling crane is provided. In an adjacent room is a group of four 13·7 kw. single-phase transformers, three connected in mesh, and one spare, transforming down from 2,200 volts to 350 volts. A 30 kw. rotary-converter, supplying at 550 volt on the D.C. side, is also in this room. The battery is in an adjacent corridor, and consists of 106 D.P. cells of 600 ampere-hours capacity on the 10-hour basis. This will deliver a current of 200 amperes at 220 volts for one hour. The booster-balancer working in conjunction with this is of the Turnbull-McLeod reversible pattern, and was also supplied by the D.P. Battery Co.

At the end of the engine-room, adjacent to the converter and transformer room, is a gallery for the control of the H.T. switchgear. The oil-switches themselves are in the room with the transformers, and are arranged with these in chambers fronted with expanded metal. They are operated by levers on the gallery, which, with all the instruments, relays, &c., are fitted to a board of the desk pattern. The only H.T. apparatus on the gallery is a leakage indicator, all the instrument and relay transformers being below in the switch chambers. The desk board comprises two generator panels, the synchronous motor panel, and the transformer panel. Ammeters, three-phase power-factor indicators (for unbalanced loads), and meters are provided on each panel, and there is also a synchronising device and a frequency meter. The two main switches for the generators are fitted with Ferranti reverse current relays. On the same gallery is a L.T. board, comprising the A.C. control panel for the rotary-converter, and two three-phase feeder panels for experimental power circuits. Provision is made for starting up the rotary-converter on the A.-C. side by paralleling and short-circuiting all the field coils, and supplying the armature with current at 60 volts alternating. When the machine is up to speed, the pressure is raised to the full 350 volts, and the field coils changed over to series connection preparatory to synchronising. The eddy-currents in the damping coils are sufficient to keep the machine running when once up to speed. Another feature of this machine is the provision of three auxiliary transformers with the secondaries in series with the A.C. side, and means for reversing the primaries to add or subtract a small pressure in a number of steps.

The main feeder board is at the opposite end of the room, and includes six 220-volt, three-wire feeder panels, the first two of which supply the main distribution board for the lighting and non-experimental power of the whole building. This is a new board, which has been erected in the old engine-room. The other panels of the main feeder board are the 550-volt D.C. rotary panel, and the 550-volt and 110-volt feeder panels. Instruments and meters are provided on each panel. Above this board is a gallery with panels for the control of the D.C. generators, the D.C. machines of the motor-generator set, the booster-balancer, and the battery.

The wiring of the building is being partly re-arranged and adapted to the three-wire system. All the experimental circuits are kept entirely separate from all other circuits. The main feeders are rubber-covered cables run along the walls of the corridors with cleats. Connection between the machines in the engine-rooms and the switchgear is made by means of lead-covered, paper-insulated cables, but there are no H.T. circuits outside the engine-rooms. Advanced students will carry out experimental work in the engine-rooms, and will take shifts. Generation at high-tension was chosen purely for the purpose of giving the students experience in the handling of high-tension machinery and switchgear. The contractors for the whole station were Messrs. Siemens Bros. Dynamo Works, Ltd. The machines and switchgear are of this firm's make, but there are recording instruments by Elliott Bros., power-factor indicators, frequency, and other meters, by Everett & Edgecumbe, and relays by Ferranti.

Swiss Railway Electrification.—The Rhaetian Railway Co., owning several narrow-gauge lines in the east of Switzerland, has decided to equip three sections of its system for electric traction on the single-phase system with 10,000 volts trolley line pressure and a frequency of 15 cycles. The sections are the Engadine lines Bevers-St. Moritz, Samaden-Pontresina, and Bevers-Schuls. The last named is now being constructed, and will be opened in the summer of 1913, from which date all three sections will be worked electrically. A contract has been entered into with the Brusio Power Station for the supply of current for a given period. The working of these sections will serve as an experiment with a view to the more extensive adoption of electric traction by the company.

Electrification of Victorian Railways.—In the Victorian Legislative Assembly last month, a member referred to the inconvenience due to the increasing traffic on the suburban railways of Melbourne, and urged the Government to introduce electric traction instead of proceeding to double the track as had been suggested. In reply, the Premier stated that the structural alterations to the track now being carried out would be of use if electric traction were introduced. Electrification alone, he thought, would not give immediate relief, but he had no doubt that the system would be eventually electrified. The Government did not propose to appoint a Commission to inquire into the question, as they considered they had sufficient information in Mr. Merz's report. The Premier assured the Assembly that the Government were fully alive to the importance of the question, and would shortly appoint a competent person to inquire further into the matter. Mr. E. C. Warde, a member of the Assembly, referring to the fact that the Railway Commissioners rejected Mr. Merz's proposal on the ground that it would require an increase of traffic of 33 per cent. to justify electrification, stated that in the intervening three years the traffic had increased on some lines by 100 per cent., while the average for the whole of the suburban system had been 34 to 35 per cent. He asserted that the Government had no intention of introducing electric traction, and complained that a recent vacancy on the Railway Commission was not filled by an electrical expert.

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PENDING ELECTRICAL LAWSUITS

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THE lists for the Michaelmas sittings of the Law Courts which commenced yesterday contain a number of lawsuits of interest to the electrical industry, but the action regarding metal filament lamp patents has not yet been put down for hearing before Christmas as was expected.

Marples, Leach & Co. are appealing against the judgment of Mr. Justice Parker in March, in which it was decided that the Bergmann lamp infringed the Z Electric Lamp Manufacturing Co.'s patent for the use of "phospham" in incandescent lamps. There will also be a motion for the production of further evidence in this case.

Another decision of Mr. Justice Parker's is being appealed against, viz., that the Ilgner patent for flywheel storage is invalid. It was alleged by the owners of this patent, viz., the Donnersmarckhütte Oberschlesische Eisen und Kohlenwerke Actien Gesellschaft, that the Electric Construction Co. had infringed their patent in an installation for the electric driving of rolling mills at Messrs. Hickman's works, but the judge held that the patent was invalid for want of subject matter.

The only other appeal is by Messrs. Babcock & Wilcox, Ltd., against a decision by Mr. Justice Warrington that in using the name Harrison in connection with a furnace, Messrs. E. Danks & Co. (Oldbury), Ltd., did not imply that they were supplying the Harrison patent furnace usually sold by Messrs. Babcock & Wilcox.

In the Chancery Division there are two actions relating to wireless telegraphy, one of which is by the Marconi Co. against the British Radio-Telegraph & Telephone Co., Ltd., in respect of the equipment of the s.s. *Nonsuch* of Messrs. Bowles Bros., London, which it is alleged infringes three of the Marconi Co.'s patents. The other is the Amalgamated Radio-Telegraph Co. *v.* Gandill, there being an action and counterclaim. The case of the British Thomson-Houston Co., Ltd., *v.* Midland Railway Co. for alleged infringement of their patents covering the multiple unit control system for electric traction, which has been in the list for the last two sittings, does not now appear, it having been settled. We understand that under the terms of the settlement, the Midland Railway Co. will agree to judgment being given for the B.T.H. Co., and recognise the validity of that Company's patent. Among the other actions is Electric & Ordnance Accessories Co., Ltd., *v.* Hancock (action and counterclaim).

The action by Mr. W. Griffiths against the proprietors of the *Daily Chronicle* for libel arising out of articles on the G.B. surface-contact system in the Mile End Road, will be mentioned in the King's Bench Division early in the session. The action *Electrical Press, Ltd.*, v. Mountain for alleged fraudulent misrepresentation is still in the list. It will be remembered that the *Electrical Press, Ltd.*, as advertising agents, placed the prospectus of Messrs. Mountain, Gibson, & Thornewill, Ltd., and were the largest creditors in the subsequent liquidation of the company.

Another action, by Crompton & Co., against Morgan & Davis, is a claim for payment, but we believe there will be no necessity for the case to come into Court.

Other actions include Babcock & Wilcox *v.* Spearing, which relates to an agreement; Settle *v.* Sheerness & District Electric Power Co., which has reference to an indemnity; and Improved Electric Traction, Ltd., *v.* Chloride Electrical Storage, Ltd., for money paid, but the latter is of no great importance.

In the Divisional Court, the case of the British Westinghouse Co. *v.* the Underground Electric Railways Co. of London appears, and we may make a shrewd guess that it is in connection with the Lots Road turbines. Another case in this Court is by the National Electric Construction Co. against the Canterbury Corporation. This is an appeal against a judgment in the Kent County Court respecting a free-wiring agreement, it having been held that a Local Authority has no power under the Electric Lighting Acts alone to make such an agreement. The Canterbury Corporation work under an ordinary Provisional Order, and have no special wiring powers.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

DYNAMOS AND MOTORS.—We have received from Mawdsley's, Ltd. (Zone Works, Dursley, Glos.), a large and attractive showcard with illustrations of a Mawdsley high-speed generating set, a miniature motor-generator set, and a number of motors driving pumps, &c.

BATTERIES AND BOOSTERS.—A new pamphlet from the Chloride Electrical Storage Co. (Clifton Junction, Manchester) contains a reprint of an article describing an Entz booster installation at the Blackburn Electricity Works, with illustrations of the equipment, and diagrams showing the excellence of the regulation obtained.

THE CARE OF MOTORS AND DYNAMOS.—An illustrated booklet has been issued by the Union Electric Co., Ltd. (Park Street, Southwark, London), giving useful instructions for starting, cleaning, and maintaining direct-current motors and dynamos, with special reference to Union machines. These practical hints as to the care of commutators should be of particular assistance to users of motors.

WIRES AND CABLES.—A provisional catalogue of vulcanised india-rubber wires and cables just to hand from Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster) supersedes their main catalogue of V.I.R. cables issued March, 1907, and relates to both "association" and "non-association" cables.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METAL FILAMENT LAMPS.—An attractive booklet is being issued by Messrs. Cryselco, Ltd., of Bedford, entitled "Light Notes on a Light Subject, by Chris Elco," and containing general notes on the manufacture of Cryselco metal filament lamps, with view of the Bedford Works, and a full price-list of both metal and carbon lamps they manufacture there.

TRANSMISSION LINE ACCESSORIES.—A pamphlet from Gebr. Hannemann et Cie, of Düren (Germany), contains particulars of several appliances for the construction and maintenance of overhead high-voltage lines. One of these is a convenient mirror mounted on a bamboo pole, with which insulators may be inspected without climbing the pole. Another device is a celluloid cap, which burns away on any arcing across an insulator, and thus shows immediately where the trouble has taken place. Special clips and tools for the attachment of line wires to insulators are also dealt with. As announced in our advertisement columns, the British patents for some of these appliances are for disposal.

HOLOPHANE FITTINGS.—The excellence of the well-known Holophane series of scientifically designed glass prismatic shades and reflectors is now generally recognised, and the new "Stiletto" form of prism has led to the introduction of some attractive diffusing and directing reflectors. New fittings are continually being brought out to utilise this glassware to its best advantage, and a number of these are contained in a catalogue just issued by Simplex Conduits, Ltd. (Garrison Street, Birmingham). A feature of some of these lies in the use of hollow rods through which the wires can be led out of sight, instead of ordinary chain for the suspension of the bowl and sphere fittings.

THE HAMPSTEAD ELECTRICAL EXHIBITION

A SUCCESSFUL exhibition of Domestic Electrical Appliances was held last week at the Hampstead Baths, under the auspices of the Electricity Department of the Hampstead Borough Council. Several wiring contractors in the district took part in it, as well as manufacturing firms and agents, and it is evident that there is a healthy co-operation between the electricity department and the wiring-firms towards increasing the popularity of electricity and the education of the consumer in its numerous applications. Great credit is due to Mr. Geo. H. Cottam and his Chief Assistant, Mr. E. Sayer, for the work they have done in this direction.

In Hampstead the extension of electric lighting into the smaller as well as the larger houses and shops is being actively encouraged, and it is not surprising, therefore, that the most prominent stand was that of Messrs. Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd.,

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and that a great feature of this stand was "Stannos" wiring. A well-designed showboard illustrated the system clearly, and the methods of fixing and jointing and patient attendants were there to explain all its details to visitors. Messrs. Siemens' stand was by no means confined to this exhibit, however, and an intersting collection of the firm's other specialities was shown, including a selection of useful and



FIG. 1.—THE SIEMENS STAND.

ornamental fittings. Among these we noticed a new type of outside lantern illustrated in Fig. 2. The novelty consists in the method of attachment of the glass globe, which is held in place by an ingenious device, so that the globe has only to be pushed up in position, and the use of set screws in the gallery is avoided. The device is shown in Fig. 2. A

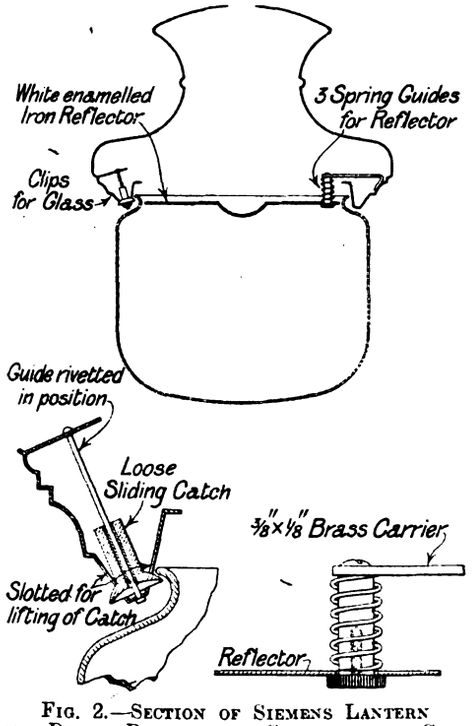


FIG. 2.—SECTION OF SIEMENS LANTERN AND DETAIL DRAWING OF GLOBE-CARRIER CLIP.

catch has only to be pushed up to allow the globe to be taken off, and on replacing the globe the catch is pressed back as the globe is pushed into position, and falls back again in the lip of the globe. As is seen in the illustration, the reflector from which the lamp is suspended is mounted on springs to prevent vibration, and although this may not be necessary with tantalum lamps, yet for other makes, at any rate, a vibration absorber is an advantage. Needless to say tantalum and "Onewatt" lamps are a feature of Messrs. Siemens' stand.

On a large number of stands electric heating and cooking appliances were very conspicuous. Messrs. Drake & Gorham, Ltd., showed Bastian heaters, Archer irons, and, among other things, an electrically-heated coffee percolator, in which a pint of black coffee could be brewed in a quarter of an hour, with the expenditure of one-sixteenth of a unit of electrical energy. Messrs. Spagnoletti, Ltd., exhibited their "Therol" system. An exhibit which attracted much attention was that of Messrs. Eastman & Warne, in conjunction with Eastman & Son, Ltd., dyers and cleaners. The various patterns of electric irons made by the former firm were shown in operation by skilled laundry hands, and some solid-looking electrically-heated soldering irons were shown. A 22 oz. iron is maintained hot with the consumption of 170 watts, and a 2½ lb. iron with 250 watts. The inclusion of the heating coil in the tool does not render it cumbrous to the slightest degree.

A new electric cooker just put on the market by Messrs. O. C. Hawkes & Co., Ltd., was to be seen at the stand of Mr. Eric Rivers-Smith. Several patterns were shown. In the one illustrated in Fig. 4 the central part is employed for grilling and roasting. This part is fitted with three 500-watt heating units (seen as white bars in the figure), which glow at a red heat. They are inserted in clips in a similar way to fuses, but are pressed tight in contact by set screws with milled heads. When a unit burns out it can be taken out in a few seconds, and Messrs. Hawkes will rewind it, or replace it, for 6d. A "Dutch oven" is placed on the shelf in front of the units for roasting, &c. At either side is a boiling plate, with a 500-watt heating unit fixed close under it.

Messrs. Purcell and Nobbs have some new designs of their electric heaters. Various sizes of the "electroyl" pattern were shown, in which the heating unit is contained in oil, and other patterns in which the oil is not employed. Among the latter was a "fresh-air heater" in which the air is led from the outside and passes across a nikelin and asbestos heating unit. The construction lends itself to easy fixing in the wall of a house or hall. "Tricity" cookers were also on view on a stand occupied by the Berry Construction Co., Ltd. Ozonair, Ltd., showed several sizes of ozonair ventilating apparatus emitting their characteristic pleasant smell; Messrs. Roper and Co. (the Kilburn "Bon Marché"), Ltd., a good show of Z lamps. Messrs. Duncan Watson and Co., and also Messrs. F. Troy and Co. showed portable vacuum cleaners in operation. The latter firm had two stands well filled with fittings and other interesting accessories, and we noticed the new Horvath 32 c.p. metal filament lamp (which we believe is the smallest of that candle power yet manufactured), in addition to a good selection of Osrams of various candle powers. The Adams Watkin lamp regulating switch was in evidence, and close

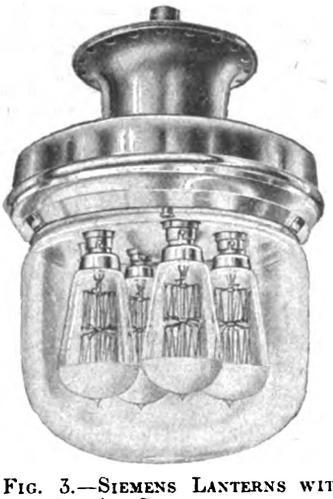


FIG. 3.—SIEMENS LANTERNS WITH SPECIAL GLOBE-CARRIER.

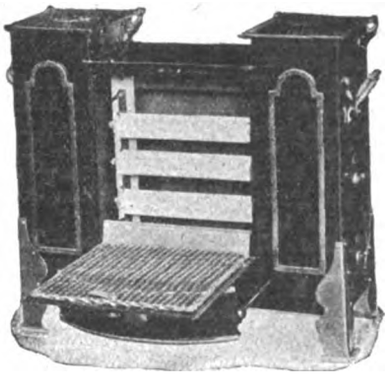


FIG. 4.—HAWKES' COOKER.

by were a collection of Aron clocks. Considerable attention was directed to a "Kaleidoscopic" sign shown by Messrs. W. Leonard and R. C. Jeboult, in which coloured lamps in box-like compartments and worked by independent thermal flashers give a pretty effect. Lastly, we must mention a new dinner lift shown by Mr. Fred. Hodgson. In this the arrangement of the gear is such that no cupboard is necessary for the lift at the dining-room end. The lift as it rises simply lifts a flap in the floor. If the mechanical details of this lift prove to be mechanically sound and durable, there should be a great future before it.

In addition to the exhibits already referred to, there was a good display of electrical fittings; Mr. William Smith particularly deserves honourable mention.

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LOCAL NOTES

Acton: *Transfer of Electrical Undertaking.*—At a special meeting of the Acton District Council last week, it was agreed, by eleven votes to nine, to accept the terms of the Metropolitan Electric Supply Co., Ltd., for the handing over to them of the electricity undertaking. In addition to giving £2,500 and being responsible for the loan charges, the Company will pay a further £2,500 on their obtaining and paying a dividend of 6½ per cent., instead of giving £5,000 at the taking over the undertaking as the Acton Council requested. The Chairman of the Electricity Committee, H. S. Schultess Young, moved, and Councillor Page seconded, that the terms be accepted, and an amendment was proposed by Councillor Dunsmore, and seconded by Councillor Schulster, that they allow the negotiations to drop, and invite tenders for the erection of a new generating station of their own. The amendment was, however, lost and the original motion carried.

Amble: *Street Lighting.*—The Council have under consideration an offer by the local Electric Lighting Company for street lighting.

Barnsley: *Street Electric Lighting.*—The Borough Electrical Engineer has prepared a scheme of street electric lighting in substitution for gas, and the matter is to be discussed by the Council.

Brighton: *Price for Tramway Energy.*—The Manager of the Corporation tramway system has complained in several of his reports of the high price paid to the Electricity Committee for energy for tramway purposes. A joint sub-committee, drawn from the Lighting and General Purposes Committees, is now to determine the price to be paid for tramway energy during the current financial year.

Carlisle: *Electric Lighting.*—The Corporation are to be allowed to apply for an Electric Lighting Provisional Order for supplying portions of the Rural District.

Derby: *Electricity Accounts.*—There is a loss of £79 on the electricity undertaking for the last year, compared with a profit of £365 in the previous year. However, there is an item of £1,427 which has been expended upon items of a capital nature, but which appears in the revenue account.

Glasgow: *Tramway Profits.*—Meetings of protest are being held by the ratepayers against transferring any profits from the tramway undertaking to relief of rates. The argument is that these should be used for the benefit of the tramways department and travelling public, as was laid down by the Committee of Parliament which dealt with the Corporation Gas Bill last session. Mr. James Willock, a past convener of the Electricity Committee, is taking a prominent part in these protests.

Halifax: *Tramway Extensions.*—It is proposed to extend the tramways to Elland. The latter Council have appointed a Committee to go into the matter and report.

Hove: *Proposed Tramways.*—The Hove Ratepayers Association has expressed its strong disapproval of a proposal by the British Electric Traction Company to introduce tramways in the town.

Leith: *Electricity Charges.*—The general feeling of the Council is that the profits from the electricity undertaking should be conferred upon the consumers instead of distributed in relief of rates, and in order that in future large surpluses should not be shown, the Convener of the Committee has been instructed to reorganise the charges.

London: *Hammersmith: Electric Lighting.*—Notice has been given to the Brentford Gas Co., to discontinue the supply of gas for the lighting of Hammersmith Bridge, electricity having been substituted.

Paddington: Tramways.—The Council have refused their consent to the construction of tramways along Edgware Road, from Marble Arch to Cricklewood. Delegates have been appointed to meet the Highways Committee of the London County Council.

Newcastle: *Tramway Extensions.*—The Corporation propose to seek Parliamentary powers for the extension of the tramways from Scotswood to Blaydon, Newburn, and Westerhope.

New Zealand: *Electricity for Domestic Purposes.*—With a view to familiarising the general public in New Zealand with the numerous applications of electricity for domestic requirements, a series of demonstrations is being arranged for by the Wellington City Council. It is also stated that similar demonstrations are to be arranged in Christchurch.

Ottery: *Electric Supply.*—Lord Coleridge presided over a meeting last week to consider the promotion of an electric lighting company for the town. Mr. Steel, a consulting engineer of Exeter, proposes to make use of some local water power, and estimates the necessary capital at £2,000.

Portsmouth: *Tramway Assessment.*—The Assessment Committee some time ago increased the assessment of the Corporation Tramways from £15,534 to £23,510. Naturally the Tramways Committee appealed against this new assessment, and as the result of a meeting between the two committees, a figure of £19,000 has been agreed upon.

Rio de Janeiro: *Electric Supply.*—The Companhia Brazileira de Energia Electrica have obtained from the Mayor of the Federal district of Rio Janeiro the approval of their plans for giving an electric supply in the city. We understand that action is being taken in the Brazilian Courts by the Rio Janeiro Light and Power Company with regard to this matter.

Scarborough: *Stoppage of Tramways.*—The Corporation are very concerned at the action of the Tramways Company in suspending its service for the winter months. Representations are being made to the Board of Trade, and there is every probability of a conference taking place between the Tramways Committee and the Corporation on the matter.

South Africa: *Uitenhage: Electric Supply.*—The General Electric Co., of London, who formed a local company for the introduction of electric supply in Uitenhage, has completed the works, and current was switched on last month.

Tramways.—Two firms have the option for a period of six months of the right to construct tramways in Bloemfontein.

West Ham: *Electricity Accounts.*—The accounts of the Electricity Department for the year to March 31st show a deficit of £93. It should be pointed out, however, that by reason of the new assessment of the undertaking, rates have cost £5,207 more than in the previous year. The number of units sold, namely, 19,156,399, is an increase of 3,634,344, and the revenue has increased from £69,812 to £79,454. The working expenses were £48,813, against £39,123.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bispham.—The Borough Surveyor is preparing plans of a proposed power house in Redbank Road.

Darlington.—A loan of £1,400 has been sanctioned for condensing plant.

Felixstowe.—A loan of £3,000 for electrical extensions is to be applied for.

Horsham.—New generating plant is to be installed at an estimated cost of £1,850.

Ipswich.—Sanction for a loan of £6,007, which has been spent in anticipation of borrowing powers, is to be sought, in addition to a further £10,993 for mains, services, meters, hire-purchase wiring, motors, and arc lamps.

Kettering.—Additions to the street electric lighting are to be carried out. A coal-conveying plant is also to be installed.

London: *London County Council.*—An expenditure of £3,100 is to be incurred in linking up the two sets of sub-stations on either side of the river. Of this sum, £2,600 is for cables and the remaining £500 is for switchgear.

Hackney.—Mains are to be extended from Clapton Common to Springfield Gardens at an estimated cost of £255.

Islington.—The L.C.C. have sanctioned a loan of £4,251 for mains, transformers, house services and meters.

South Africa.—It is stated that the Rand Mines Power Supply Co., Ltd., have made an application for a licence to erect two generating stations, and the Victoria Falls & Transvaal Power Co. for a licence to supply electrical energy from six generating stations. Further particulars from the Board of Trade, 73 Basinghall Street, London.

South Shields.—An inquiry into a loan of £9,410 for electrical extensions was held last week. Mr. Vesey Knox, K.C., appeared on behalf of Messrs. Smith's Dock Co., and the North-Eastern Railway Co., whose rateable value in the borough amounts to £66,000. He explained that the object of his appearance was to see that the expenditure on the electricity

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undertaking was controlled and managed in such a way as to produce the best result to the rates. In the course of the discussion it came out that the County of Durham Electric Power Co. are prepared to supply the Corporation with electricity in bulk upon terms which were said to be one-third the present generating costs of the Corporation, and eventually the inquiry was adjourned in order to see if the Corporation and the Power Company could come to an agreement.

Stockton-on-Tees.—The Electrical Engineer is preparing an estimate of possible extensions of plant.

Tonbridge.—An inquiry was held last week concerning a loan of £1,441, partly for service charges in substituting electricity for gas for street lighting. During the course of the inquiry, the Inspector, Mr. H. R. Hooper, expressed himself in his usual manner on this question, and further suggested that the cost of conversion should be charged to revenue and not to capital.

Wednesbury.—The Local Government Board have sanctioned, without holding an inquiry, a loan of £4,000 for extensions at the Electricity Works.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Rebuilding of premises in Broadway, Hammersmith. Messrs. Sich and Co.

Two blocks of dwellings, Church Lane, Tooting.

Buildings on the southern side of Upper Clapton Road, Hackney.

Additions to Old Kent Road Special Schools, Bermondsey.

Additions to Hatfield Street School, Southwark.

Re-erection of Victoria Station (District Railway) buildings.

Eighteen houses at Hart Grove, Ealing. Architect, A. Dawkins, 31, Craven Street, Strand.—Eleven houses, Leyborne Avenue. J. Kaphan, 19 Ealing Road, South Ealing.—Nine houses and Institute, Meadvale Road. Ealing Tenants, Ltd., 32 Woodfield Crescent, Ealing.—Eighteen houses, York Road. A. J. Taylor, 22 Overdale Road, South Ealing.

Plans for 39 electric theatres are awaiting the approval of the London County Council.

Proposed alterations and extensions to Stratford Hospital.

Proposed new offices for Public Trustee in Kingsway.

PROVINCES.

Aberdeen.—Church, John Knox Parish.

Beckenham.—Elementary School in Witham Road.

Bexhill.—York Hall is to be wired for electric lighting.

Birmingham.—Fire Station in Moseley Road.—Also Art Gallery.

Bournemouth.—Science and Art School.

Bo'ness.—Nurses' Home. Mr. Dalziel, W.S., Edinburgh.

Bradford.—Additions to Guardians' premises.

Caterham.—New Council Offices.

Chatham.—Cottage Homes and Receiving Ward. Medway Guardians.

Cork.—Rebuilding of Munster and Leinster Bank. Architect, A. Hill, 22 Georges Street, Cork.

Darlington.—Fifteen houses in Harding Street, and twelve houses in Hollyhurst Road.

Derby.—New County Offices, St. Mary's Gate.

Dudley.—Women's Hostel at Training College. Architects, Messrs. Crouch, Butler & Savage, Birmingham.

Dundee.—Training College for St. Andrew's University. Electric theatre in Logie Street. D. Oppenheim. Electric theatre in Watson Street. John Spink.

Durham.—Several new schools and additions to existing schools are to be carried out. A. J. Dawson, Clerk, Education Committee, Shire Hall, Durham.

Eastleigh.—Theatre in Market Street.—Proposed Cottage Hospital.

Ebbw Vale.—Drill Hall for first Welsh Field Ambulance Corps.

Eccles.—Proposed school in Vane Street.

Esher.—Parish Hall in Church Street.

Farnworth.—Tenders are invited for the electric lighting of the Carnegie Library. Architect, W. J. Lomax, 11 Fold Street, Bolton.

Gateshead.—Additional buildings for the Guardians.

Gosport.—Addition of three class rooms to Grove Road School.

Grantham.—Proposed extension of Messrs. Hornsby's Works.

Grays (Essex).—School in Bridge Road.

Hinckley.—Isolation Hospital.

Horsham.—Proposed Public Baths.

Inverness.—New police premises.

King's Lynn.—School in Paxton Terrace.

Leeds.—Alterations to large block of buildings, junction of Little Queen Street and Wellington Street. Architects, Thomas Winn & Sons, 84 Albion Street.

Liverpool.—New court, Dale Street, and alteration to public buildings.

Manchester.—Schools in Gibbon Street and Clarendon Road. Education Committee, Deansgate.—Labour Exchange. H.M. Office of Works, Manchester.—Church for St. Andrews, Droylsden, and Clayton districts. Ecclesiastical Commissioners.

Merthyr Tydfil.—New block at Workhouse Infirmary. Architect, T. Roderick, Clifton Street.

Motherwell.—Hall in Camp Street.

Mountain Ash.—Working Men's Club. Architects, Messrs. Morgan & Elford, 1 Jeffrey Street.

Paisley.—Additions to factory. Messrs. Eadie Bros. & Co.

Salford.—Extension to Infirmary.

Stanley.—Girls' school. Durham Education Committee.

Swansea.—103 houses on the Cwm Estate.

Torquay.—Electric lighting of Princess Pier and gardens.

Tunbridge Wells.—Electric theatre in Camden Road.

Watford.—New Grammar School for Boys in Rickmansworth Road.—Children's Home in Ashby Road.

Weston-super-Mare.—Church school in Milton Road.

West Riding (Yorks).—Proposed Sanatorium. County Council.

Whitehaven.—Council School in Irish Street.

Winchester.—New Council School.

Yeovil.—Elementary School in Kiddles Lane.

York.—Considerable additions at the Workhouse.

MISCELLANEOUS

Australia.—Tenders are invited by the Deputy-Postmaster-General at Melbourne by November 22nd for 95 miles of telephone cable, 358,800 paper sleeves, and 3,840 telephones, and by November 29th for telephone instruments. Particulars from 73 Basinghall Street, London.

London: *London County Council.*—The Council have at present four electrically-driven watering cars fitted with grinding gear for removing rail corrugations. Owing to the appearance of corrugations along routes opened since these cars were ordered, they are inadequate for the purpose, and four additional cars are to be obtained.

Frodingham.—It has been decided to light the streets by electricity, current being purchased from the Frodingham Iron & Steel Co.

West Ham.—Tenders are invited by October 20th for 12 double-deck electric tramcars, 12 maximum traction trucks, and 12 complete electrical equipments, including magnetic track brakes. Further particulars from the Manager.

Electricity Supply in Bethnal Green.—The agreement between the Bethnal Green and Shoreditch Borough Councils, under which the latter are to afford a supply of electricity in bulk to Bethnal Green, has now been prepared, and has been submitted to the London County Council for their comment. The Highways Committee call the attention of the Board of Trade to one or two points in the agreement. They do not think the penalties in the case of failure in supply are quite clear; they also suggest the necessity for a percentage loss in the distributing mains in Bethnal Green being inserted in the agreement. The accuracy of the meter measuring the bulk supply, if challenged, is to be referred to the Chief Electrical Engineer of the London County Council, but the Council prefer that the Electric Inspector, appointed under the Shoreditch Electric Lighting Provisional Order, should be the person. The agreement also provides that the consumer's meters in Bethnal Green, which are to be read by Shoreditch, should be of a type approved by the Shoreditch Electrical Engineer, but the Highways Committee fail to see any good reason for this. A most important point raised is that the agreement is for seven years from March 31st, 1911, but no provision is made for any extension of it, and as the County Council will have to lend the money for the works in Bethnal Green on a 20 or 30 years period of repayment, it is suggested that the term of the agreement should more nearly approximate to this, or, at any rate, that renewal should be made possible. A number of other minor points are also discussed. From the engineering point of view no exception is taken, and from the point of view of the future development in the supply of electricity in London, the Highways Committee sees an advantage in it by reason of the fact that it obviates the establishment of another small generating station.

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TENDERS RECEIVED AND ACCEPTED

Hull.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for a 900-kw. generating set, at £5,573, has been accepted.

London; *London County Council.*—The tender of Messrs. Stanley Bros., Ltd., for 440,000 stoneware cable ducts at £9 per 1,000, less 2½ per cent., has been accepted. The tender of Messrs. Patman & Fotheringham, Ltd., at £7,193 has been accepted for the erection of the second portion of the Bow car shed. The tender of the Edison & Swan United Electric Light Co., Ltd., at £138 13s. has been accepted for the electric wiring and fitting. The General Electric Co., Ltd., and Messrs. Pinching & Walton also tendered at £148 9s. and £151 15s. respectively. The following tenders were received for the wiring and fitting of the second section of the Central Car Repair Depôt :—Central Motor Engineering Co., £1,571; E. Lawrance & Sons, Ltd. (accepted), £1,702 17s.; G. E. Taylor & Co., £1,863 19s.; Johnson & Phillips, Ltd., £1,877; Tilley Brothers, £1,888 12s.; E. Newbald & Co., £2,024; Pinching & Walton, £2,035 10s; G. Weston & Sons, £2,043 12s.; Gordon O. Lawson, £2,320: Barlow Brothers & Co., £2,425 16s.

The tender of Messrs. Johnson & Phillips, Ltd., at £2,185, has been accepted for covering with asbestos tape various high and low tension cables used in connection with the tramways. The following tenders were also received :—Messrs. Siemens Bros. & Co., Ltd., £2,280; Western Electric Co., Ltd., £2,310; British Insulated & Helsby Cables, Ltd., £2,524; and W. T. Henley's Telegraph Works Co., Ltd., £2,905 16s.

The tender of the Phœnix Aktien-Gesellschaft für Bergbau und Hüttenbetrieb, Duisburg-Ruhrort, Germany, has been accepted for the supply of 4,800 steel tyres for driving wheels, at £4,080, and that of Messrs. John Batt & Co., Ltd., for 1,600 pony wheel tyres at £1,013 6s. 8d.

Hackney.—The following tenders have been received for the extension of the main switchboard at the electricity works :—Walsall Electrical Co., £249 10s.; Ferranti, Ltd., £715; Spagnoletti, Ltd., £340; Drake & Gorham, £353; British Thomson-Houston Co., Ltd., £525; Bertram Thomas, £339 10s.; Electric & Ordnance Accessories Co., Ltd., £305; Kelvin & White, £900; British Westinghouse Co., £786; Johnson & Phillips, Ltd., £422. The tender of Messrs. Spagnoletti, Ltd., is recommended for acceptance.

Manchester.—The Manchester Corporation Electricity Department have placed an order with the British Insulated & Helsby Cables Ltd., for some 8,000 yards of paper-insulated aluminium conductor cable, of equivalent section to 1 sq. in. copper.

South Africa.—Messrs. C. A. Parsons and Co. have received an order from the Durban Municipality for two 2,000 kw. turbo-alternators.

APPOINTMENTS AND PERSONAL NOTES

The following appointments have been made by the Stoke-on-Trent Corporation :—As Resident Electrical Engineers : Mr. H. W. Edwards, Burslem District; Mr. W. Adams, Hanley District; Mr. C. Cuthbertson, Longton District; Mr. W. A. Turnbull, Stoke District. As Mains Superintendents : Mr. H. C. Heath, for Burslem; Mr. S. G. Marston, for Hanley; Mr. C. H. Thomas, for Stoke.

Mr. H. Bedson, Meter Superintendent of the old Hanley Electricity Department, has been appointed, out of eighty candidates, Mains Superintendent to the Maidenhead Electricity Department.

Mr. A. G. Whyte (editor of our contemporary, *Electrical Industries*) is the author of a new novel entitled "The Templeton Tradition," which has just been published by Messrs. Blackwood & Son. The leading characters are partners in an engine-building firm, and the relations of master and man are developed in a novel manner.

The salary of Mr. C. A. Blascheck, Borough Electrical Engineer at Canterbury, has been increased from £325 to £350 per annum, and that of Mr. Lewis, Assistant Engineer, from three guineas per week to £185 per annum.

Agents are wanted for the sale of artificial Trinidad Lake bitumen. (See an advertisement on another page.)

A London electric supply company have a vacancy for an improver with mechanical and electrical training. (See an advertisement on another page.)

An experienced draughtsman is required for power station machinery and pipe lay-out work. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 15s. to £59 per ton (last week, £58 to £58 5s.).

Change of Address.—Messrs. Simplex Conduits, Ltd., have now removed their motor department from 116 Charing Cross Road to Garrison Lane, Birmingham, where Mr. Wahl, the manager of this department, will in future have his offices and all testing will be carried out.

Owing to increase in their business, the Sloan Electric Co., Ltd., will shortly be removing to "Conradty House," 12 Golden Lane, E.C. The trade will, in the course of a few weeks, be notified by circular of the exact date of removal.

Dissolution of Partnership.—J. H. Woodhead and H. Woodhead, electrical engineers and contractors, Gascoigne Street, Leeds, have dissolved partnership.

Bankruptcies.—The public examination of F. Peacock, electrician, 59 North Station Road, Colchester, was completed last week. The statement of affairs shows £228 owing to thirty-two creditors, with no assets.

Creditors of the Polesworth Electrical Appliances, Ltd., are requested to send in claims to Mr. H. Hackett, 36 Carrs Street, Birmingham, not later than November 12th.

Electricity in Business.—Messrs. Electrical Installations, Ltd., 27 Martin's Lane, Cannon Street, inform us that they are equipping a large stand at the forthcoming Business and Advertising Exhibition at Olympia (October 13th to 22nd), in order to demonstrate the many ways in which electricity can conduce to economy in business.

Metallic Packing.—We are informed by the United States Metallic Packing Co., Ltd., Soho Works, Thornton Road, Bradford, that the main engines, electric light engines and pumping engines of the new White Star liner *Olympic*, shortly to be launched from Messrs. Harland and Wolff's yard, will be provided with United States metallic packing made at Bradford.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Calcutta Tramways Co.—Interim dividend of 2s. 6d. per share.

Calcutta Electric Supply Corporation.—Interim dividend at the rate of 7 per cent. per annum for the June half-year.

United Electric Tramways Co. of Montevideo.—The receipts for the first half of this Company's current year show an increase of £25,100 over those of the corresponding six months of last year.

Norwich Electric Tramways Co.—For the year to June 30th there was a net profit of £6,107. Reserve is credited with £2,500, and a dividend of 1¼ per cent. paid, carrying forward £307. The number of passengers increased by 617,511.

Mexico Tramways Co.—Dividend at the rate of 7 per cent. for September quarter.

City of Birmingham Tramways Co.—Interim dividend at the rate of 10 per cent. per annum for nine months to September 30th.

New St. Helens & District Tramways Co.—Dividend of 1½ per cent. on account of preference arrears.

Cleveland & Durham Electric Power Co.—The accounts for the past year, which show a profit of £12,942 compared with £2,098 for the previous year, were adopted at the annual meeting on Friday. Mr. J. Falconar, the Chairman of the Company, said that the main capital expenditure had now been completed, and that the increase in profits was sufficient evidence of the manner in which the Company's undertaking was now expanding.

Willans & Robinson.—At the half-yearly meeting on Tuesday Mr. J. C. Peach, while regretting the loss of £8,001 during the past six months, expressed the opinion that there were signs that the worst had been reached in the matter of low prices, and that given staying powers, the Board would overcome the difficulties created by this condition of affairs. One obvious cure for the excessive competition in the electrical industry was amalgamation, a policy which had been adopted with success in many other industries. The directors were ready to take advantage of any reasonable opportunity of this character that might present itself, but it was a policy that could not be forced.

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ELECTRICAL ENGINEERING

No. 199 [Vol. VI., No. 42] THURSDAY, OCTOBER 20, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

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All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

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SUMMARY

WE publish this week a series of articles particularly dedicated to the electric light consumer and prospective consumer, and dealing with shop and shop-window lighting. They commence with some notes on the general arrangement of shop lighting installations, the number and position of lamps required, and illustrations of some suitable shades and reflectors are given. Shop-window lighting is next dealt with in a separate article, and the relative merits of various methods of arranging lamps are discussed, several forms of reflector for effective concealed lighting are illustrated, and this form of illumination is recommended as preferable in a great number of cases to lighting by lamps hung on visible pendants, &c. The use of arc lamps is also considered, and a few notes are given on decorative lighting. A number of forms of lantern for exterior shop lighting are illustrated, and the general question of lighting shop fronts from outside, both by incandescent lamps and by arc lamps, is dealt with. A few figures as to the cost of arc lighting are given. A more technical article follows, giving detailed descriptions of the various electric signs. These range from the simple box sign for window advertising, consisting of a sheet-metal box with painted glass fronts and a thermal flasher controlling a single lamp, to the enormous writing and colour-changing signs erected on the outside of buildings. The latter are controlled by ingenious motor-driven switches, some types of which are described and illustrated. Various means are adopted to give clear and brilliant effects without producing an unpleasant glare. The exterior signs must also be water-tight and durable. Finally we give tables showing the cost of lighting by metal filament lamps. (Pages 657–665.)

A NOVEL application of the Telewriter consists in placing a receiver in a shop window and causing it to write advertisement notices, general news items, in view of the public. The concealed operator may also cause it to address remarks to lookers-on. (Page 665.)

A NEW locking device for bayonet lamp-holders has been introduced. It can be attached to existing holders, the only alteration required being a slot in the liner of the holder. (Page 665.)

AMONG the Specifications published by the Patent Office on Thursday was one by A. C. Heap for a transformer starter for A.-C. motors, in which the inductive relationship of the primary and secondary windings can be varied to obtain a gradual increase of the applied pressure. The transformer is cut out automatically when the full voltage is reached.—An apparatus for producing a compact mica casing round the sides of former-wound armature coils is described by M. Meirowsky.—G. A. Kohler covers an A.-C. solenoid for automatic switchgear with a short-circuited winding on the core.—A patent covering the use of auxiliary metallic contacts in circuit-breakers for taking the current after the main contacts are opened but before the arcing contacts are parted, expires during the current week.—Two patents of interest to electrical mining engineers also expire after the full life of fourteen years. (Page 666.)

AN interesting engineering and machinery exhibition is being held at Manchester. (Page 667.)

A PORTABLE ventilating set recently introduced consists of a small centrifugal blower direct-coupled to a D.C. motor, the whole being light enough to carry about. It can be placed on the window-sill for blowing air in or out of a room. (Page 667.)

A PROMINENT stand at the Business Exhibition at Olympia demonstrates the latest methods of electric lighting, heating, ventilating, and telephones suitable for business premises. (Page 667.)

A LETTER in our correspondence column calls attention to the attitude of certain towns with regard to the proposed Municipal Wiring Bill, and a correspondent writes regarding the manufacture and sale of Diesel engines. (Page 668.)

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An illustration is given of a railway station lighting installation where metal filament lamps are used exclusively. (Page 668.)

Applications for space are now invited for the Electrical Exhibition which will be held at Olympia (London) from September 23rd to October 21st, 1911. (Page 669.)

The wireless telegraph equipment of the Wellman airship has been a complete success, although the vessel herself did not prove equal to the Transatlantic voyage. It is due entirely to wireless telegraphy that the crew were rescued. (Page 669.)

The National Electrical Manufacturers' Association have altered their articles of association with a view to confining the management more completely to British manufacturers. (Page 669.)

Messrs. Marples, Leach & Co., as agents for Messrs. Bergmann (Berlin), appealed on Friday against the judgment of Mr. Justice Parker that by the use of phospham in the manufacture of their lamps, they infringed one of the patents of the "Z" Electric Lamp Manufacturing Co. After an argument lasting three days, to the effect that although phospham was used in the manufacture of the Bergmann lamps, it was used for a different purpose to that of the "Z" Co., the court dismissed the appeal without calling on counsel for the "Z" Co. to reply. (Page 669.)

In the King's Bench Division of the High Court on Thursday, the action of Griffiths *v.* Lloyd and others, which related to the experimental installation of the G.B. surface contact system in the Mile End Road, was announced as having been settled. The proprietors of the *Daily Chronicle*, the *Star*, and the *Morning Leader* have apologised to the owners of the G.B. surface contact system for statements made in their papers which were held to be libels. They have also agreed to pay a substantial sum as damages. (Page 669.)

The second portion of the Birmingham Corporation power station, making a total capacity of 19,000 kw., has been completed.—A competing electric supply company is being promoted in Buenos Aires.—Considerable sums are being saved at Burton-on-Trent and Croydon by the use of meters on tramcars.—The Dundee Town Council have not approved of municipal wiring powers, and the Cheltenham Council have decided to hear objections from local contractors.—Meetings are being held protesting against the Dolter contact-system in Hastings.—The reconstruction of the Torquay Dolter tramways is being put in hand.—Flame arc lamps are being installed experimentally for street lighting in Calcutta. (Page 671.)

Extensions of electricity works are proposed at Wednesbury (£4,600); Yarmouth (£5,800); Oldham (£12,544); Battersea (£9,000); Carlisle (£12,645); and Bury St. Edmunds (£1,430). Extensions are also contemplated at Swindon, Beckenham, and Ayr. Electrical stores are required by the Dublin United Tramways Co. and the London County Council; a complete tramway system is required in New Zealand, and six tramcars at Rawtenstall. (Page 672.)

It is proposed to reduce the capital of the Cleveland & Durham Electric Power Co. from £1,000,000 to £700,000. Dividends at the rate of 10 per cent. per annum are declared by Callender's Cable & Construction Co., 7½ per cent. by Stothert & Pitt, and 4 per cent. by Drake & Gorham. (Page 674.)

ARRANGEMENTS FOR THE WEEK

FRIDAY, OCTOBER 21st.

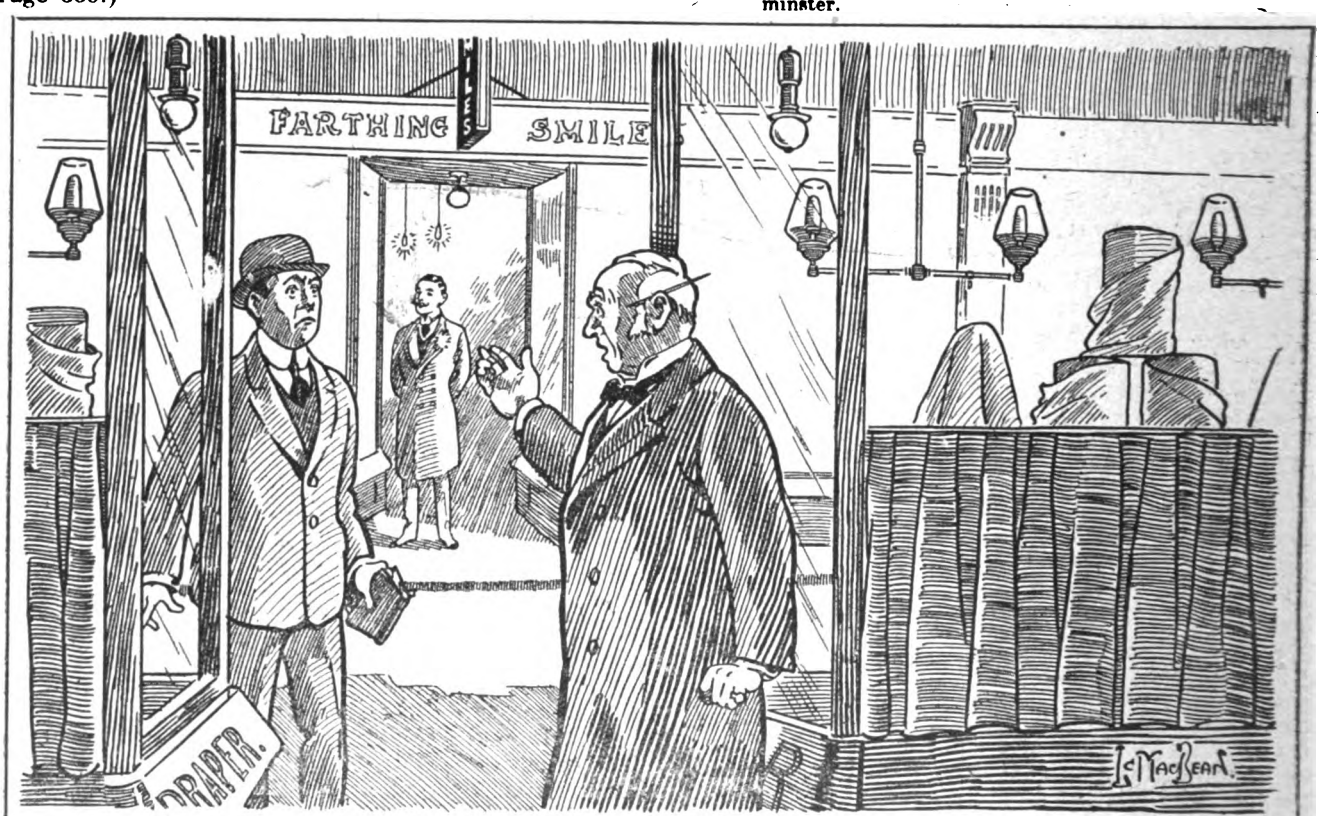
Electro Harmonic Society.

8 p.m. Smoking Concert at Holborn Restaurant (King's Hall).

TUESDAY, OCTOBER 25th.

Junior Institution of Engineers.

7.30 p.m. Second Lecture on "Law Relating to Engineering," by L. W. J. Costello, at Caxton Hall, Westminster.



WHAT THE ELECTRIC LIGHT CANVASSER HAS TO PUT UP WITH.

Irate Shopkeeper: It's no use your talking to *me*, young man. I'm not going to believe electricity is cheaper than gas because *you* say so, and I like your impudence talking of what I spend in redecorations; it's *me* not *you* as pays for 'em. And let me tell you that the air of *my* establishment is not vitiated by gas or anything else, and that *my* stock does not fade or get dirty. You can go back to your master, young man, and tell him that he needn't send you here again nor his silly postcards and tracts. But you may tell your master that as Farthings and Smiles opposite have taken away half my customers with their foolish electric light, he can put it up here too.

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ELECTRIC LIGHTING OF SHOPS AND SHOP WINDOWS

THE present article reviews the question of lighting shops and shop windows from the point of view of the consumer or prospective consumer. It may be taken for granted that every tradesman will consider electric light to be the most desirable method of illumination, and therefore he will doubtless welcome some general information as to the best manner to arrange his installation, an indication of the cost of lighting, the best methods to be employed for shop-window and shop-front lighting, the various types of electric signs, and other matters of a similar nature. We trust, therefore, that the following pages will be useful to those who are considering what is the best, most economical, cleanest, and safest method of lighting their shops, as well as to those who are contemplating alterations or extensions of their existing lighting arrangements.

The first point to be considered is the number, size, and position of the lamps in the shop itself, and in laying out his scheme the consumer will be greatly assisted by knowing that, as the electric lamps have no open flame, and give off comparatively little heat, he can place his lamps practically where and how he likes. Moreover, he is not so hampered as he would have been a few years ago on the question of cost, for an inspection of the tables on a later page will show that with the new metallic filament lamps the cost of the electricity consumed is extremely small. These tables give the cost of current per 100 hours for lamps of various sizes, so that a fairly accurate estimate may be made in advance.

The interior arrangement of shops is so varied that it is not possible to give a hard and fast rule as to the amount of light required. As a rough and ready rule, one candle-power for every 2 sq. ft. of floor surface is a good average to take for good bright illumination. If the goods sold are chiefly white or of a light colour, and the shop has a white ceiling, considerably less light than this will be found sufficient for most purposes, especially if it is possible to distribute the lamps evenly. On the other hand, if the colours are dark, or if the lamps have to be hung very high, an increase in light is necessary. In shops of a medium size, it is a good plan to arrange the lamps on this basis initially, using, say, the 55-watt or 100-watt lamps given in the tables on p. 665, and to replace these by smaller or larger lamps if it is found that the illumination is too bright or insufficient. An advantage of electric light is that a lamp may be changed for a smaller or larger one in a minute.

In rooms with counters it will probably be found best in most cases to hang the lamps in lines above the centre of the counters, and not between them. Generally a height of about 7 ft. 6 in. will be found suitable, but in a high room it will be found necessary to suspend the lamps at a greater height, and the same applies if a few lamps of high candle-power are used rather than several lamps of lower candle-power, as a "patchy" light must be avoided at all costs. It must not be forgotten, also, that if the shop windows are very brightly lighted, or if an intense light is employed outside for show purposes, the interior of the shop must also be more brightly lighted than would otherwise be the case, and the lamps should be placed fairly high up, as the more even distribution of light which ensues has a pleasant effect on the customer entering the shop.

We will not devote much space to the choice of fittings, as the consumer will prefer to be guided by his individual taste. In nine shops out of ten, however, the plain "pendant" is the most suitable, for with these there is a large scope for choice in the selection of shades. In shops where coloured goods are sold, coloured shades will usually be best avoided, but there are an extremely large number of sizes and shapes of white, "opal," fluted, crinkled, and frosted glass shades to choose from. It should be borne in mind that, as a general rule, the larger the diameter of the shade, the better is the distribution of the light. The "holophane" shade has the property of distributing the light uniformly. It is made in a number of forms, both as shades open at the bottom, and as globes and bowls, and by the selection of a suitable pattern the light can be concentrated or diffused in accordance with almost any requirements. The globes are generally constructed with a series of horizontal prisms on their outer surface for redirecting the light rays, and a series of internal prisms, which give perfect diffusion. The reflectors are constructed upon an entirely different principle. The outer surface is substantially covered with total or double reflecting prisms calculated to reflect the light rays back through the body of the glass and out of the open mouth of the reflector. Quite recently a new pattern, known as the "stiletto" form has been brought out. This is superior in appearance to the older patterns, and quite as effective in directing the light. They are made in three varieties, as shown in the illustrations overleaf, the blocks for which were kindly lent us by Messrs. Drake and Gorham, Ltd. (66 Victoria Street, S.W.). The following particulars as to spacing these reflectors will be found of use. The "Extensive" shades should be placed at a distance apart equal to twice their height above the plane of illumination. The "Intensive" type reflectors should be placed at a distance apart equal to 1½ times their height above the plane of illumination. The "Focussing" type reflectors should be spaced apart equal to their height above the plane of illumination.

"Counterweight" (up and down) pendants should only be employed when they are absolutely necessary, as they conduce to the "patchy" illumination which, as we have already pointed out, should be avoided. When they are indispensable, however, the consumer is advised to insist on the counterweight having a large pulley, and it may be pointed out also that there are some patterns of "ceiling rose" particularly designed to prevent the cord from coming off the pulley at the top.

We must qualify our recommendation of plain pendants by warning the consumer that he should insist on his wiring contractor employing flexible cord of the best quality. It is immaterial whether he uses silk-covered or cotton-covered cord, but whichever he selects, it is false economy to employ any other quality than the best.

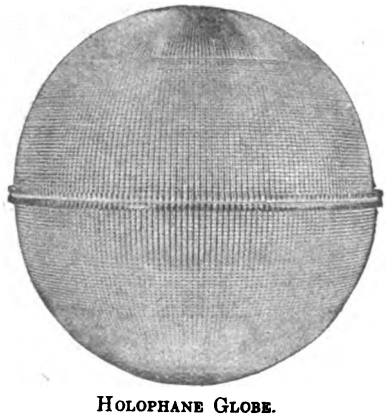
The consumer, in planning his installation, should not forget that one of the advantages of electric light is that the switch need not necessarily be close to the lamp it controls, and he should therefore himself decide the most convenient position for the switches, and not leave it to the wireman to put them up where he likes. If switches are grouped, Lundberg's "twinob" switch (which is virtually two switches under one cover) will be found convenient in reducing the space taken up, and incidentally its use saves

SPECIAL NOTICE.—*Central Station Engineers and Managers, and Wiring Contractors, who desire to obtain supplies of this issue for distribution among consumers and prospective consumers, should place their orders at once either with their newsagents, or with the Kilowatt Publishing Co., Ltd., Temple Chambers, London, E.C., who will forward parcels of 240 copies and upwards carriage paid (smaller quantities 1½d. each post free.)*

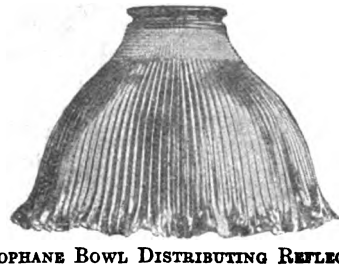
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expense, as it costs less both to supply and fix than two single switches.

In the choice of lamps, preference should be given to metal filament lamps, a number of makes of which are mentioned in the article on p. 664. Carbon filament lamps of 5 and 8 candle-power may be used in cupboards and small rooms where much light is not required. The 8 c.p. carbon-filament lamp consumes the same amount of electricity as the 32-watt metal



Holophane Globe.



Holophane Bowl Distributing Reflector.

filament lamp, which gives about three times the candle-power, but the lamp itself costs less.

The question of the cost of wiring has still to be mentioned. We are loth to give any general estimate of the cost, and recommend consumers to obtain estimates from local wiring firms of good repute, who can examine the premises and quote the exact prices for which they will be prepared to carry out the work. The cost can vary from 5s. per lamp up to 25s. or 30s., according to the system employed, the size and character of the building, &c. In new buildings of an important, substantial, and permanent character, in which the wiring is to be concealed, solid-drawn pipes with screwed joints are placed in the walls and floors under the plaster, floor-boards, or concrete during erection, and the wires are drawn into them after the plastering and flooring is completed. The next best work is with tubes having a welded or brazed seam instead of being solid drawn. Wires in wooden casing make a good job in dry buildings and when the casing may be fixed on the surface and under floor-boards, but casing concealed in the walls is not recommended for new buildings. For ordinary shop lighting, what is known as the bonded slip joint conduit system is an inexpensive method of tube wiring, which answers very well for surface work, and wiring with twin lead-covered, rubber-insulated wire is an inexpensive method which is satisfactory if carefully laid with the wires placed out of reach of possible injury or properly protected on the surface of walls. Lastly we may mention the "Stannos" system of wiring, in which the insulated wire is tightly surrounded by a tinned copper tube. This has come much into favour recently, especially for surface work, and makes a neat, sound, and safe job if properly carried out. In obtaining quotations for work, wiring contractors should be asked to give alternative tenders for different systems, explaining the suitability of each for the particular premises.

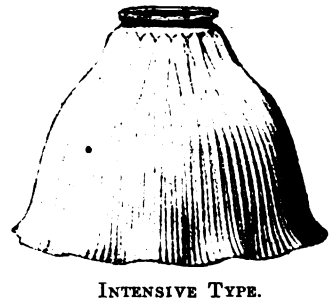
SHOP WINDOW LIGHTING

THERE are, broadly speaking, three methods by which the illumination of shop windows may be effected, namely:—(1) By means of more or less elaborate pendant fittings or brackets, carrying lamps with or without shades at a moderate height within the window—too frequently with the lamps in full view of the passer-by. (2) Entirely by lamps in lanterns outside of, and in front of, the window; and (3) By concealed lamps aided by reflectors. This classification is intended to apply to incandescent lighting, which is, of course, now practically entirely carried out by metal filament lamps, but in many cases, as we shall see below, arc lamps can be used with good results, both inside and outside the windows.

The first method is the old-fashioned system, and as compared with the others, it has certain disadvantages. It must be always borne in mind that the primary object of shop-window lighting is to illuminate the goods displayed, rather than to direct attention to the source of light. Lamps of too great brightness visible to the onlooker will cause an unpleasant glare in the eye, which will prevent him seeing the goods in comfort, and in a similar way the use of very elaborate fittings will call attention away from the goods. As usually carried out, this method involves the use of a good deal of flexible wire, which has some disadvantages. There are, however, numerous cases where the system is useful in windows of small or moderate size, either alone or in combination with the other methods, but it is important that shades be used to shield the excess of light from the onlooker, and at the same time to direct the light downward on to the goods, also that fittings only of the simplest character be employed. Excellent reflecting shades for the purpose are those known as Holophane glassware, of which we have already given some particulars. For the kind of shop-window lighting we are considering, the "concentrating" and not the "distributing" shades should be used, and when the lamps are fairly high, and goods are low down, it is surprising how good an effect can be produced by their aid with only a few lamps of moderate size.



Extensive Type.



Intensive Type.



Focussing Type.

"Stiletto" Holophane Reflectors.

For a great many types of window, the second

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method is much to be preferred; with the lamps entirely outside in suitable lanterns. For a shallow window, with goods arranged all the way up, a brilliant and even illumination is very easily obtained, and the larger sized metal filament lamps lend themselves admirably to the purpose. We deal more fully with this method of lighting on pp. 660–2, under the heading of "Shop Front Lighting."

The third method, that of "concealed lighting," is for many classes of goods by far the most effective, and of late years manufacturers have vied with one another in the production of suitable reflectors and systems of mounting lamps for the purpose. A very large amount of light can be used without any danger of dazzling the eyes of the onlooker, because the lamps are hidden, and if the system is carried out in its entirety, so are the fittings themselves. Rows of lamps can be employed, giving very even distribution of light. The light can come from the top, bottom, sides, or all round, or can be concentrated upon particular goods which it is desired to illuminate with special brightness. In the case of jewellery, and to a less extent with silver and with glass, light coming from a great number of hidden points produces a sparkle and brilliancy otherwise unobtainable. A good effect can be obtained in some classes of window by lighting entirely from the top, in which case reflectors of the types shown in Fig. 1 may be employed. Some of these are for fixing up, either on brackets or hung from chains, inside the top of the window, out of sight, and others for standing on the glass top when the window is in the form of a closed show case. For bottom lighting, which, however, is usually insufficient by itself, reflectors of some such form as that shown in Fig. 2 may be employed, or any other of the very numerous patterns of long box reflectors adapted for ordinary sizes of metal filament lamps. For side lighting it is usually essential that the reflectors should be very narrow if they are to be hidden, and considerable ingenuity has been exercised in the design of reflectors of this class. The pioneers of lighting by rows of narrow lamps concealed in trough reflectors were the Linolite Co., whose "Tubolite" system employs tubular lamps with longitudinal filaments placed end to end in a narrow aluminium trough reflector of carefully designed curve, giving more even distribution of light than do those where rows of ordinary lamps are employed. There are, however, now a vast number of linear reflectors on the market, suitable for metal filament lamps, under various names. A convenient reflector intended for the narrow "Olive" pattern of Osram lamp is shown in Fig. 3. The lamp carriers can be conveniently swung out of the way for cleaning the reflectors. Another form, which is convenient owing to the angle of the reflector being adjustable while the position of the lamp is fixed, is shown in Fig. 5 in two sizes. Very numerous other designs are made, some with the lamps in separate compartments, and others employing specially narrow tubular lamps in holders, secured by clips in troughs varying in width down to about 1¼ in. Another narrow form with special tubular lamps is shown in Fig. 6. Most of the exceptionally narrow strip reflectors employ carbon lamps. Curved strip reflectors can also be obtained. The methods of wiring are also very numerous, but that is a matter which need not be gone into here. Reflectors for single lamps and for fixing temporarily on to shelves are shown in Fig. 4. This class

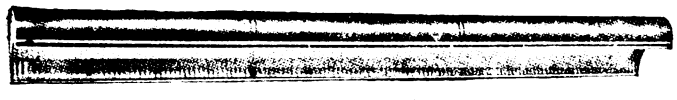




Fig. 2.—Reflector for Bottom Lighting.



Fig. 1.—Reflectors for Top Lighting.

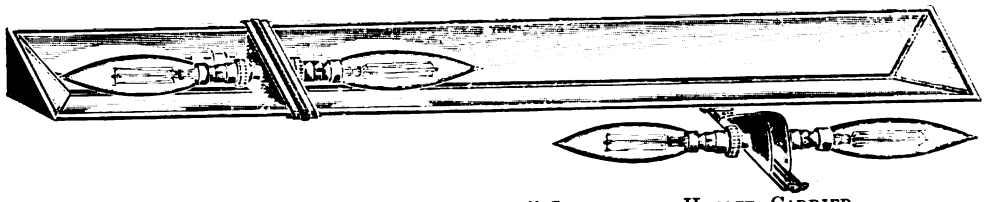


Fig. 3.—Reflector for Osram "Olive" Lamps with Hinged Carrier.

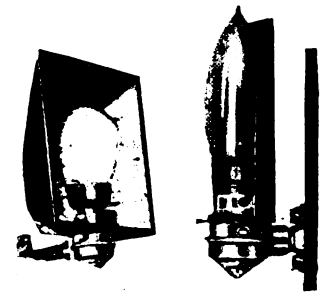


Fig. 4.—Single Lamp Side Reflectors.

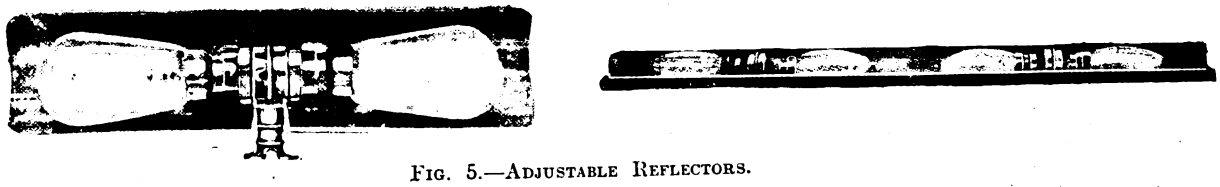


Fig. 5.—Adjustable Reflectors.

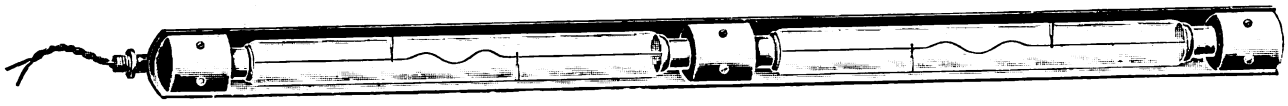


Fig. 6.—Narrow Strip Reflector.



Fig. 7.—Miniature "Fairyland" Strip.

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of reflector will often be found of use where it is unnecessary to run a whole strip reflector up the side of a window.

It is impossible to give any fixed rules as to the total number and size of lamps required for a window of any particular size, so much depends on the method of lighting employed, and the class of goods to be displayed. Although a brightly lighted window is one of the best sources of attraction as an advertisement, mere quantity of light is of no value unless the illumination is properly directed.

The field for arc lamps for pure window lighting is not quite so extensive, although there are cases where they may be preferred.

Although the most efficient source of illumination, the flame arc lamps so familiar in the streets are not suitable for interior window lighting. This is due partly to the slightly irritating fumes given off, partly to the yellow colour of the light, which makes it bad for colour-matching, and partly to the fact that flame lamps must be hung high, on account of the brightness of their globes. For very large general stores, however, with good ventilation the flame lamp is sometimes employed, but the favourite arc lamp for interior lighting is the enclosed lamp, which can be made almost perfect with regard to colour values by the use of a specially tinted glass to absorb some of the blue rays. The original open arc is approximately colour-true, but requires more frequent carboning than enclosed or flame lamps. On account of the high efficiency of metal filament lamps, however, they are generally preferable for window lighting, except where a perfectly colour-true illumination is required, when the special enclosed arc lamp gives the best results.

So far we have dealt only with lighting, the sole object of which is the illumination of articles in the window; but there is also another use to which electric lamps may be put, and that is for decorative lighting for special purposes, such as Christmas displays, where rows of small white or coloured lamps are used in festoons, on Christmas trees, or to outline some prominent feature in the window. Only lamps of very small size should be used, in accordance with the principles mentioned above, as if the eye is dazzled attention is apt to be drawn away from objects illuminated in the ordinary manner. Among the various forms of "strip" made for the purpose may be mentioned the following:—

The General Electric Co. supply a lighting strip for interior and outside decorative lighting, known as "Pixielite" strip. This comprises ordinary lamp-holders, mounted at intervals along a substantial twin cable. We understand that after exhaustive experiments, this company has succeeded in producing a fire-proof composition for moulding the holders.

The Imperial Lighting Co., the manufacturers of the well-known "Fairyland" strip, have introduced a new design which is particularly suitable for the decorative lighting of shop-windows. A miniature lamp is employed, and the screw socket holders are attached at any desired intervals, as shown in Fig. 7. As this fitting is entirely watertight, the strip can be utilised for outside decoration also. The lamps are grouped partly in series and partly in parallel, and can be wired for any supply pressure. "Fairyland" strip with bayonet caps of aluminium to take ordinary lamps is now obtainable as well as the original screw-socket and ordinary B.C. patterns.

An attractive decorative strip, comprising a floral festoon of paper flowers with miniature lamps at intervals, is supplied by the Franco-British Electrical Co., Ltd., who also have some novelties in the way of prismatic or pearl glass fittings and festoons in which the miniature lamps are connected without lamp-holders, according to a patented system.

We are indebted to the following firms for blocks used for the illustration of this article:—The General Electric Co. (67 Queen Victoria Street, E.C.), Messrs. Siemens Brothers Dynamo Works, Ltd. (Caxton House, Westminster, S.W.), Messrs. Krupka & Jacoby (11 Queen Victoria Street, E.C.), the Sun Electrical Co., Ltd. (118 Charing Cross Road, W.C.), and the Imperial Lighting Co. (157 Blackfriars Road, S.E.).

SHOP FRONT LIGHTING

THE object of lamps outside shops is threefold—to illuminate the objects in the window, to call attention to the shop, and to add to the general illumination of the pavement outside the shop. We wish to urge that the first is the most important. A brightly lighted window in itself attracts passers-by, and by reflected light assists in the general illumina-

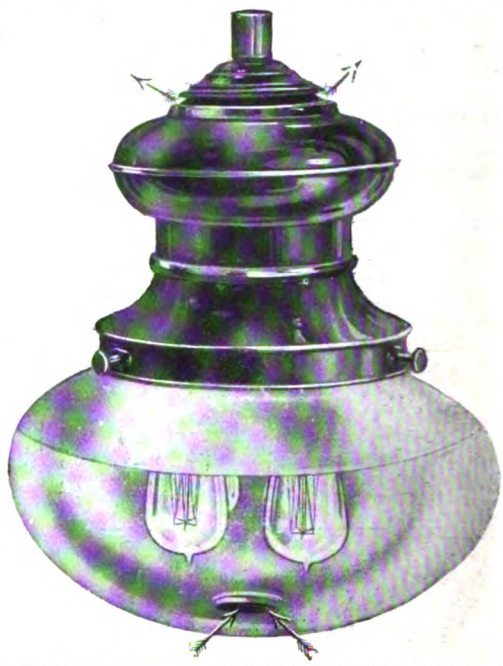


Fig. 1.—Outside Lantern showing Method of Ventilation.

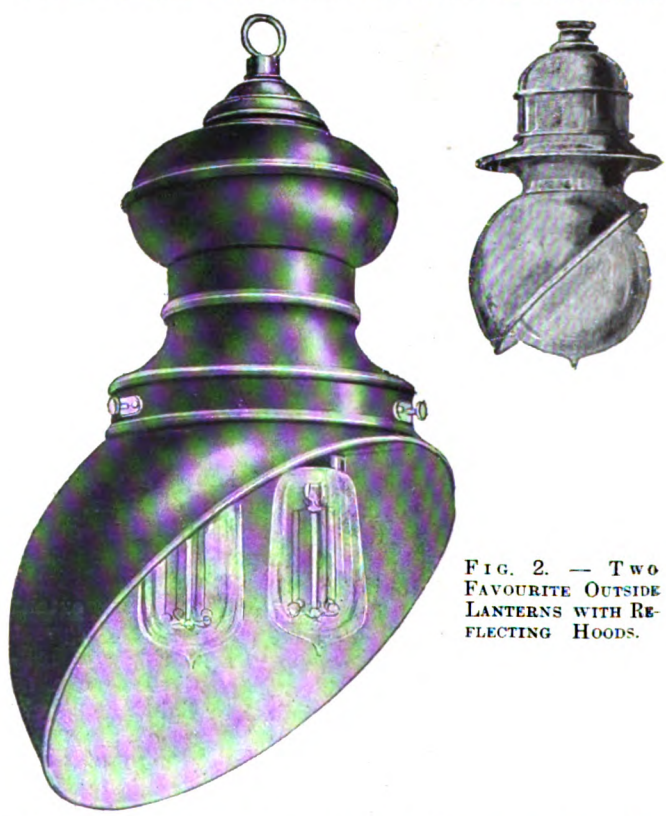


Fig. 2. — Two Favourite Outside Lanterns with Reflecting Hoods.

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tion. The use of a row of unshaded arc lamps of thousands of candle-power close together certainly attracts attention, but is productive of more annoyance to the general public than it attracts admiration of intending customers. As we shall see, many lanterns are obtainable which shield the light from the eyes of the passer-by while throwing it on the goods in the window and on the pavement.

Of lanterns suitable for use with metal filament lamps of the larger sizes, and these can now be obtained even up to 1,000 c.p., we illustrate a number of simpler typical patterns in the accompanying figures; numerous more ornamental lanterns are also made. In Fig. 1, the arrows show one method of providing ventilation. The main points to be observed in the selection of these are adequate ventilation of the fitting, to prevent it becoming unduly heated by the powerful lamps employed, ease of removal of the shade or globe, and especially where vibration is at all likely to be present there should be some arrangement of springs between the lampholders and body of the lantern. A



Fig. 3.—Cast-iron Lantern for Exterior Shop Lighting.

lantern fitted with an excellent clip for easy removal of the globe, combined with a spring supporting arrangement, was described in our last issue in connection with the Hampstead Exhibition. Fig. 2 shows some patterns of lanterns with hoods over the lamps forming reflectors. A strong and simple cast-iron fitting is represented by Fig. 3, and a box-type reflector lantern is seen in Fig. 4.

It is important that due attention be paid to the protection of the wiring of these exterior lanterns. The leads should be enclosed in iron pipe down to the lantern, and special care should be taken at the leading in point at the top that the wires are not exposed. A neat connecting box supplied by the General Electric Co. for this purpose is illustrated in Fig. 5.

A good deal of outside shop lighting is done by arc lamps.

For lighting large shop-windows exclusively from the outside, the flame arc lamp is at once the most economical and the most suitable source of illumination, except where a colour-true light is required. In the latter case, enclosed arc lamps with special tinted globes, or the ordinary open arcs, should be used. Flame lamps can be obtained in various sizes, consuming from 300 to 600 watts each, and giving a light equivalent to groups of metal filament lamps aggregating from 1,500 to 3,500 candle-power respectively, but consuming only one-seventh of the current such groups would take. They must be run two in series on 100—130-volt circuits, and four in series on 200—250-volt circuits. The number of hours for which they will run before needing fresh carbons varies from 8 to 30, according to the length of the body of the lamp, the larger lamps taking longer carbons. Lamps with two or more pairs of carbons can be obtained, giving longer burning hours, if desired. Enclosed lamps can be run singly on 100-volt circuits, and two in series on 200—250-volt circuits. These lamps are not much more economical than an equivalent group

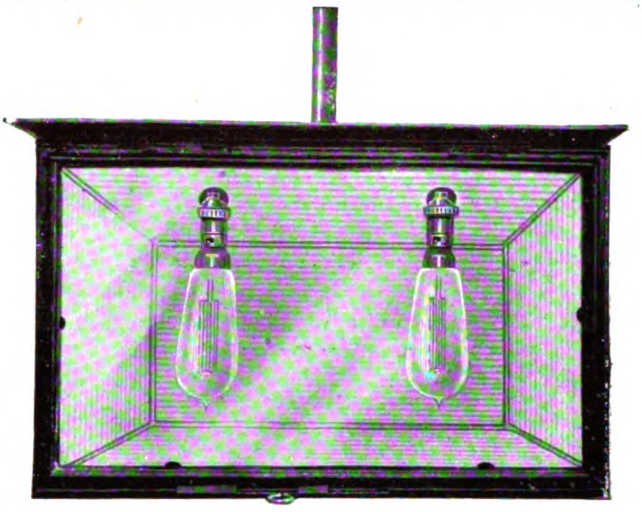


Fig. 4.—Box-type Reflector Lantern.

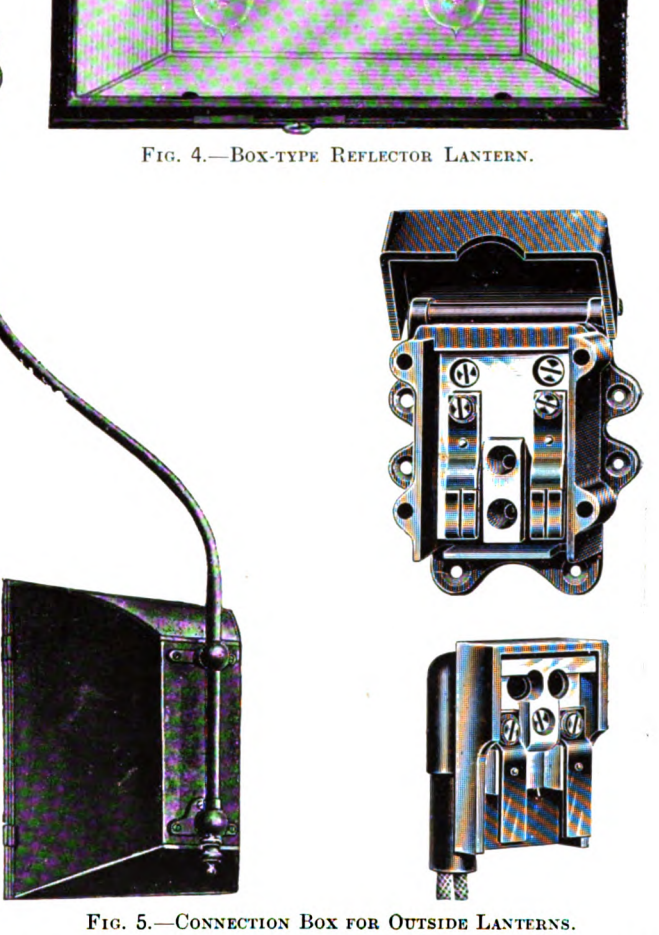


Fig. 5.—Connection Box for Outside Lanterns.

of metal filament lamps, consuming, as they do, about three-quarters the amount of current, while they need recarboning at periods varying from 50 to 200 burning hours, according to the size of the lamp. They give a light of a truer colour-value, however, than metal-filament lamps. Open arc lamps are rarely suitable as they have to be run several in series, and require frequent recarboning.

Whereas the costs of running metal-filament lamps consist simply of the cost of the current consumed and the charge for lamp renewals, both of which are easily estimated, in the case of arc lamps there are the costs of recarboning and cleaning. The cost of the carbons varies within wide limits (from 0·2d. to 2d. per lamp-hour), according to the quality and pattern of carbons employed. Thus, for a flame lamp of some 2,000

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mean hemispherical candle-power, employing metal-cored carbons, the carbon cost will amount to about 1d. per lamp-hour, while by employing cheaper carbons and running the risk of having a rather unsteady light, the cost may be reduced almost down to one farthing per lamp-hour. The cost of current consumed per lamp is easier to estimate. Thus a usual size of flame arc is known as a 6-ampere lamp, and gives a mean hemispherical candle-power of about 1,500. These must be run two in series on a 100-volt circuit, and the cost of current at 4d. per unit will amount to 10s. per 100 lamp-hours for each of the two lamps. For a 10-ampere lamp, which would be the largest size suitable for shop-lighting, the cost of current only would amount to 16s. 8d. per 100 lamp-hours for each lamp. For 200 or 250-volt circuits it would be necessary to run four lamps in series. Enclosed lamps working singly on 100-volt circuits take from 300 to 800 watts, give a mean horizontal candle-power of from 350 to 1,000, according to the current taken, and cost from 10s. to 27s. per 100 lamp-hours. When working in series, the cost is about the same per lamp.

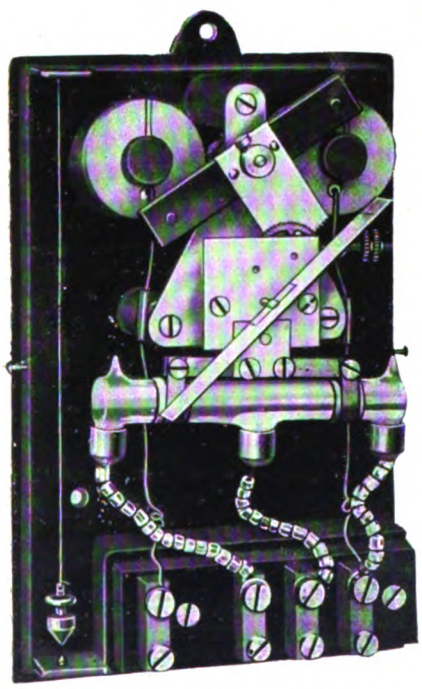
We are indebted to the following firms for kindly lending us the blocks with which this article is illustrated:—The Wardle Engineering Co., Ltd. (196 Deansgate, Manchester), the General Electric Co., Ltd. (67 Queen Victoria Street), the Cable Accessories Co. (Britannia Street Works, Tivedale, Tipton, Staffs), and Messrs. Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.).

ELECTRIC SIGNS

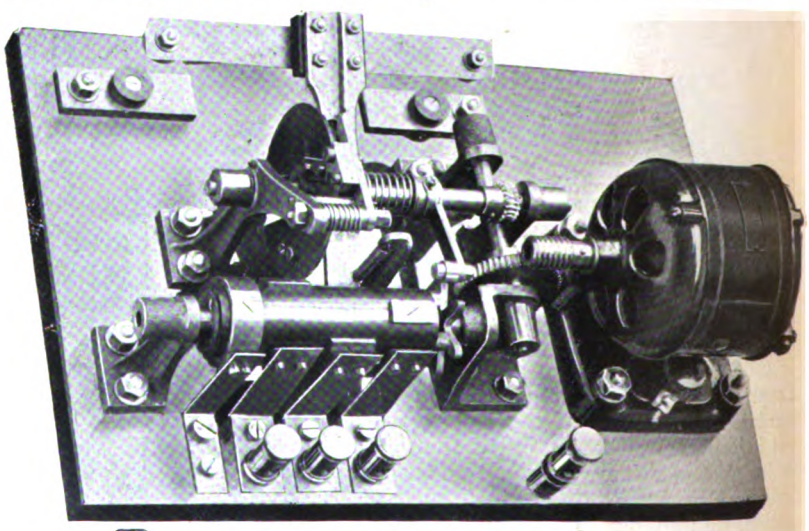
ONE of the foremost manufacturers of electric signs is the Sun Electrical Co., Ltd. (118 Charing Cross Road, London, W.C.). An artistic pattern for shop windows, serving the double purpose of advertising a name and illuminating the goods displayed in the window, is illustrated below. This consists of a hammered *repoussé* panel in which the letters are cut as shown. The whole is backed with satined opalescent glass and a "Sunlite" reflector fitting



"Sun" Interior Window Sign.



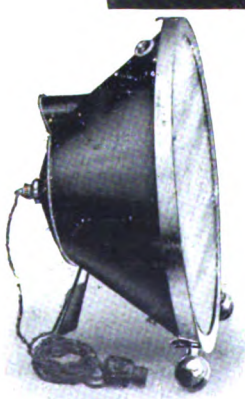
"Sun" Two-way Mercury Switch.



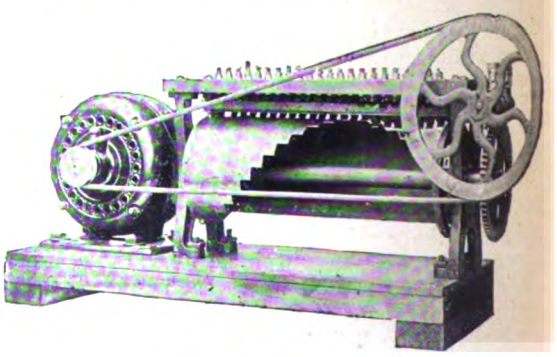
"Venner" Motor-driven Switch.



Indoor Box Sign.
(*Electrical & Engineering Supplies Co., Ltd.*)



"Simplex" Window Sign.

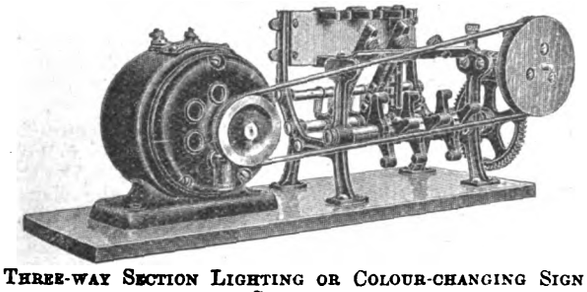


Writing Sign Switch.
(*General Electric Co., Ltd.*)

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is attached to the back. Box signs can be fitted with the new "Mirrorgraph" front, which appears as an ordinary mirror when the light is off, the lettering or design only showing through when the lamp is switched on. Among the patterns supplied by this firm for outdoor use are the well-known opal-glass moulded letter signs. These letters show to better advantage than the ground-glass letters in daylight. Lamps of three colours placed inside and connected to thermal flashing devices produce a very attractive sign, as the colours appear, blend, and disappear in an irregular manner, giving the effect of a changing opal. For the large continuously changing signs for which it is required that the changes should occur in a defined succession with regular intervals, the firm supplies an automatic magnetic switch with mercury contacts. The switch illustrated is a two-way device, such as would be used for lighting a sign with two colours alternately. It comprises a two-pole electromagnet in shunt with the main circuit, and an armature attached to a tube with three contacts, and a globule of mercury. The tube is filled with an inert gas to prevent oxidation or arcing. The armature (which is rocked against the tension of a spring) works a train of wheels attached to an air-vane, and the time elapsing between each movement can be regulated from ½ to 6 seconds by varying the length of the vane. The time is thus independent of the current. Motor-driven switches for writing and colour-changing signs for currents up to 25 amperes per way are manufactured by this firm. These consist of lever switches with carbon contacts and worked by cams. The kaleidoscopic sign of this company gives a continuous change of colouring at indefinite intervals all over the front of the sign. Another useful device for window advertisement is a small collapsible sign, which can be packed away flat when not in use.

A number of different patterns of automatic switches for continuously changing switches have been devised. Among the latest of these are the two which we illustrate, supplied by the General Electric Co., Ltd. (67 Queen Victoria Street, London, E.C.). The first of these is for a writing sign, in which the individual lamps are switched in one by one. As shown, this comprises a brass drum cut away in steps and rotated under a row of phosphor-bronze spring contacts so as to lift them in succession. No current is carried by the drum, which merely serves to lift the spring contact strips up against a row of fixed contacts. For "snake crawling"



THREE-WAY SECTION LIGHTING OR COLOUR-CHANGING SIGN SWITCH.
(General Electric Co., Ltd.)

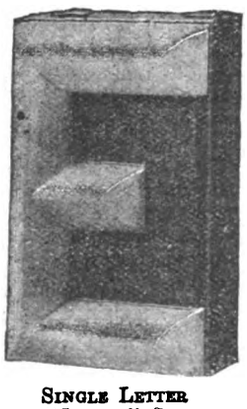
and other effects, the drum is cut spirally, so that a certain number of lamps are always on or off. The second switch illustrated is for colour-changing effects or for switching on signs in sections. It comprises from 3 to 10 knife switches which are closed successively by levers or cams. Each switch is closed against the force of a spring and is held in by a spring catch, which is released by a second cam or lever. The cams are adjustable. It may here be mentioned that the well-known "Thermo" flashers supplied by the General Electric Co. for box signs, &c., have been recently reduced in price.

A useful circular box sign which can be used separately or in the aggregate to make up a large sign for the outside of buildings is manufactured by Simplex Conduits, Ltd. (113 Charing Cross Road, London, W.C.). This comprises a conical metal reflector with a single lamp at the apex, and fronted with a circular glass plate on which is painted lettering or a design. For fixing a number of these signs (each representing one letter) in a row to the outside of a building, a system of tubular steel framework has been standardised, which is easily screwed together and erected. In an attractive modification of the Simplex box sign, the circular glass plate is of ground glass and is fixed at the side of a vertical cylinder. A lamp is mounted in the centre of the cylinder, and a cylindrical wire cage is rotated round the lamp at a slow speed by means of a small electric motor. Over the surface of the cage is fixed a patchwork cover of many-coloured gelatine paper, and the light is thrown on to the glass through this. A very pretty effect is obtained, the colours continuously changing all over the glass and blending in a most striking manner.

A useful flashing sign for shop windows illustrated herewith is made by the Electrical & Engineering Supplies Co., Ltd. (36 Upper Thames Street, London, E.C.). It consists of a solid oak frame, fixed to a sheet-metal box, containing a flasher and a 16-c.p. lamp. Transparencies comprising lettering cut out in tough black paper pasted over with strips of thin white or coloured paper and placed between two sheets of glass, are inserted in the frame. Different notices and advertisements are kept in stock, and thus the wording of the sign can be frequently changed. The whole can be hung or stood in any suitable position indoors. In the heavier signs of this firm's make for outdoor use the box is of sheet-steel, with an angle-iron framework to give the necessary rigidity. The front consists of two pieces of plate glass; the outside piece is clear, and the inside is painted on the surface facing the clear-glass front. In order to render the lettering sharply defined and durable, the glass is recessed round the letters by sand-blast, and the recessed parts are then painted, and the colouring burnt in. Alternatively, the letters may be recessed and painted, the background remaining white. In another interesting mode of manufacture, a compound plate glass, consisting of a sheet of natural red glass and a sheet of clear glass rolled together is used. The letters are sand-blasted out to the depth of the red sheet, leaving white letters on a red background, or *vice-versa*. When burnt-in coloured lettering is employed, the background may be ground glass or opal glass. The former gives a more brilliant effect when illuminated, but the latter looks better in daylight. Quite a different type of sign is that in which silvered or gilt letters are fixed radially on a circular black wood background, and are illuminated by a lamp at the centre shielded from the view of the observer. These are economical, but not so neat as the box signs.

A number of the "Venner" signs, manufactured by Venner & Co. (6 Old Queen Street, Westminster, London), are to be seen about London. In these signs, the letters are outlined in small glass spheres set in the perforated cover of a metal box, in which one or more electric lamps are placed. Owing to the reflection inside the glass beads, a very brilliant effect is obtained with only one or two lamps in the box for each letter, and the effect is equally good when viewed from a fairly sharp angle. The Wardle Engineering Co. employ these signs in a modification of the reflector lanterns shown in Fig. 2 on p. 660, described in our article on the Manchester Exhibition on p. 667. An extremely good effect is produced by using three lamps for each letter, coloured red, green, and blue. For writing and colour-changing signs, Messrs. Venner supply an ingenious form of motor-driven switch. The slowly-rotating contact drum is combined with an intermediate quick-acting carbon-break switch, which comes into action immediately before the drum contacts operate, thus preventing sparking and reducing the wear at the contacts. As shown in the illustration, the switch is worked by a device consisting of a slotted disc on a rotating shaft, and a spring-controlled cam loose on the same shaft. This cam also provides means for varying the period of extinction.

An attractive style of sign suitable for fixing outside over shop windows is that known as the "Luxol" sign, and supplied by Krupka & Jacoby (11 Queen Victoria Street, London, E.C.). As shown in the example illustrated, this sign consists of one or more moulded glass letters, which are mounted in the front of a sheet-metal box. As the rounded face of each letter projects out of the surface of the box front, the sign can be read at a much greater angle than in the ordinary flush signs. The letters are of ground glass, which gives a most brilliant effect with a very small amount of light, as the whole surface of the glass is illuminated by internal reflection. If opal glass is used, a better effect is obtained by daylight, but the night effect is not so good. The "Luxol" signs are claimed to be most economical, as a single 5-c.p. lamp will illuminate thoroughly a 6-in. letter, or two 5-c.p. lamps a 12-in. letter. The depth of the letter and box does not exceed 5 in. Messrs. Krupka & Jacoby

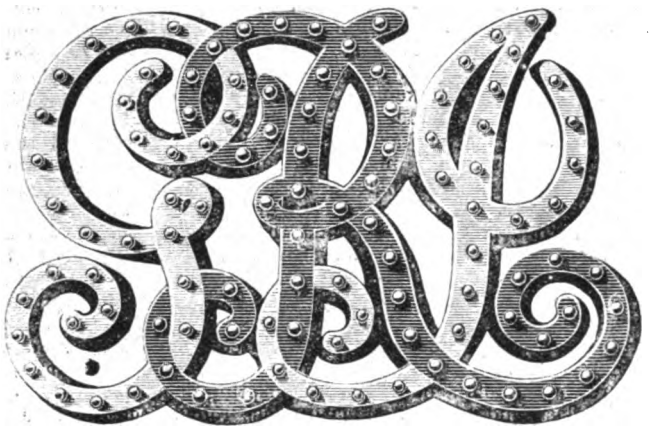


SINGLE LETTER OF "LUXOL" SIGN MOUNTED SEPARATELY.

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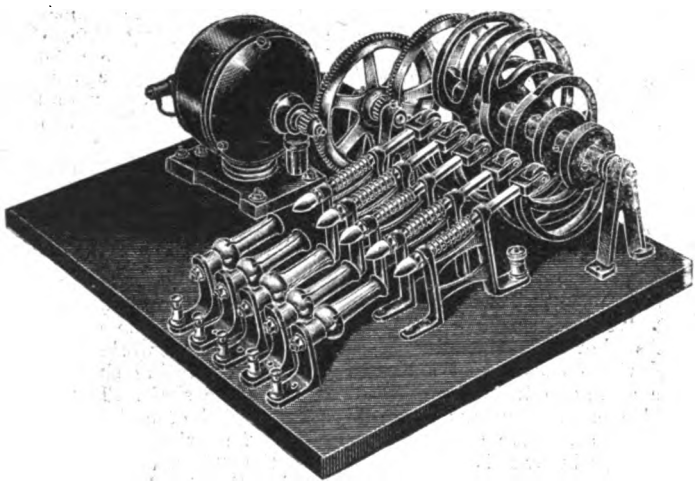
have recently introduced a compact flashing box sign for inside display or window advertising. It measures 5¾ by 19½ by 4½ in.

The neat and brilliant signs now much in evidence in the London streets, and comprising block or script letters of wood, painted white and studded with miniature lamps, are known in the trade as "Franco" signs. These are supplied



"Franco" Miniature Lamp Sign.

by the Franco-British Electrical Co., Ltd. (50 Oxford Street, London, W.), and also by the Imperial Lighting Co. (157 Blackfriars Road, London, S.E.). The letters are cut out in well-seasoned oak. Holes are bored, spaced from 2 to 3 in. centres, and the patent miniature lamp-holders for the screw-socket 1-c.p. 14-volt lamps are inserted in these, and connected up by rubber-covered twin cable, laid in a groove at the back. An insulating composition is run into this groove after the connections are completed, and each lamp is provided with a milled collar, which makes a water-tight joint with the socket. In this manner the whole sign is rendered thoroughly water-tight. The lamps are not con-



Plunger Contact Flashing Switch for Changing Signs.

nected in simple series, but are grouped in such a manner that if one lamp fails, the others are not extinguished. It is advisable, however, to replace a burnt-out lamp as soon as possible. Although the lamps employed have carbon filaments, the light is most efficiently utilised, and a brilliant effect is obtained for a small consumption. The coloured Coronation sign illustrated contains 105 lamps, takes about 350 watts, and thus costs 0·35d. per hour for current with a charge of 1d. per unit. Further, modifications of the "Franco" signs are made in which the lamps are arranged in trough-shaped letters of sheet-metal to confine the light to the surface of the letters. The changing signs are operated by means of a motor-driven switch. Phosphor-bronze spring contacts carrying current to the various groups of lamps are arranged in a row on a fixed bar, and a metal drum, cut away in steps so as to complete the various circuits in succession, is rotated under them. The switches consume about 60 watts, or a little over one-twentieth of a unit per hour. In the heavy pattern illustrated, solid plunger contacts are forced by cams against springs into split-tube sockets, from which a quick break is obtained when the cams release them. Such contacts will take up to 20 amperes per way, and the usual sizes have seven or eight ways.

The Electric Sign & General Advertising Co., Ltd. (36 Cowoross Street, London, E.C.), the pioneers of the electric sign industry in this country, are the makers of the famous "Bovril" signs and others of a similar nature. One design of letter sign consists of wood or metal grooved letters, with miniature lamps, spaced at short intervals in the grooves. The lamps are of three different colours, are interspersed, and those of the same colour are switched on together. By using a special rotary switch the colours can be mixed and varied in any desired manner. This switch consists of a fibre disc, slowly rotated by a worm-geared motor inside a ring. The disc has metal contacts on its periphery, and the separate lamp contacts, comprising springy strips of phosphor-bronze, are spaced round the inner periphery of the ring. A new box sign has a thermal flasher worked in combination with relays, so that separate portions of the front are illuminated in an ordered succession, as in the case of motor-driven signs. This sign requires no adjustment, and only requires to be connected up to the supply circuit.

Before concluding these notes on electric signs, it will be as well to warn our readers as to the difficulties which may be encountered by those desiring to erect large advertising signs outside their premises. A formidable obstacle is the Sky Sign Act of 1894 and 1904, which will not allow any advertisement to be erected on, or above, any building or structure if any part of it will be visible against the sky from any street. If placed on a board, however, it is permitted to extend 3 ft. above the cornice or wall on which it is fixed. Further, the London County Council have taken proceedings against the erection of several signs under the 1894 Building Act, on the ground that they were projections in front of the building line; in most cases, however, they have lost the actions. The by-laws of the L.C.C., administered by the police, have also to be considered, as these prohibit signs which "change *suddenly* in colour, intensity, or direction to the danger of the public." For this reason, the larger signs are switched off and on in sections or change from white to a dull colour before being switched off. The Advertisement Regulation Act of 1907 gives local authorities power to make by-laws to restrict or prohibit advertisements in public parks, pleasure promenades, and similar open spaces. After the five years' grace allowed by this Act, it may be that the signs seen from the Embankment, Trafalgar Square, and the parks, &c., will have to be taken down. Further obstacles at present are clauses in the leases of buildings, either forbidding advertisements of firms other than those renting the premises, as in the case of Crown property, or requiring special permission and payment of a rent. In some cases the fixing of the framework of signs to the main structure of the building is forbidden; but the clause can be often evaded by suspending the sign from the roof.

THE COST OF LIGHTING BY METAL FILAMENT LAMPS

A GREAT cheapening of the cost of electric lighting was made by the introduction of the now widely-used metal filament lamp, so that electric lighting is not only the cleanest, safest, healthiest, and most effective method of illumination, but it is actually the most economical. For shop-lighting purposes, where fairly large units of light are the rule, it has even more completely superseded the older carbon lamp than in the case of house lighting. In its larger sizes, too, it can compete with small arc lamps as regards economy, although when we come to really large units for exterior lighting there is no doubt that the flame arc lamp still holds the field.

In order to enable intending consumers to obtain readily an idea of the cost of lighting with these lamps, we have prepared two tables, showing at a glance the approximate cost of the electricity consumed by each lamp in 100 hours for all the various sizes at different prices of supply. The figures in brackets refer to the voltage of the supply. The first table gives this for Osram lamps. In these lamps the filament is made of the metal tungsten, which is now employed in the majority of metal filament lamps (*e.g.*, the Mazda, "Z," Simplex, Leuconium, Brimsdown, "Onewatt."

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Table I.—Approximate Cost of Electricity Consumed by Osram Lamps per 100 Hours.

Trade Designation of Lamp.	British Candle-power.	Price per Unit of Supply. 3d.	3½d.	4d.	4½d.	5d.	5½d.	6d.	6½d.	7d.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
17 watts (100–135 volts).	14½	5	6	6½	7½	8½	9½	10	11	1 0
25 watts (100–135 & 150–155 volts)	22½	7½	8½	10	11½	1 0½	1 1½	1 3	1 4½	1 5½
32 watts (200–260 volts)	22½	9½	11½	1 0½	1 2½	1 4	1 5½	1 7½	1 8½	1 10½
32 watts (100–135 & 150–155 volts)	28½	9½	11½	1 0½	1 2½	1 4	1 5½	1 7½	1 8½	1 10½
40 watts (200–260 volts)	32	1 0	1 2	1 4	1 6	1 8	1 10	2 0	2 2	2 4
55 watts (100–135, 150–155, & 200–260 volts)	45	1 4½	1 7½	1 10	2 0½	2 3½	2 6½	2 9	2 11½	3 2½
100 watts *	90	2 6	2 11	3 4	3 9	4 2	4 7	5 0	5 5	5 10
200 watts *	180	5 0	5 10	6 8	7 6	8 4	9 2	10 0	10 10	11 8
300 watts *	270	7 6	8 9	10 0	11 3	12 6	13 9	15 0	16 3	17 6
400 watts *	360	10 0	11 8	13 4	15 0	16 8	18 4	20 0	21 8	23 4
600 watts *	540	15 0	17 6	20 0	22 6	25 0	27 6	30 0	32 6	35 0
1000 watts *	900	25 0	29 2	33 4	37 6	41 8	45 10	50 0	54 2	58 4

* These lamps are made both for 100-135 and 200-260 volts with the same candle powers.

&c.) With the exception of the last-mentioned, which is only made in the larger sizes, these tungsten lamps are all made in sizes approximating to those in Table I., and their consumptions are about the same.

Table II. relates to tantalum lamps. These, it will be seen, are not quite so economical in current consumption as the tungsten lamps, but the cost of the lamps themselves is less, and the lamp will also stand rougher usage as the filament, which is of wire-drawn tantalum, is tougher. Tantalum lamps are rated by the makers in candle-power, and not in watts. The ratings are, however, in the German "Hefner" units, so we have added the values in British candle-power to render the two tables comparable.

Table II.—Approximate Cost of Electricity Consumed by Tantalum Lamps per 100 Hours.

Trade Designation of Lamp.	British Candle-power.	Price per Unit of Supply. 3d.	3½d.	4d.	4½d.	5d.	5½d.	6d.	6½d.	7d.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
10 c.-p. * 100–120 volts	9	5	6	6½	7½	8½	9½	10	11	1 0
16 c.-p. * 100–120 & * 130–160 volts	14·4	8½	9½	11	1 0½	1 1½	1 3	1 4½	1 5½	1 7
16 c.-p. 100–120 v lts	14·4	10½	1 0½	1 2	1 3½	1 5½	1 7½	1 9	1 11	2 0½
25 c.-p. 100–130, * 140–160 & * 200–250 volts	23·5	1 0½	1 2½	1 5	1 7	1 9½	1 11½	2 1½	2 3½	2 6
32 c.-p. 100–130, 140–160 and 200–250 volts	23·8	1 4½	1 7	1 9½	2 0½	2 3½	2 6	2 8½	2 11½	3 2
32 c.-p. 200–250 volts	28 8	1 9½	2 0½	2 4½	2 7½	2 11½	3 2½	3 6½	3 9½	4 1½
50 c.-p. 100–130, 140–160 and 20 –250 volts	45	2 1½	2 5½	2 10	3 2½	3 6½	3 10½	4 3	4 7½	4 11½

* These lamps are suited to continuous-current circuits only; all the other sizes can be used either on alternating- or continuous-current circuits.

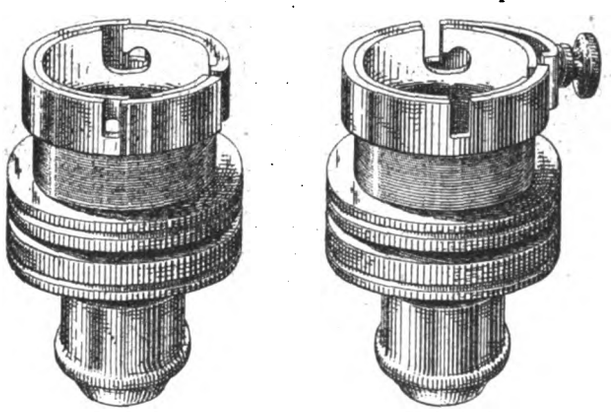
We have not thought it necessary in these tables to include lamps for voltages below 100 volts. Lamps of 25, 50, and other low voltages are sometimes used in connection with small transformers to reduce the pressure, where small units of light are desirable. The total cost of the light obtained will be slightly more than that given in the above tables, owing to the loss of energy in the transformer, but will still be very much below that of lighting by carbon filament lamps. By far the larger amount of incandescent shop lighting is carried out by means of metal filament lamps direct on the ordinary supply circuits.

THE TELEWRITER AS AN ADVERTISER IN SHOP-WINDOWS

MOST of our readers will be acquainted with the telewriter, the ingenious apparatus that actually writes out in the handwriting of the sender many miles away messages which would ordinarily be telephoned and transmitted verbally with doubtful accuracy. The mechanism and working of the instrument was fully described in ELECTRICAL ENGINEERING, July 7th, 1910, p. 447. The telewriter has been in use for some years by a number of important business houses for inter-departmental communication, and an exchange in London enables subscribers to communicate with each other in writing or to transmit telegrams direct to the Post Office or the offices of cable companies. One of the latest applications, however, is the use of a single transmitter and receiver, connected by a short length of wire, as an advertising medium in shop windows. The receiver, which has a special enlarged writing board, is placed in the window in the view of the public, and the transmitter is worked at any convenient point in the shop or adjacent office. The arm of the instrument is caused to write out items of the day's news interspersed with advertising matter relating to special articles on sale, &c. The operator is concealed, but may have a view of the window, and may cause the instrument to write personal remarks about, or make sketches of, people in the crowd watching, to their astonishment and the amusement of the others. A complete set, comprising transmitter and receiver, can be hired from the National Telewriter Co., Ltd. (20 Bucklersbury, London, E.C.), for a small fee weekly. The terminals of the apparatus are connected by means of an adapter to a lamp-holder, and only a small amount of current is taken. Where no electrical supply is available, accumulators can be used.

NEW LOCKING LAMP-HOLDER

A NEW device, which can be easily attached to existing lamp-holders for securely locking them, and thus preventing the removal of the lamps except by authorised persons, has been introduced by the General Electric Co., Ltd. (67 Queen Victoria Street, London, E.C.). As shown in the sketch, it consists simply of a split steel ring with a small screw key. The liner of the holder has to be slotted about ⅜ in. down, in order to apply the device, but this can be readily done by the user, or, if desired, the General Electric Co. will supply separate liners ready slotted. The action of the device is evident from the sketch. The lamp is inserted



Locked. Unlocked.

G.E.C. LOCKING LAMP-HOLDER.

in the usual manner, and the catch at one end of the ring slips into the slot as the lamp is turned. To take out the lamp, a screw "key" is inserted and screwed in until the catch is lifted above the liner, and the lamp is then turned and removed in the usual way. On taking out the key, the holder is ready for the insertion of another lamp, which it locks in automatically as before. We understand that the addition of this device to the standard lamp-holder increases the price by 2s. 3d. per dozen. Keys are supplied at 6d. per dozen. The rings, which will be supplied separately if desired, are plated with brass to prevent corrosion, and to make them uniform with the holder.

Electric Smelting.—It is stated that an application is being made to the Norwegian Government for a concession for electric smelting on the Tromsö Iron Fields. If the concession is obtained it is intended to begin work in the spring.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published October 13th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

21,357/09. **A.-C. Motor-starter.** A. C. Heap. In order to obtain a gradual increase of the applied pressure when starting A.-C. motors, the starter consists of a one-to-one ratio transformer with the primary and secondary windings arranged so that their inductive relations can be continuously changed from zero to a maximum. Automatic gear is provided to prevent too sudden an increase in the applied pressure, and to cut out the transformer directly the full voltage has been applied. Fourteen figures.

1,146/10. **Motor Control.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). In the system employing "notching relays" to regulate the successive closing of the contactors, the relay series coils are arranged to serve as overload relays to open some or all of the contactors on an overload, thus protecting the motor by reducing the voltage applied. For this purpose, contacts on the "notching relays" are connected with respect to the corresponding contactors so that the circuits of the latter are opened when the relays operate on an overload. Three figures.

1,459–60/10. **Liquid Sterilisers.** H. B. Hartman (Pittsburg, U.S.A.). These specifications describe electrolytic apparatus for purifying water and other liquids by subjecting them to the action of a current flowing between aluminium electrodes, the gases and salts generated acting on the organic impurities. The circuit is automatically made with the starting of the flow of the liquid, but is not broken until shortly after the flow stops, so as to ensure a complete treatment. The liquid undergoes several successive treatments, and is mixed with the generated gases for a short time between each. Eight figures.

14,125/10. **Turbo-alternator Rotors.** Allgemeine Elektricitäts Ges. In order to assist the cooling of the rotor windings of turbo-alternators, the parts of the rotor body in the neutral zones between the poles and at the pole edges, *i.e.*, those portions not required for the field flux, are omitted. Other parts of the rotor not necessary for the support of the end windings projecting over the effective part of the rotor are also omitted, and a flow of cool air through these portions of the body is induced. Six figures.

14,961/10. **Coil Insulation.** M. Meirowsky (Cologne). This specification describes an apparatus for producing a close stratified insulating casing round former-wound armature coils. The side of the coil is partly enveloped by an endless band which passes over hot rollers at its contacts with the coil. As the coil is rotated, the mica sheets are fed in between the band and the coil, and are compressed on to the latter by the rollers. Two figures.

15,417/10. **A.-C. Solenoids for Automatic Controllers.** G. A Kohler (Chicago, U.S.A.). A.-C. solenoids with cores to move over a considerable distance and with sufficient force to work a contact device, consist of a stationary solenoid with separate coils for the different phases, and a core of laminated iron. The latter is provided with a short-circuited winding or simply a metal sheath and a return path for the magnetic flux outside the solenoid comprising two strips of laminated iron one on either side. Five figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Names in italics indicate communicators of inventions from abroad.
Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Lauterbach [Vapour lamps] 1,113/10; Heimann and Schäffer [Working arc lamps in series with incandescent lamps] 11,582/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Steynis [Insulating devices] 2,899/10; Von Pinterschofen [Insulating tubes] 14,459/10.

Dynamos, Motors and Transformers: Leitner [Train-lighting] 22,611/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Marine propulsion] 26,346/09.

Electric Ignition: Phillips, 29,947/09; Etablissements de Dion-Bouton (Soc. Anon.) [Distributors] 10,780/10.

Electrometallurgy and Electrochemistry: Cowper-Coles [Electroplating] 22,374/09.

Incandescent Lamps: Kuzel and Wedekind [Production of zirconium] 23,215/09.

Instruments and Meters: Cooper [Speed alarms] 21,490/09.

Storage Batteries: Pescatore and Tudor Accumulator Co. [Ventilation of cells] 4,567/10.

Switchgear, Fuses, and Fittings: Patterson [Safety-lamp for mines] 19,359/09; Feld Bros. & Co. and Sobotka [Connectors] 20,035/09; Bousfield [Standard resistances] 27,335/09; Olmsted [Control apparatus] 4,696/10; McKenzie & Holland, Ltd. and Wood [Switches] 11,281/10; Freiberg [Lamp-holders] 12,609/10.

Telephony and Telegraphy: Webb [Telephones] 22,580/09; Burns [Wireless transmitter] 22,640/09; Chisholm [Telephone system] 8,332/10.

Traction: Patterson [Automatic signalling system] 14,925/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Current-collectors] 24,016/09; Siemens & Halske A.-G. [Traffic protecting device] 18,670/10.

Miscellaneous: Day and Allen [Advertising signs] 21,782/09; Heitman [Electromedical apparatus] 22,072/09; Headland [Fire-alarms] 22,617/09; Scherl [Gyroscopic apparatus] 27,687/09; Brennan [Gyroscopic apparatus] 30,417/09; James (*Compagnie Générale de Phonographes et Cinematographs*) [Machine for manufacturing films] 2,998/10; Stevenson [Boxes for metal filament lamps] 3,900/10; Tas [Signs] 6,361/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: Sagaer [Magnetos] 20,306/10.
Incandescent Lamps: Carangelo, 21,740/10.
Instruments: Spalazzi [Transmitting angular movements to a distance] 2,633/10.
Miscellaneous: Presser [Electric welding] 14,859/10; Hanss [Tidal hydraulic power plants] 21,221/10.

Opposition to Grant of Patent

27,380/09. **Recording Instruments.** H. Hammarlund (Svängsta, Sweden). Opposition has been entered to the grant of this patent, which describes a mechanism for producing a lateral as well as a longitudinal movement of the inking band of recording instruments, so that the marking styles may come into contact with different parts of its surface.

Application for Amendment

24,643/08. **Storage Battery Plant.** A. M. Taylor desires to amend this specification, which covers special designs of boosters and methods of controlling them. Each booster set has two separate armature windings on the same or separate cores, and is controlled by a series-parallel grouping switch and an automatic switch which short-circuits the booster fields. This arrangement provides for an increased range of voltage, and the automatic switch protects the boosters against excessive rushes of current. The use of a "bucking" booster in conjunction with an extra set of cells is also covered by this patent. The proposed amendments are detailed in the Official Journal of the Patent Office of October 12th, 1910, p. 1703.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

23,765 of October 26th, 1896. **Miners' Lamps.** W. Ackroyd and W. Best. This patent covers a magnetic unlocking arrangement, and also an igniting electrode which can be turned out of the flame after the wick has been ignited.

23,872 of October 27th, 1896. **Coal Cutters.** F. W. Hurd. Mechanism for electrically-driven coal-cutting machines with rotary and reciprocating cutter bars is covered by this patent, which also describes gearing for machines of the disc and chain-cutter type.

23,942 of October 27th, 1896. **Circuit-breakers.** R. Belfield (*A. J. Wurts, U.S.A.*). The single claim of this patent is as follows:—"In a switch or circuit-breaker having more than one set of contacts, the provision of metallic contacts through which the current flows after the main contacts have been opened and before the circuit is finally broken through infusible contacts provided for the purpose."

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: J. Y. Johnson (*Badische Anilin und Soda Fabrik*) [Improving power-factor of A.-C. distribution systems] 14,460/04.

Dynamos, &c.: Siemens Bros. & Co. and H. Berry [Ventilation of commutators] 13,589/05.

Instruments, &c.: J. M. Tourtel [Prepayment meters] 13,430/05.

Switchgear, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Overload protective devices for compounded self-exciting alternators] 13,379/05.

Telephony, &c.: S. G. Brown [Wireless telegraphy] 14,190/05; C. J. and F. X. Belin [Phototelegraphy] 13,470/05.

Traction: E. Rothwell [Stud-switches for surface-contact system] 14,792/04.

Miscellaneous: Edison Ore-milling Syndicate (*T. A. Edison, U.S.A.*) [Magnetic separators] 14,295/03.

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ENGINEERING AND MACHINERY EXHIBITION IN MANCHESTER

AN engineering and machinery exhibition, organised by the *Engineering Review*, is being held at the City Exhibition Hall (Liverpool Street, Deansgate, Manchester); it was opened last Friday, and will remain open until November 5th. Although nothing of a strikingly novel character is shown to distinguish the exhibition from others of a similar nature, yet there is much to interest Manchester engineers, who will not find a visit to the exhibition wasted time.

The chief electrical engineering exhibit is that of Ferranti, Ltd. (78 King Street, Manchester, and Hollinwood, Lancs.), who have some good specimens of their switchgear on view. Their larger switchgear is represented by an example of their three-panel ironclad high-pressure switchboard, suitable, for instance, for a large manufacturing works supplied at high pressure, but we were particularly struck with the attention given to the smaller classes of switchgear, of which admirable examples were shown. Among these were motor starters of all sizes, and with the high finish and workmanship characteristic of all Messrs. Ferranti's manufactures, and a new pattern of small ironclad circuit-breaker to conform with the new Home Office Rules for workshops and factories, and also suitable for use as a house-service cut-out in place of fuses. Resistance "dimmers," and field regulating switches of the compressed carbon dust type, and of good solid design, are also exhibited in various sizes and shapes. In addition, samples of the firm's usual types of switchgear, instruments, and meters are on view.

The Wardle Engineering Co., Ltd. (196 Deansgate, Manchester) have a good selection of their electric lanterns prominently displayed on a stand near the door. These fittings are particularly well suited for shop front and outside shop-window lighting, and also for the illumination of workshops and other large spaces. For the former purpose, an innovation has been introduced by fixing letters on the "Venner" glass sphere principle, either in the back of the reflector or in the lower part of the hood, so that the light shines through and the lantern serves at the same time as a first-class illuminated sign. We prophesy great popularity for this pattern.

Some excellent specimens of machine tools are exhibited by various makers. Messrs. Drummond Bros., Ltd. (Churchill Works, near Guildford, Surrey) show, in addition to a collection of their usual lathes and other machine tools of a smaller size, a "Drummond-Barreto" universal screw-cutting, turning, boring, drilling, milling, and gear-cutting machine, which although primarily designed for ship-repair work, should have many other useful applications.

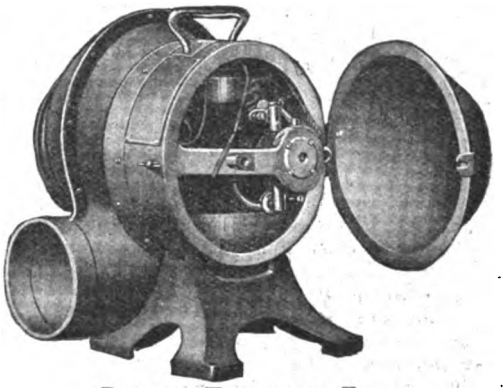
Among other exhibitors, we may mention Messrs. Ackroyd & Best, Ltd. (Morley, near Leeds), whose miner's lamp with electromagnetic lock and machine for safely relighting lamps underground is demonstrated; Messrs. Aiton & Co. (Derby), whose automatic exhaust valve should be inspected by visitors; and the "Auto" Recorder Co. (Leicester), who have a CO_2 recorder in operation.

A paper was read at the Exhibition on Monday by Mr. Frank Nasmith entitled, "The Electrical Engineer and the Textile Machinist." After some general remarks as to necessity for special knowledge of textile conditions on the part of electrical engineers preparing schemes for the electrical driving of spinning mills, an example was taken of the way in which electrical driving could even be made to improve the conditions as in the Brown-Boveri system of variable speed drive of ring spinning machines by the Deri motor, in which a constant tension can be kept on the yarn by varying the speed of the spindle according to the diameter of the cop under the ring. Another way in which electricity had helped the textile manufacturer was in the Carver system of replacing the cards in a Jacquard loom by designs in a metal band forming contact and non-contact surfaces under a series of contacts controlling the hooks which produce the pattern electromagnetically. A further example mentioned was the Chapman electric neutraliser for counteracting the effect of static charges on the yarn by means of high tension alternating charges produced by a small transformer.

The Municipal Wiring Bill.—Ealing is now to be added to the list of towns which have agreed to give financial support. It will be remembered that there was considerable local excitement in Dundee with regard to the proposal that the Corporation should support the Bill, and it has now been decided that the Corporation will support it with the exception of the wiring clause.

PORTABLE VENTILATING SET

A HANDY little portable ventilating set comprising a small D.C. motor, direct-coupled to a centrifugal fan, has been introduced by the Sturtevant Engineering Co., Ltd. (147 Queen Victoria Street, London, E.C.). As shown in the illustration, the fan casing is composed of two light steel stampings, and as the motor is of a specially light construction, the whole can be conveniently carried about. The blade wheel of the fan is of the Sturtevant "Multivane" pattern, and supplies a large volume of air at a fairly low velocity with small power consumption. The set can be connected to the lighting circuit, and costs to run only a few pence per day. It is supplied in three sizes with D.C. enclosed motors, wound for 220 or 110 volts. The set can be placed on a window-sill or can be fixed up permanently for blowing fresh air into a room or for exhausting the air out of the room. It should be particularly useful for smoking rooms, kitchens, laboratories, telephone boxes, lavatories, engine-rooms, boat cabins, &c., and can be employed with advantage in offices, schoolrooms, and sick rooms.



PORTABLE VENTILATING FAN.

ELECTRICITY AT THE BUSINESS EXHIBITION

A GOOD display of the ways in which electricity is of use in offices is made by Electrical Installations, Ltd. (27 Martin's Lane, Cannon Street, E.C.), at their stand at the exhibition now being held at Olympia. Electric lighting is represented by an extensive display of Osram lamps, including a demonstration of their ability to withstand vibration in the form of a little hammer worked by a trembler continually knocking against a lamp bulb. Attention should also be drawn to the collection of holophane glassware, the superiority of which in being able to make the most of the light where it is actually wanted is most effectively shown. The Laurie and Inglefield system of "travelling" pendants hanging from a little trolley on an overhead wire is shown in combination with an ingeniously constructed spring extensible flexible lead for hand lamps, where the conductors are coiled round a central covered spring, which can also be used as an earth lead. There is also a good display of "Quartz" heating apparatus (see ELECTRICAL ENGINEERING, Vol. V., p. 631), and one corner of the stand is devoted to telephone apparatus, including a new secret inter-communication system. The Ozonair system of ventilation and air purification is also demonstrated, and the application of electricity to accurate timekeeping is exemplified by the latest system of Aron electric clocks, in which two master clocks are employed which can check each other, and either of which can automatically take control of the system if the other becomes deranged.

The company have an interesting system of maintenance contracts applying to lighting as well as telephone installations, by which they take whole charge of an installation, and are responsible for all lamp and fuse renewals, &c., and keeping apparatus in good condition at very moderate rates.

Manchester Section of the Institution of Electrical Engineers.—The new session of the Manchester Section was well inaugurated last Friday by a conversazione held at the Whitworth Institute. Mr. Peck (Chairman of the Section) and Mr. Ferranti (President-Elect of the Institution) received the guests with Mrs. Peck and Mrs. Ferranti, and over 200 people were present. The majority of the prominent members from Manchester and the neighbouring towns were there, and a number of members had also come from a distance to make use of the opportunity to meet old friends. Some excellent vocal and instrumental music had been provided, and the function, which is a new departure for the Manchester Section, was a decided success.

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CORRESPONDENCE

MUNICIPAL WIRING BILL.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I notice that it has been stated in your paper that amongst the Corporations who have promised moral and financial support to the above Bill are Glasgow and Barnes.

I beg to inform you that in neither of these cases has the recommendation of the Electricity Committee to support the Bill been confirmed by the Council.

I am, dear sir, yours truly,

LEONARD G. TATE.

Electrical Contractors' Association,
20 Bucklersbury, E.C.
October 15th, 1910.

DIESEL ENGINES.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—As a user of Diesel engines, I am naturally interested in the announcement by Messrs. Willans & Robinson and also a letter from the Diesel Co. in your current issue.

I have always understood, however, that the Diesel Engine Co., have no works of their own, and do not manufacture engines, but that they merely act as an intermediary between the manufacturer and the user. Further, I believe that in some cases they recommend foreign-made, and in others British-made engines as being superior one over the other.

The Diesel plant in my charge is British-made, purchased direct from the manufacturers, and gives every satisfaction.

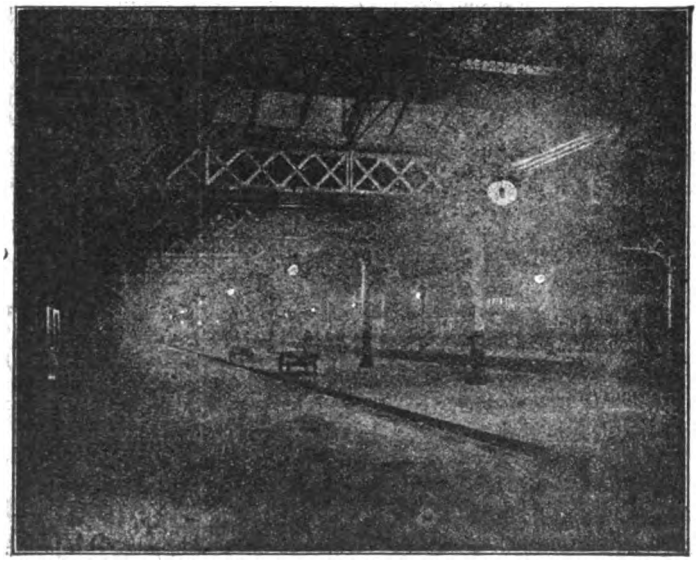
I believe I am correct in saying that the original Diesel patents have now expired, and it is therefore competent for any firm to enter the lists.

Yours faithfully,

ALL BRITISH.

OSRAM LAMPS FOR RAILWAY STATION LIGHTING

THE accompanying illustration, which has been sent us by the General Electric Co., 67 Queen Victoria Street, E.C., represents an installation of Osram lamps recently put up at the Mayfield Street station—the new station recently built by the London and North-Western Railway Co. to deal with Manchester local traffic. The platforms are lighted



OSRAM LAMPS AT MAYFIELD STREET STATION, MANCHESTER.

throughout by Osram lamps, and thirty-six 400 c.p. 200-volt lamps are used, arranged in fittings which have been supplied by the General Electric Co., Ltd., hung on chains from girders 15 ft. from the bottom of globe of fitting to ground, and arranged 60 ft. apart. The work has, we understand, been carried out by Messrs. Collier & Co., 29 King Street West, Manchester.

Theft.—The late traffic manager of the Lanarkshire Tramways Co., John Downes, is being charged with embezzling sums of money, amounting to £550, which had been entrusted to him by various persons for the purchase of shares in the company.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

METAL FILAMENT LAMPS.—A useful blotting slip from Messrs. Drake & Gorham, Ltd. (66 Victoria Street, S.W.), calls attention to the fact that they can give immediate delivery of Osram and tantalum lamps. Affixed to it is a most effective miniature reproduction of the firm's new large catalogue, by turning over the folding front of which are revealed the prices of the complete range of sizes of both Osram and tantalum lamps in a more convenient form than we have yet seen them arranged.

ARC LAMPS.—The Jandus Arc Lamp & Electric Co., Ltd. (Hartham Road, Holloway, London, N.), have issued a revised edition of their arc lamp catalogue. This contains full particulars of the well-known Jandus enclosed flame lamp, with which a burning life of 70 to 90 hours on one trim is obtained with low running costs. A new small pattern lamp of this type, taking from 200 to 300 watts and with the same burning hours, is described. Ordinary enclosed lamps, miniature enclosed lamps, and special colour-matching lamps are also listed, as are various accessories, including the Jandus self-replacing automatic cut-out.

CAST-IRON AND STREET LIGHTING FITTINGS.—We have received from the Cable Accessories Co., Ltd. (Britannia Street Works, Tinidale, Tipton, Staffs.), a comprehensive catalogue of cast-iron and other electric light fittings. These include a very complete range of watertight single-light pendants, brackets, &c., mill fittings, and hand lamps, as well as a great variety of ships' fittings. Particular attention should be drawn to the "Sceaco" series of cluster light fittings for metal filament lamps, one of which is illustrated in Fig. 1 of our special article on shop front lighting. In addition to these cast-iron lanterns, a few designs with spun sheet metal tops are included. The street lighting fittings for metal filament lamps comprise a number of complete lanterns, swan-neck fittings, brackets, &c., as well as conversion fittings for gas-lamp posts.

MOTOR STARTERS.—A leaflet from the Adams Manufacturing Co. (Bedford) describes a series of new types of alternating-current solenoid motor-starting switches. These include double or triple-pole solenoid switches for motors capable of being thrown directly across the line to start, as well as equipments in which relays are employed to actuate groups of solenoid switches in the motors requiring resistance or auto transformer starters.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

INSTALLATION MATERIAL.—The Electrical Company, Ltd. (122-124 Charing Cross Road), are issuing a new list of materials for electric light and power installations in a very convenient pocket form, which should be of use to contractors. The first section deals with continuous and alternating-current motors and starters of small and moderate size, electric crane equipments, lift controllers and accessories, fans, high and low-tension switches, &c., distribution boards, plugs, hand lamps, and flame and other arc lamps and accessories. Other sections are those of the meter department, including switchboard and portable instruments, meters, &c.; the cable department, with particulars of wires, cables, conduits, &c., and the lamp department illustrating applications of the Aegma and Nernst lamps and various forms of strip, chain, &c., for decorative lighting signs, &c.

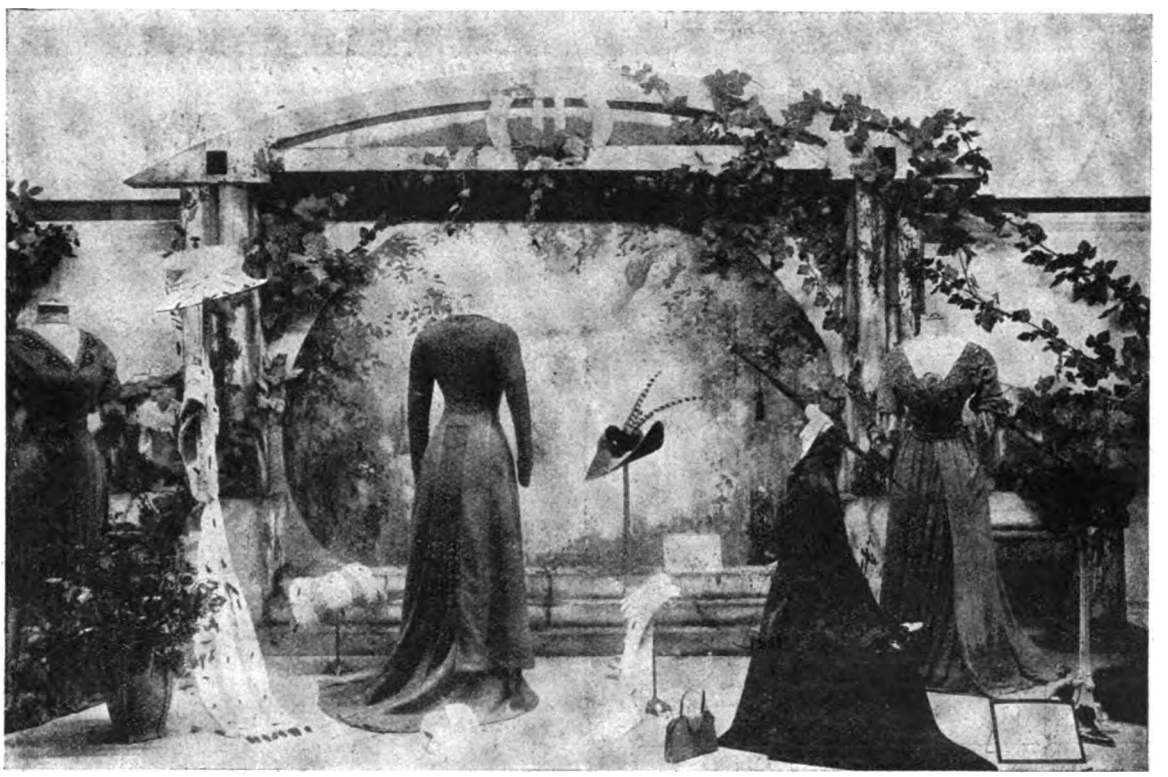
PETROL LIGHTING SETS.—An illustrated booklet in German, published by the Allgemeine Elektricitäts Gesellschaft of Berlin describes the working and management of small lighting sets with direct-couped two- or four-cylinder petrol engines.

HOUSE SERVICE FUSE-BOXES.—A leaflet which has been recently issued by the Edison & Swan United Electric Light Co., Ltd., Ediswan Buildings, Queen Street, London, deals with an improved form of house service cut-out. The base is of vitreous porcelain, fixed in an asbestos-lined cast-iron case. The cover, which is also of cast-iron, asbestos lined, is provided with a small inspection window, through which the fuse may be viewed. All live metal parts are, of course, thoroughly shrouded. Insulating bushes are provided, and the case can be sealed in the usual manner. A complete range of standard cut-outs for motor and house-service work is now made in this type, with 3 in., 4 in., and 6 in. break, according to the current with which they are to work. The pattern with 3 in. break is made in 25 and 50 ampere sizes for use on non-inductive circuits up to 250 volts pressure; the 4 in. break is used for 25, 50, 100, and 250 amperes on non-inductive circuits up to 250 volts; whilst the 6 in. break is made in the 25, 50, 100, and 250 ampere sizes for use on inductive circuits up to 500 volts pressure.

IRON AND STEEL.—The Consett Iron Co., Ltd., Durham, have sent us a set of circulars describing the company's manufacture of steel plates, angles, channels, bars, &c. A description is given of the company's staiths at Derwenthaugh on the Tyne for shipping coals and coke, and a list of fire-bricks and quarls manufactured by the company is also included.

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OSRAM
LAMPS



FOR SHOP WINDOW LIGHTING

REDUCE ILLUMINATION EXPENSES TO A MINIMUM.

The above Photograph, reproduced by kind permission of Messrs. Selfridge & Co., Oxford St., W., was taken at midnight, the sole lighting effects being obtained by **OSRAM LAMPS** used in conjunction with scientifically designed reflectors, providing perfect illumination and an even distribution of light.

UNRIVALLED FOR BRILLIANCY AND LONG LIFE.

Contractors should write for a supply of OSRAM Advertising Literature, printed with name and address FREE, for distribution amongst customers.

All Voltages 2 to 260. All candle-powers 1 to 1000. Average life over 2000 hours.

THE GENERAL ELECTRIC CO., LTD.,

Head Office: 67, QUEEN VICTORIA STREET, LONDON, E.C.

Telephone—London Wall No. 3600 (15 Lines). Telegrams—"Electricity, London."

BRANCHES:

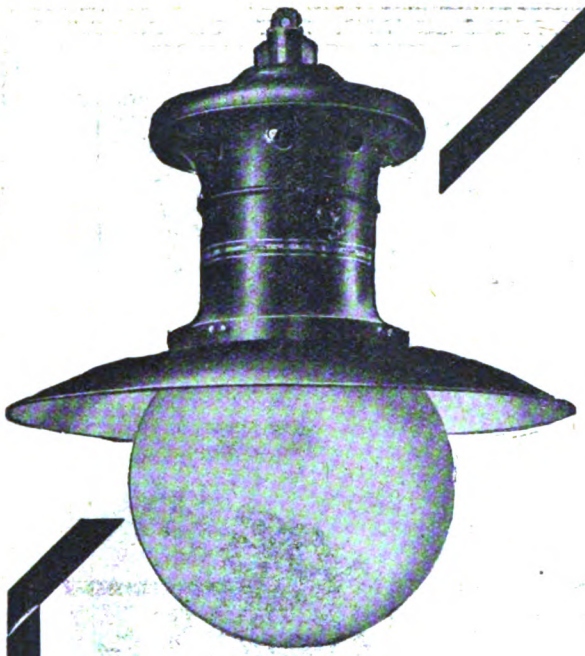
Manchester: Victoria Bridge.
Glasgow: 71, Waterloo Street.
Birmingham: 42, High Street.
Newcastle-on-Tyne: 30, Gallowgate.
Dublin: 16, St. Andrew Street.
Belfast: 13, Queen Street.
Cardiff: Womanby Street.

Also at—
PARIS, MADRID, MILAN, CAPETOWN, and JOHANNESBURG, &c., &c.

BEEHIVE TRADE MARK

WORKS: **London, Witton, Birmingham, Manchester.**

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PATTERN D.

SIMPLEX
Interior and Exterior Fittings for Shop-Window :: Illumination ::

The Interior Fittings are a combination of Holophane Reflectors and Wireless Cluster bodies, and provide the most efficient and artistic method of lighting it is possible to obtain.

PATTERN D.

Designed for easy wiring, using Wireless Cluster bodies.

PRICE EACH, Complete as Illustrated.

List No.	Description.	Price.
9885	For two 50 c.p. lamps ...	24/-
9886	For three 50 c.p. lamps ...	25/-
9887	For four 50 c.p. lamps ...	26/-

Globe 11½ in. diameter.

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17005	,, ,,	5 ,,	2 1 9
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17014	,,	4 ,,	2 15 6
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ELECTRICAL EXHIBITION AT OLYMPIA

We have been favoured with an advance copy of the floor plan and prospectus of the 1911 Electrical Exhibition, which will be held at Olympia (London) from September 23rd to October 21st, under the auspices of the National Electrical Manufacturers' Association. The organising managers are the International Trade Exhibitions, Ltd., Broad Street House, London, E.C. The last electrical exhibition, held at Manchester under the same auspices and management in 1908, was a great success, and coming, as this one does, at a time of a general revival of trade, it should benefit the electrical industry considerably. Arrangements are being made to create a special interest among manufacturers in every industry utilising power, and the management is making special endeavours through Government channels to bring the exhibition to the notice of likely users of electrical equipment in all parts of the world. Applications for space should be made to the organising managers as soon as possible if the best positions are desired.

THE WELLMAN AIRSHIP

The only possible means for news of the Wellman airship, during her unsuccessful attempt to cross the Atlantic, to be transmitted to shore was by wireless telegraphy, and apart from the purely aeronautical aspects of the venture it was of interest as a completely successful experiment in wireless telegraphy from dirigible balloons. We have already given some notes on the wireless equipment (see Electrical Engineering, October 6th, page 635), from which it will be remembered that the installation was designed for a maximum range of 100 miles, and utilised the equilibrator or trailing rope as an earth connection. A number of messages were sent successfully up to a certain point, but for some days these appear to have ceased as the ship was carried by unfavourable winds further than the hundred miles range of her apparatus from the "track" of the liners. There was considerable trouble with the equilibrator, and notwithstanding the serious jerking in the heavy seas which have been encountered, this could not be cast off, as this would at once remove the earth connection and reduce the range of communication to almost nothing. In face of these difficulties, however, the wireless equipment remained in working order to the end, and it is entirely due to its efficiency that the daring crew attracted the attention of a passing ship before they took to their lifeboat and were finally saved.

NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION

The committee of this Association a short time back decided that in future in addition to the ordinary annual general meeting of the Association, half-yearly meetings should be held, and that these should preferably be held in towns other than London, where the annual general meeting has to be held. The first of these half-yearly meetings was held on Tuesday last week at Manchester. It has been felt for some time by nearly all the members that the old Articles of Association did not confine the management of the Association sufficiently to British manufacturers, and Mr. Butler, of the Electrical Power Storage Co., Ltd., who was elected to take the chair, pointed out to the meeting the somewhat drastic alterations which had been made in the new Articles of Association, and proposed a resolution in favour of their being passed, which was duly carried, as was also the second resolution put by the chairman for the purpose of empowering the committee to re-classify the existing members as soon as the new Articles come into force.

Manufacturing sections consisting of members of the Association who manufacture similar goods have recently been formed, and many points were decided on as to the constitution and management of such sections, the main object being the bringing together of competing manufacturers for the purpose of getting matters of common interest settled. A resolution was passed regarding the desirability of joint action in view of the great increase in the number of exhibitions which are now being promoted, and another was agreed to relating to the formation of a co-operative exhibit by members of the Association at the Turin Exhibition.

The last item on the agenda related to the action of certain municipalities who were out-stepping the bounds of merely using their shops as repairing shops, and were doing a certain amount of manufacturing. A resolution was passed to the effect that it was undesirable for extended powers for manufacturing and trading purposes to be granted to local authorities.

During the last twelve months the membership of the Association has nearly doubled itself, and as most of the new members are large firms, the capital represented by the members of the Association is now some three or four times that which it was.

THE BLACKENING OF METAL FILAMENT LAMP GLOBES

The appeal of Messrs. Marples, Leach & Co. (now Adnil Electric Co., Ltd.) against the judgment of Mr. Justice Parker in the action against them early this year by the "Z" Electric Lamp Manufacturing Co., Ltd., was dismissed by the Master of the Rolls, and Lords Justices Fletcher-Moulton and Farwell on Tuesday, without calling upon counsel for the "Z" Co. to reply. The action was for infringement of patent No. 21,654 of 1906, which covers a process for removing the last traces of carbon in filaments manufactured from compounds of tungsten by combining the carbon with the nitrogen in the ammonia given off by heating suitable phosphorous compounds in vacuo. Phospham is said to be particularly suitable. Messrs. Bergmann, who are the makers of the infringing lamps, did not deny the use of phospham, but claimed that it was not used for removing carbon, inasmuch as in their opinion the blackening of metal filament lamp globes is not due to carbon, but is a tungsten deposit. It was argued that if by their use of phospham to produce phosphorous gases for the improvement of the insulation of the interior of the lamp and so prevent blackening, they did remove carbon, they did not infringe the "Z" Co.'s patent. They did not aim at removing the carbon, and it was immaterial for their purpose whether it was removed or not. The case was reported fully in our issues for February 17th and 24th and March 10th, Mr. Justice Parker holding that there was infringement.

In putting the case before the Appeal Court, Mr. Terrell, K.C., occupied nearly three days in arguing (1) that the Bergmann Company did not aim at removing carbon by the use of phospham, (2) that phospham did not remove carbon, and (3) if it did, it would not prevent blackening, whereas the patent specifically stated that it was one for the removal of carbon to prevent blackening. He also asked permission to call further evidence on the point that by cintering the filaments in an atmosphere of hydrogen, instead of hydrogen, nitrogen, and ammonia, without using any phospham, the carbon contents of the filament were removed to an extent ten times greater than the process used by the "Z" Company, in which phospham was used. Since March of this year all the Bergmann lamps had been manufactured in this way, and a much improved filament obtained, but at the trial before Mr. Justice Parker, he was in ignorance of this fact. This request was not acceded to on the ground that the Bergmann Co. were obviously in possession of this information, and that consequently they could have put it forward at the trial.

G.B. SYSTEM IN MILE END ROAD

In the King's Bench Division on Thursday the libel action Griffiths *v.* Lloyd and others, relating to the experimental installation of the G.B. surface-contact system in the Mile End Road by the London County Council, was announced as settled. It will be remembered that whilst the experiment was being carried out, considerable criticism of the action of the London County Council was made by a number of daily newspapers, including the *Daily Chronicle*, the *Star*, and the *Morning Leader*. Mr. Justice Lawrance was informed that a settlement had been arrived at on the terms of the newspapers in question making an apology and paying a substantial sum in damages. The apology took the form of it being pointed out that the criticisms of the system made by the papers were only intended to refer to the system as laid down by the London County Council, who had introduced certain modifications, against which the G.B. Co. had protested. It was never intended to attack the G.B. system *per se*, but only the modified system as installed by the London County Council. Prominence was given in the apology to the fact that the G.B. system is working most successfully at Lincoln. Consequently the action for libel was withdrawn.

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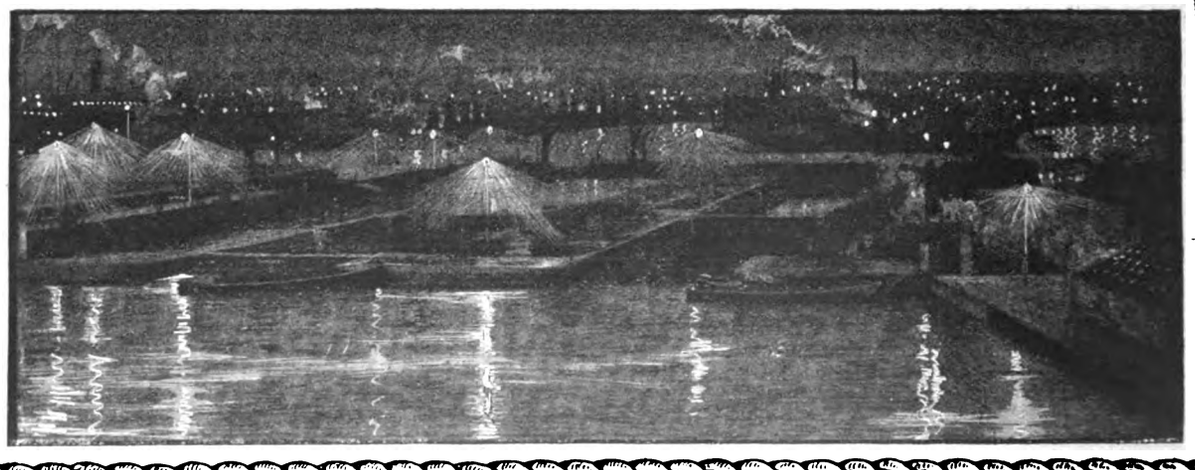
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LOCAL NOTES

Argentine: *Electric Supply.—The Review of the River Plate* states that the electric power station at San Francisco (Cordoba) has been inaugurated. The Sociedad Co-operativa Luz Electrica de General Belgrano has been formed with a capital of $70,000.

River Plate Telephones.—The change over to central battery working at the Avenida exchange of the United River Plate Telephone Co. has now taken place. About 4,000 subscribers are connected to the exchange.

Ashton & Hyde: *Tramway Purchase.*—The 21 years' lease of the Oldham, Ashton & Hyde Electric Tramways Co. will expire in a few years, and the various Councils concerned in the lease are now holding meetings to consider the advisability of undertaking a joint purchase when the time arrives. It is understood that the Company are prepared to double the track, which is at present single line, on condition that a new lease for 21 years is granted.

Birmingham: *Completion of Power Station.*—The second portion of the Summer Lane power station has now been completed. Alderman Bowater, Lord Mayor of Birmingham, last week ascended the 230 feet chimney stack and laid the last brick. The Summer Lane power station was opened four years ago with a plant capacity of 8,500 kw., but the capacity of the completed station is 19,000 kw. It may be mentioned that in connection with the proposed extension of Birmingham, the King's Norton Council have consented to agree on condition that the King's Norton electric lighting provisional order is put into force by the Corporation.

Buenos Aires: *Electric Supply.*—According to the *Review of the River Plate* a number of French and English business men residing in the Argentine propose to form a limited company for the supply of electrical energy in Buenos Aires. It is proposed to ask for a concession for 40 years. Our contemporary adds that they are not aware of the capital of the new company, but "it will be exceedingly venturesome to commence a competition against the existing company, which has its mains extended in every direction, and also seven power stations.".

Burry Port: *Electric Supply.*—An electric lighting provisional order is to be applied for.

Burton-on-Trent: *Meters on Tramcars.*—The Tramways Manager reports that the introduction of meters on the tramcars has resulted in a saving of electrical energy amounting to between £10 and £20 per month for the 20 cars in use.

Cheltenham: *Municipal Wiring.*—The Electric Lighting Committee are still undecided whether to recommend the Council to support the proposed Bill of the Municipal Electrical Association conferring wiring powers upon all municipalities. At the last meeting of the Corporation the matter was again discussed, and referred back to the committee in order that they may hear the further objections of the local contractors to the Bill.

Croydon: *Meters on Tramcars.*—It is stated that the experiment of fixing meters on every tramcar to check unnecessary waste of current has resulted in a saving of £6,000 a year.

Edinburgh: *Electricity Revenue.*—A document has been prepared by the City Treasurer dealing with the finances of the various departments of the Corporation. In regard to the electric light undertaking he points out that the rates have never been called upon in any way; indeed, since 1897 no less than £49,242 have been transferred to the relief of rates out of the profits of the undertaking. It is pointed out that the interest and redemption charges average over 6 per cent. per annum, and that thus the undertaking does not get the benefit of cheap money. The City Treasurer expresses the opinion that it is open to serious question whether such a system of indirect taxation, which bears on the small number of consumers of electric light, and which does not apply to either the gas or water undertaking, is justifiable in itself and fair to the electric light undertaking and the consumers.

Street Lighting.—According to the annual report of the Inspector of Lighting in Edinburgh, the streets are at present lighted by 1,229 arc lamps, 22 incandescent lamps, and 10,293 gas lamps. The cost of arc lamps has been decreased from £20 per lamp in 1895 to £9 per lamp at present.

Hastings: *The Dolter System.*—An agitation has been started with the object of substituting the overhead system for the Dolter system along the sea front.

India: *Street Lighting.*—The Calcutta Corporation have put in an experimental street lighting installation. Flame arc lamps have been adopted, and the experiment is to be continued, with the assistance of the Calcutta Electric Supply Co., for two months.

Japan: *Imports of Electrical Machinery.*—In a British consular report dealing with the trade of Kobe last year, it is stated that whilst the proportion of British imports of electrical goods to German and American machinery has increased greatly, and British electrical machinery is much esteemed by the Japanese, the great difficulty to contend with in Japan is that cheapness is likely to outweigh considerations of quality. Many new electric light and tramway companies were started during 1909, and these have increased the demand for British-made wires and cables. There are now many small cable manufacturing stores in Japan, but only one can be said to compete in quality with the imported goods, and this one is equipped with British machinery and has the services of a British cable expert.

Jerusalem: *Electric Supply.*—It is stated that tenders have been invited from European firms for the erection of an electricity works. It is intended that the undertaking shall be run by a company, but that the municipality have the right to purchase at the end of a term of years.

Liverpool: *Tramway Receipts.*—During the nine months of the present year the tramways receipts show an increase of £15,000 over those of the corresponding period of last year.

London: *London County Council: New Tramways.*—In addition to the tramways for which powers are to be sought in the next session of Parliament, the Highways Committee have made some further recommendations involving a total length of seven miles at an estimated cost for construction, exclusive of cars, car sheds, sub-stations, &c., of £163,290.

Camberwell: Electricity Accounts.—The Council have made representations to the London County Council as the purchasing authority of the County of London Electric Supply Co.'s undertaking, calling attention to the absence of statements in the company's accounts relating to each of the undertakings authorised by the company's various Provisional Orders. The London County Council support the views of the Borough Council that the accounts should be kept separate, and are in communication with the Board of Trade on the matter.

Marylebone: Current for Electrical Vehicles.—The Electricity Committee propose that current for electrical vehicles should be supplied at ½d. per unit between 11 p.m. and 6 a.m. for a minimum consumption of 100,000 units per annum. Between 6 a.m. and 11 p.m. the price is to be 1d. per unit. The General Manager is to have the right to cut off the current altogether in case of emergency.

Tramways.—The Improvements and Housing Committee recommend that the Council should not give their consent to the tramways proposed by the London County Council from Marble Arch to Cricklewood; Marylebone Road to Swiss Cottage; and Edgware Road to Upper Baker Street.

Street Lighting.—A total of 3,367 gas lamps have now been converted to electricity.

Matlock: *Electric Supply.*—Messrs. Bullen, of Bradford, propose to apply for an electric lighting Provisional Order.

Newcastle: *Trolley Omnibuses.*—The Castle Ward Rural District Council have refused to give their consent to the running of trolley omnibuses through the Westerhope district by the Corporation.

Peru: *Proposed Electric Railway.*—It is stated that a concession to use the waters of the River Chancery, or Pasamayo, has been granted to a syndicate for the purpose of an 80-mile electric railway between Hancon and Huacho.

Scarborough: *Stoppage of Tramways.*—A conference took place in London last week with regard to the proposal of the Scarborough Tramways Co. not to run a service during the winter. The company are strongly opposed to a continuation of the service during the winter, and threaten that if this is imposed upon them, they will discontinue the whole service. It is possible that a local inquiry will be held by the Board of Trade.

Swansea: *Tramway Purchase.*—A committee has been formed to carry on negotiations for the purchase of the Swansea Improvements & Tramways Co. Notice has been given to acquire compulsorily two sections of tramway, the periods for which will shortly fall in.

Torquay: *The Dolter System.*—It is anticipated that the conversion of the whole of the tramways to the overhead system will be completed by next Easter.

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TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bury St. Edmunds.—A loan of £1,430 has been granted for additional machinery and mains.

Carlisle.—A new feeder is to be laid in Lowther Street.

Sanction has been given to a loan of £7,645 for new plant, and £5,000 for additional mains.

Kinross.—A proposal to light the street by electricity is under consideration by the Town Council.

Liverpool.—The West Derby, Liverpool, and Toxteth Park Joint Hospital Committee invite tenders for a complete installation of electric lighting at the Hospital for Consumption at Heswell. Particulars from the Clerk to the Committee, Brougham Terrace, Liverpool, and tenders by October 24th.

London: *Battersea.*—The L.C.C. have advanced £9,004 for extensions at the electricity works.

Stepney.—The L.C.C. have advanced £7,150 for electrical extensions.

Shoreditch.—The sum of £350 is to be expended upon new meters and demand indicators, and £311 upon a main in Regent's Row.

Oldham.—A loan of £12,544 has been sanctioned for feeder cables, repayable in 20 years.

Roumania.—Tenders are invited by the Town Council until November 22nd for the erection of an electricity works for the town of Focshani.

Spain.—The Spanish Government have decided, owing to the high cost of obtaining such apparatus in Spain, to invite foreign competition for electric lighting and other supplies required by the various Government departments.

Swindon.—The Electrical Engineer has been instructed to prepare a report upon extensions at the electricity works.

Wednesbury.—A loan of £4,600 for extensions at the electricity works has been granted without a local inquiry.

Yarmouth.—A Local Government Board inquiry was held last week concerning a loan of £5,800 for street lighting, cooling tower, and mains.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Reconstruction of the Miller General Hospital, Greenwich.

Additions to Cottage Homes, Goldie Leigh, Plumstead.

Eight houses, Aurelia Road, Croydon. W. Langridge, Brighton Road.—Eleven houses, Bingham Road. R. Palmer, Sherwood Road.—Six houses, Parchmore Road. H. C. Reynolds, Kensington Avenue.—Eleven houses, Leander Road. C. Bradford, Brixton, S.W.—And nineteen houses, Portland Road. J. W. Hall, 54 Ashchurch Road, Croydon.

The architect for Mr. Hammerstein's new opera house in Kingsway is Mr. Bertie Crewe, 75 Shaftesbury Avenue, W.C.

A loan of £17,500 has been granted for the erection of an elementary school in Pitshanger Lane, North Ealing.

New headquarters for Salvation Army at Hackney.

Additions to Stoke Newington Co-operative Society's premises.

Rebuilding of Jewish Synagogue, Mile End, recently destroyed by fire.

PROVINCES.

Ayr.—Alterations to County Hospital.

Bacup.—Secondary School and Technical School at Waterfoot. Architect, Mr. H. Littler, Ribblesdale Place, Preston.

Chadderton.—New Town Hall.

Dundee.—New Hospital. Medical Officer of Health.

Edinburgh.—Additions to factory of Messrs. T. & H. Smith & Co., chemical manufacturers.

Glasgow.—Conversion of building in Hopehill Road to electric theatre.—Warehouse and offices in Bishop Court. J. G. Deans, Bishop Street, Anderston.—Electric theatre at 592 Dobbiesloan.—Laundry at Royal Samaritan Hospital for Women.

Govan.—Rebuilding of Messrs. M'Ilwraith's works in Broomloan Road.

ELECTRICAL OUTBREAKS.

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¶ It is the only Fire Appliance that can be used with safety on a live Cable.

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Price 5/- each.

Guaranteed to remain effective for a number of years.

TESTIMONIALS.

THE POTTERIES ELECTRIC TRACTION CO., Ltd.
Tramway Depot, STOKE-ON-TRENT,
October 3rd, 1910.

Messrs. Kyl-Fyre, Ltd., Eastbourne.

Dear Sirs,

On two occasions we have had fires behind the main switch-board due to the fusing of cables, and these were quickly stopped by the use of your Extinguishers. In one case at least considerable damage would have been done had the fire not been quickly got under.

Yours faithfully,
(Signed) W. THOM, General Manager.

THE CLYDE VALLEY ELECTRIC POWER CO.,
55, Bothwell Street, Glasgow.
August 11th, 1910.

Dear Sirs,

We recently had occasion to use two of your "Kyl-Fyres" for an electrical outbreak at Bellshill Switchhouse, and these were found to do their work satisfactorily. We shall feel obliged if you will let us have renewal charges for two extinguishers.

Yours faithfully,
For the CLYDE VALLEY ELECTRIC POWER CO.
(Signed) D. M. MACLEOD, Resident Engineer.

FULL PARTICULARS—

KYL-FYRE, Ltd., Eastbourne, and 92, Market St., Manchester.

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Hull.—Additions to Gourock Rope Co.'s warehouses.—Extensions to British Oil and Cake Co.'s mills.—Theatre, Anlaby Road Assembly Hall, Spring Bank. Mr. W. H. Bingley.—Additions to works of Messrs. T. Jackson and Co. —New works for Messrs. Reckitt & Sons at St. Mark Street. —Additions to the Hull Hide, Skin, & Fat Co., Maxwell Street.

Hyde.—Town Hall and police buildings.

Leeds.—Alterations and additions to Union Infirmary, Becket Street. Architects, J. M. Bottomly & Welbourn, 13 Bond Street, Leeds.

Liverpool.—New sorting office, Rice Lane. W. Gilruth, H.M. Office of Works, Liverpool.

Loughborough.—Proposed Concert Hall. Parks Committee.

Macclesfield.—Council school on Byron Street site. Builders, Messrs. G. Roylance & Co., Ltd.

Manchester.—Tenders are invited for the electric lighting of the Corporation power station, Whitworth Street, West Manchester.

Middlesbrough.—Home, in place of cottages in Benjamin Street. Holy Cross Mission.

Nelson.—Public baths.

Newport (Mon.).—Higher Elementary Schools, Stow Hill.

Newton Abbot.—Infirmary.

Northampton.—Post Office in St. Giles's Street.

Penzance.—New pavilion.

Scarborough.—Conversion of Salisbury Hotel into music hall.—Alterations and additions at Secondary School.

Sussex.—Cottage Hospital at Hayward's Heath.

Weston-super-Mare.—Proposed centralisation of County Council Offices.

Windsor.—New reception station at Victoria Infantry Barracks. Director of Army Contract, London.

Wolverhampton.—Workshop for Chillington Tool Co., Ltd., Willenhall Road.

MISCELLANEOUS

Australia.—The Deputy Postmaster General at Sydney invites tenders by November 16th for telephone, telegraph, and electric light material. Particulars from 72 Victoria Street, London, S.W., or 73 Basinghall Street, London, E.C.

Ayr.—The Council have approved of a scheme for lighting "the front" at a cost of over £400.

Beckenham.—A Local Government Board inquiry is to be held concerning a loan of £11,000 for free wiring purposes.

Dublin United Tramways Co.—Tenders are invited for stores, including electrical supplies, for the year to December 31st, 1911. Particulars from the Secretary, and tenders by November 7th.

London: *London County Council.*—Tenders are invited for the supply of various stores during 1911, including electrical fittings, carbons, insulating materials, cables, wires, and electric lamps. Particulars from the Clerk to the Council, and tenders by October 31st.

New Zealand.—The Invercargill Town Council invite tenders for an electric tramway system. Specifications may be seen at Messrs. W. Coward & Co., 91 Finsbury Pavement, London, and Messrs. Alfred Dickinson & Co., Central House, New Street, Birmingham, and Gresham House, Old Broad Street, London.

Norwich.—The Electricity Committee recommend that the scheme for substituting electricity for gas in the public streets be carried out in two portions, and that the first shall include the displacement of 750 gas lamps.

Rawtenstall.—Tenders are invited by October 31st for six single-deck tramcars, complete with trucks and electrical equipment. Particulars from the Borough Electrical and Tramways Engineer.

Law Relating to Engineering.—The first of six lectures on this subject was delivered at Caxton Hall, Westminster, on October 10th, under the auspices of the Society of Engineers and the Junior Institution of Engineers. The lecturer, Mr. L. W. J. Costello, M.A., LL.B., dealt with the authority of the engineer and his duties and liabilities, and at the conclusion of the lecture a number of questions were answered. Tickets can still be had from the Secretary of the Junior Institution of Engineers, 39 Victoria Street, S.W. The fee for the course is 6s. for members of either society, and 12s. for non-members. The second lecture is on Tuesday next at 7.30 p.m.

Stannos Wiring.—The *Cleckheaton Guardian* describes an electric lighting installation at "Fir Dene," Gomersal, the residence of Major H. S. Atkinson, which is being carried out by Messrs. Saville & Walton (Chancery Lane) on Messrs. Siemens Brothers and Co.'s now well-known Stannos system. The saving in time of installations with this system is well shown by the fact that the whole installation of 52 lamps is expected to be complete within 14 days from the commencement of the work.

TENDERS RECEIVED AND ACCEPTED

Calcutta.—Bruce, Peebles & Co., Ltd., have received an order for sixteen 475-kw. La Cour converters for the Calcutta Electric Supply Co.

Folkestone.—The tender of the Folkestone Electricity Supply Co. has been accepted at £36 18s. for re-arranging the electric lighting, and the installation of new fittings, &c., at the Library.

General Post Office.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the contract from the General Post Office for "Tantalum" and "Onewatt" lamps.

Gillingham.—An air compressor for the Diesel engine plant is to be purchased from Messrs. Mirrlees & Co. at a cost of £30.

London: *London County Council.*—The tender of Messrs. Kirk & Randall at £22,386 has been accepted for the road work and platelaying in connection with the reconstruction of the tramways from Kentish Town Road *via* Highgate Road to Swains Lane.

The tender of Messrs. Medway's Safety Lift Co. at £282 has been accepted for the provision of an electric lift at 23 Belvedere Road for the tramways department.

Messrs. Reid Bros. are to carry out the duct-laying for the Battersea Park Road to King's Road, Chelsea, and Putney Bridge to High Street, Wandsworth, tramways at £2,140. The cables will be supplied by W. T. Henley's Telegraph Works Co., Ltd., at £7,045, and the switch panels by Messrs. Johnson & Phillips, Ltd., at £200.

The Highways Committee recommend the acceptance of a tender by Messrs. Charles Wall, Ltd., for the erection of the third portion of the Hammersmith car shed at £2,280. The track work, electric lighting, and overhead equipment, &c., is to be carried out by the staff of the tramways department.

Lewisham.—The contract for the complete electrical equipment of the Lewisham Hippodrome has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd. The wiring work has been sub-let to Messrs. G. E. Taylor & Co., Bush Lane, Cannon Street, London, E.C. Siemens' fittings and tantalum lamps will be used throughout. "Stannos" wiring has been specified, and the circuits will be protected by Siemens "Zed" fuses.

Newport (Mon.).—The Corporation has recently accepted tenders as follows:—Carbon filament lamps, Edison & Swan United Electric Light Co., Ltd., and General Electric Co., Ltd.; radiator lamps, Edison & Swan United Electric Light Co., Ltd.; meters, Electrical Co., Ltd., Bat Meter Co., Ltd., British Westinghouse Co., Ltd., and Electrical Apparatus Co., Ltd.; rubber cables, General Electric Co., Ltd.; single paper cables, Callender's Cable & Construction Co., Ltd.; sale of superseded plant, C. D. Phillips, Newport; steel girder work, T. H. Howell, Ltd., Newport; cast-iron pipes, Jordans, Ltd., and Thos. Spittle, Ltd., Newport; and cast-iron stanchions, W. A. Baker & Co., Ltd., Newport.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. N. Bailey, of the British Westinghouse Electric & Manufacturing Co., Ltd., has been awarded by the Manchester Association of Engineers the Constantine Gold Medal for the best Paper read during the year. Mr. Bailey's Paper, which was read during the session 1909-10, was entitled "The Exhaust Steam Turbine."

A lecturer on electric wiring is required at the South Western Polytechnic Institute. (See an advertisement on another page.)

Cable Engineer and Works Manager wanted for a new factory in England (see an advertisement on another page).

An improver is wanted at the Watford electricity works (see an advertisement on another page).

Meters Approved.—The Board of Trade have approved of the Electrical Company's continuous current watt-hour meter, type K.G., and of the means provided for fixing same.

The Board have also approved of the Wright Miniature electricity meter manufactured by the Reason Manufacturing Co., Ltd., of Brighton, and of the means provided for fixing same.



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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 5s. to £59 10s. per ton (last week, £58 15s. to £59).

Siemens' Rubber Tapes and Solution.—We are informed by Messrs. Siemens Brothers & Co., Ltd., that the net prices for their india-rubber tapes and solution (in Catalogue No. 510 and Reprint No. 510 A), which came into force on April 8th, 1910, have been reduced by 20 per cent., as from Monday, October 17th.

Agencies Wanted.—A Montreal firm of importers wish to be placed into communication with British manufacturers of electrical plant and supplies. Further particulars from 73 Basinghall Street, London, E.C.

Liquidations.—The Appleby Crane & Transporter Co., Ltd., is to be wound up voluntarily. Mr. W. B. Peat, 11 Ironmonger Lane, London, is arbitrator.

A meeting of the Telegraph Printing Co., Ltd., will be held at Krause's Cafe, Bank Street, Manchester, on Nov. 16th at 4 p.m., to hear the liquidator's account of the winding up.

"Zed" Fuses.—Amongst the buildings which are being equipped with Messrs. Siemens Brothers Dynamo Works, Ltd.'s well known "Zed" fuses are the Royal Liver Buildings, Liverpool, the new Y.M.C.A. Buildings, Manchester, the Newport Technical Institute, and the Palladium Theatre, London. At the Stafford works a new shop is now being equipped exclusively for the production of these fuses, and two new sizes to be called "ZIV" and "ZV" respectively, with cartridges for a normal capacity of up to 100 and 200 amps. will be placed on the market in the course of the next few weeks. Those interested should write for particulars to the firm's showrooms and stores at 39 Upper Thames Street, London, E.C.

The Wellman Airship.—We understand from the Holophane Co. (12 Carteret Street, Westminster, S.W.) that the lamps on the Wellman airship were equipped with Holophane steel reflectors.

NEW COMPANIES

SWANN GARLAND.—Registered by Harwar & Son, 22 Chancery Lane, London. Capital £5,000. Dealers in electric light fittings, &c.

FURNACES.—Palace Chambers, Westminster, London. Capital £12,000. Electrical and mechanical engineers.

ELECTRIC FIRE PREVENTION APPLIANCES & GENERAL MANUFACTURING CO.—Registered by H. Dade & Co., 14 Queen Victoria Street, London. Capital £1,000. Electricians, &c.

ELECTRIC POWER PLANTS, Caxton House, Westminster, London.—Capital £15,000 (10,000 preference shares). Contractors for electric plant, turbines and apparatus, suppliers of electricity for light and power, &c., and to adopt an agreement with A. H. Gibbings and P. J. Mitchell. The subscribers are C. O. Bastian, 91 Palmerston House, London, E.C., electrical engineer; A. H. Gibbings, 17 Gambier Terrace, Liverpool, electrical engineer; P. J. Mitchell, Caxton House, Westminster, electrical engineer; and D. Bennett, Caxton House, Westminster, engineer. The first directors are P. J. Mitchell, C. O. Bastian, and A. H. Gibbings.

CARLTON ENGINEERING CO.—Carlton House, Regent Street, London. Capital, £6,000. Electrical, mechanical, and general engineers.

UNITED SHERARDIZING.—Registered by Hills, Godfrey & Halsey, 23 Queen Anne's Gate, Westminster, London. Capital, £60,000 (14,000 five per cent. preferred ordinary). To acquire the right to use the process known as "sherardizing" and to acquire certain patents, and to adopt an agreement with Mr. T. H. Nelson.

TELEPHONE SUBSCRIBERS' PROTECTION ASSOCIATION.—144 St. Vincent Street, Glasgow. Capital limited by the guarantee. To combine telephone users and to protect their interests

ALLIANCE ELECTRICAL STORES.—Registered by Messrs. Slaughter & May, 18 Austin Friars, London. Capital, £25,000 (47,500 preferred ordinary shares of 10s. each, and 1,250 deferred ordinary shares of £1 each). To acquire the business of the Alliance Electrical Co., Ltd. (in liquidation).



LLANGEFNI ELECTRIC LIGHT & POWER CO.—66 Victoria Street, London. Capital, £3,000 (2,750 five per cent. cumulative preference). To supply electricity in Llangefni.

PROGRESSIVE ENGINEERING CO.—Registered by A. H. Atkins, 27 Fetter Lane, London. Capital, £500. Electrical and mechanical engineers.

WHIPPLE & CO.—9 Cook Street, Liverpool. Capital, £2,500. To acquire the business of electrical engineering contractor now carried on by C. R. Whipple at the above address.

LYNESS SYNDICATE.—Registered by Jordan & Sons, 116 Chancery Lane, London. Capital, £3,500 (2,000 deferred). To develop the Lyness patent electric motor control finger and tip.

J. B. SAUNDERS.—9 York Street, Westminster. Capital, £20,000. Electrical and Mechanical Engineers.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Deutsche Gasglühlicht A.-G. (Auergesellschaft), Berlin.—The report for the past year shows a net profit of £512,000, as against £202,000 for the previous year. A dividend of 50 per cent., as in the previous year, is recommended.

New St. Helens & District Tramways Co.—The accounts for the year to June 30th show a net profit of £1,589. After paying a dividend of 1½ per cent. per annum, the sum of £390 is carried forward.

Cleveland & Durham Electric Power Co.—It is proposed to reduce the capital from £1,000,000 to £700,000 by cancelling the 1,081 £5 deferred shares held in trust for the company for the purpose of surrender; reducing the remaining deferred shares from £5 to 10s. each; and reducing the ordinary shares from £5 to £4 each.

Callender's Cable & Construction Co.—Dividend at the rate of 10 per cent. per annum on the ordinary shares, less tax.

Drake & Gorham.—There was a net profit of £5,757 for the year to June 30th, and after payment of a dividend at the rate of 4 per cent. per annum, a balance of £1,142 is carried forward.

Stothert & Pitt.—Dividend of 2½ per cent. for the half-year, making 7½ per cent. for the year, and placing £900 to reserve, carrying forward £2,455.

Montevideo Telephone Co.—There is a net profit of £20,564 for the year to July 31st. £11,000 are transferred to depreciation, and final dividends at the rate of 5 per cent. per annum on the preference shares and 6 per cent. per annum on the ordinary shares are recommended, carrying forward £3,921.

Pachuca Light & Power Co.—An issue of £800,000 five per cent. first mortgage fifty-year bonds is being made, for which the principal and interest are unconditionally guaranteed by the Mexican Light & Power Co. The price is 88½. The latter company will supply the Pachuca Co. with power.

The Electro-Harmonic Society.—The first concert of the season will be held at the King's Hall, Holborn Restaurant, on Friday evening, October 21st, Mr. S. Z. de Ferranti in the chair. Succeeding concerts are fixed for November 21st, December 16th, January 13th, February 21st, and March 24th. The ladies' nights will be November 21st and February 21st.

Telegraph Traffic.—Owing to a violent cyclone, communication with Cuba has severely suffered, all the land-lines being down. It has also affected through traffic to the West Indies beyond the Island, which is being sent by other routes. The Cuba Submarine Telegraph Co.'s cables along the south coast of Cuba have not, so far as it is known at present, been damaged. Telegrams to Portugal *via* Spain are subject to delay, excepting by the direct line and *via* Bordeaux. The Rome-Constantinople line was down on October 17th, but restored on the 18th inst.—The Réunion-Mauritius cable was repaired on the 17th, having been inoperative since May 19th last.

Workman's Compensation.—In the King's Bench Division on Monday before Mr. Justice Channell, a case was commenced in which a Mr. Settle sued the Sheerness & District Electric Power & Traction Co. and the Queensborough Wharf Co. for the refund of £300 paid by him to the widow of an employee who was killed through coming into contact with an overhead main. It appears that the Power Company, without the consent of the Board of Trade, and contrary to the regulations concerning high-tension wires, carried a cable over the building, and within 5 ft. of the roof, in which the employee in question was working. In the course of his duties he came into contact with the wire and was killed, and Mr. Settle, as his employer, was ordered to pay £300 as compensation. He claimed that the accident was due to the negligence of the two companies mentioned above for not fixing notices as to the danger, and also for having put up the wire contrary to the law. When the case for Mr. Settle was concluded the judge intimated that he was not at all clear on the law relating to such a case, and suggested that the best way would be for the parties to come to terms. Acting on this suggestion the parties conferred together, and settled the action, but the terms were not disclosed.

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ELECTRICAL ENGINEERING

NO. 200 [VOL. VI., NO. 43] THURSDAY, OCTOBER 27, 1910. [PRICE ONE PENNY.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for SITUATIONS VACANT AND WANTED ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

OFFICIAL NOTICES and TECHNICAL COLLEGE ANNOUNCEMENTS are inserted at the rate of Ninepence per line (column width).

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Small Advertisements and Official Announcements, *Wednesday first post.*
Displayed Advertisements, *Tuesday first post.*
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All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.
Telegrams: "Circling, London." Telephone No.: 5509 Holborn.
Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

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SUMMARY

OUR special correspondent in Ceylon sends some particulars of such scope as there is for electric light and power in the island, and describes the recent advances in the telegraph and telephone systems. (Page 677.)

A NEW pattern of petrol-electric omnibus chassis is described, in which the road wheels are driven through differential and worm gear by a single series-wound motor supplied by a dynamo coupled to the petrol engine. Direct-drive is not resorted to at any speed, and starting and speed control is effected by means of the engine throttle valve and the dynamo field. The motor field is shunted at top speed. No storage battery is carried, and the maintenance costs are claimed to be exceedingly low. Two such vehicles have recently been dispatched for public service in India, and a modified pattern is to be employed in London. (Page 678.)

A SHORT description is given of the stage lighting control arrangements at the "Little Theatre." (Page 680.)

MR. A. W. Gamage made some very cogent remarks on the subject of gas *v.* electric street lighting at the head of a deputation to the Holborn Borough Council. (Page 680.)

WE are able to give some particulars of the street lighting installation with overhead mains which has been put down at Dowlais by the Merthyr Electric Traction & Lighting Co. (Page 681.)

AN ampere-hour meter, recently introduced by the British Thomson-Houston Co., is described on page 682.

THE Marylebone Electricity Department are making very rapid progress in the replacement of gas fires by electric radiators in their district. (Page 683.)

IN his presidential address to the Institution of Automobile Engineers, Mr. F. W. Lanchester spoke in favour of petrol electric drive, on the "auto-mixte" system for vehicles of moderate speed. (Page 683.)

A WELL-KNOWN maker of arc lamps criticises our figures for cost of carboning in our special articles on shop lighting. (Page 684.)

AN anti-vibration metal filament lamp for use in mills, factories, ships, &c., has been introduced. The tungsten filament is divided up into a larger number of short loops than is usual, and has a specially elastic suspension. (Page 684.)

STEPS are being taken by the Marylebone Electricity Department to encourage the use of electric vehicles by giving special rates for current for accumulator charging during non-peak hours. A new service of electric omnibuses is contemplated, and there are rumours of the extended introduction of electric vans. (Page 685.)

A REVISED standard specification for steel wiring conduit has been issued by the Engineering Standards Committee. The specified length of the thread on the end of tubes is shorter, so as to avoid the butting of the tubes in coupling pieces. (Page 685.)

THE Lodge-Muirhead Wireless & General Telegraphy Syndicate, Ltd., will shortly petition the High Court for an extension of term of a patent granted to Sir Oliver Lodge in 1897, relating to wireless telegraphy, and claiming the use of inductances in the oscillating circuits for tuning. (Page 685.)

IN the Appeal Court on Thursday, the decision of Mr. Justice Parker early in the year, in which he declared the Ilgner patent for the electrical driving of reversing rolling mills to be invalid for want of subject matter, was upheld. The Court expressed the opinion that the Ilgner patent merely combined the Ward-Leonard system with the addition of a fly-wheel, and that no

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new result was obtained by the combination. (Page 686.)

The arbitration to determine the price to be paid for electrical energy by the Paisley District Tramways Co. to the Paisley Corporation was continued in London on Tuesday. The Corporation urge that comparisons between the prices paid in other towns and in Paisley are quite irrelevant to the question now being considered, and that the only basis upon which the charge should be calculated is the cost to the Corporation. It was stated in evidence that at present the profit made by the Corporation from the tramway supply is only 0·65 per cent. on the capital expenditure. On the other hand, the Company claim that the power-station, which contains over 4,000 kw. of plant for a load which has never yet reached 2,000 kw., is very much overloaded with plant, and that this accounts for the inability of the Corporation to decrease the price. (Page 686.)

A room eight yards square in London is to be lighted by gas instead of electricity. The *Journal of Gas Lighting* is jubilant. (Page 687.)

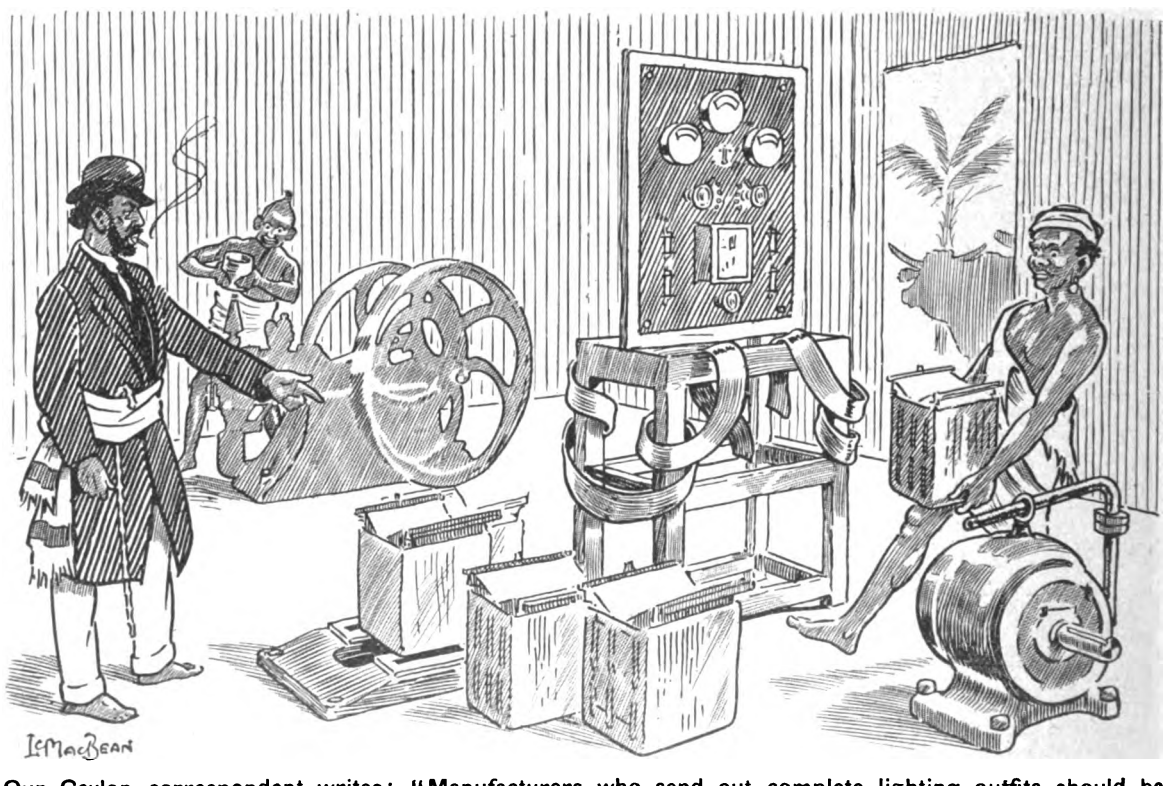
Negotiations between manufacturers of electric motors and of machine tools in America have resulted in certain rules being recommended with regard to the standardisation of outputs, speeds, and dimensions of small D.C. and A.C. motors. (Page 687.)

Among the specifications published by the Patent Office on Thursday last were two by the British Thomson-Houston Co. describing respectively a trolley head for a railless electric vehicle, and a system of electrical marine propulsion in which a special turbine is provided for reversing.—W. R. Bousfield, K.C., covers a mercury standard resistance combined with a thermometer tube which may be graduated to read direct in ohms.—The ventilation of storage battery cells for boats is the subject of a patent by The Tudor Accumulator Co.—Application has been made for the restoration of two patents by H. Pieper covering respectively the combined operating lever and the automatic solenoid control of the Pieper Auto-Mixte petrol-electric system for motor-cars. The patents expired last March owing to non-payment of renewal fees.—Opposition has been entered to the grant of a patent to Siemens Bros. & Co. for an automatic telephone exchange system employing two-fold selection. (Page 688.)

Bushey Council are recommended to support an application by the Hertfordshire County Council to run trolley omnibuses.—The London County Council have passed a large scheme of tramway extensions. The veto of the Borough Councils may be the subject of a conference.—Opinions on the Brighton Council are divided as to the proposed tramways to Worthing.—There is a possibility that the new St. Paul's Bridge may be designed without provision for running tramways over it.—In consequence of certain insinuations regarding the management of the electricity undertaking, the Borough Electrical Engineer at Worthing has demanded an inquiry. (Page 689.)

Extensions are to be carried out at Bahia Blanca, Birmingham (£143,250); Edinburgh (£14,000); Islington (£19,365); Southwark (£1,830); Woolwich (£5,285); New Zealand (£50,000); Pembroke (£14,000), and Southend (£17,859). Motors and transformers are required at Warrington, cable at Peterborough, and tramway stores at Bradford. (Page 690.)

Messrs. Ferranti made a profit of £31,236 during the past year. Satisfactory results were recorded at the meetings of the Clyde Valley Electric Power Co. and Messrs. Drake & Gorham. The proposals to reduce the capital of the Cleveland & Durham Electric Power Co. have been approved. (Page 692.)



Our Ceylon correspondent writes: "Manufacturers who send out complete lighting outfits should be more careful in sending full instructions for their erection. In one case a high-class London firm sent out a very complete plant without *any* instructions whatever. As the writer found it, everything, including oil engine, dynamo, and even accumulators, had been erected all together in a small galvanised iron shed." The above is our artist's conception of the manner in which the plant may have been disposed.

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ARRANGEMENTS FOR THE WEEK

FRIDAY, OCTOBER 28TH.

Physical Society.

5 p.m. At Imperial College of Science, South Kensington. Exhibition of a New Method for Producing High-tension Discharges, by Prof. Ernest Wilson and W. H. Wilson.

Institution of Electrical Engineers: Manchester Local Section.

7.30 p.m. At Midland Hotel. Inaugural Address by Chairman, Mr. J. S. Peck.

SATURDAY, OCTOBER 29TH.

Association of Mining Electrical Engineers.

3.30 p.m. Notts and Derbyshire Branch. At University College, Nottingham. Discussion on Presidential Address.

5.30 p.m. Warwickshire Branch. Imperial Hotel, Birmingham. Discussion on "The Resistance of the Human Body to Electric Currents," by Mr. W. Foster, and on the Presidential Address.

6.30 p.m. Lancs. Branch. Grand Hotel, Manchester. Discussion on the President's Address with reference to examinations.

MONDAY, OCTOBER 31ST.

Institution of Electrical Engineers: Newcastle Section.

8 p.m. At Armstrong College. Address by the Chairman, Mr. C Faraday Proctor.

TUESDAY, NOVEMBER 1ST.

Electrical Contractors' Association.

3 p.m. At Frascati's Restaurant, Oxford Street, London. Discussion on "Means to be taken to improve the status and efficiency of our Association."

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. Supper and Smoking Concert, Mosley Hotel.

Institution of Civil Engineers.

8 p.m. Presidential Address by Mr. Alexander Siemens and presentation of medals and prizes.

ELECTRICAL ENGINEERING IN CEYLON

(From Our Special Correspondent)

CEYLON can hardly be described as a profitable field for exploitation by manufacturers of electrical machinery and apparatus, but all the same, there is a steady stream of imports of an electrical character. These in 1909 reached the total of £15,000, and the figure shows a fixed tendency to advance. The largest importer is the Government, with £8,700 to its credit for telegraph, telephone, and electric lighting material. It is satisfactory to note that of the total only £300 worth of material was obtained outside the United Kingdom. Ceylon is an island of practically the same area as Ireland, and it might be expected to show a greater consumption of electrical goods than is actually the case. But this cannot be, so long as the country remains, as it is, principally agricultural, and that largely of a primitive type. Manufacturing industries scarcely exist, and although there are plumbago mines, they are worked in very primitive fashion by hand labour. In one of these mines, owned by a European near Kandy, however, an electrically-driven pump has been installed, supplied from an oil-engine-driven generating set. A certain amount of power is used in the tea industry, but the scope for electricity here is very restricted, as the type of machinery is not specially adapted for electrical driving, either from its high speed or scattered distribution. As water-power is plentiful in the tea country, the usual power outfit for a tea factory consists of a water turbine of, say, about 50 h.p., with a crude oil engine for occasional and reserve use during the dry season. Crude oil is obtained at cheap rates from the Burmah and Borneo oil fields, and forms in all respects the most suitable fuel for Ceylon. The rubber industry is a rapidly developing one in Ceylon, but this, again, calls more for cheap primitive labour than for the aid of electrical machinery.

Electric lighting of tea factories and estate bungalows has been indulged in to an increasing extent since the introduction of metal filament lamps, but the units required are very small, a 10 h.p. plant sufficing for a large factory and adjoining bungalows. Unlike sugar mills, tea factories do not continue operations day and night. Manufacturers who send out complete lighting outfits of this description should be more careful in sending full instructions for their erection. In one case a high-class London firm sent out a very complete plant without *any* instructions whatever. As the writer found it, everything, including oil engine, dynamo, and even accumulators, had been erected all together in a small galvanised iron shed.

Practically the only heavy electrical machinery imported is that required for the upkeep of the small electric lighting and tramway systems of Colombo and Kandy. The price of electrical energy is so high (8d. per unit) that it is useless to expect any rapid development in this field, more particularly so as the local companies make no reduction in the price of energy supplied for fans.

The Government appears to have made a start with the water-power development at Blackpool for the electric lighting of Nuwera-Eliya, the hill sanatorium of Ceylon. The installation will only be a small one—enough for lighting the principal hotels, Government offices and private bungalows in the town.

More rapid development is to be noticed in the telephone system of the Colony. Late last year two new exchanges were opened in Kandy and Nuwera-Eliya respectively; and this year trunk lines are being constructed to link these towns with the capital—Colombo. Early in the present year the planting centre of Galaha was linked up to Kandy by means of silicum bronze trunk wires run on the existing telegraph poles. Some of this special construction work would look strange to English eyes; in this last instance the country is extremely hilly, and the spans extend from hill-top to hill-top, in some cases covering a quarter of a mile in one span. The planting community is very much alive to the value of telephonic communication between and among its scattered estates and districts. Considerable enterprise has been shown in the starting of small exchanges, each serving its district within a radius of about ten miles, and of these there are now a fair number in operation. The attitude of Government towards these enterprises has been one of friendliness, and on the understanding that they are not worked on a profit-making basis, they have been supplied with telephone material by the Telegraph Department at cost price. A circular letter to the planters, recently issued by Government, shows that it is their intention gradually to take over such local systems, and weld them into the general telephone system of the Colony as opportunity offers.

The Colombo telephone system continues to grow at the rate of about 20 per cent. per annum. If this rate continues it will soon be the largest system in the East. According to the last Administration Report some difficulty has been experienced in keeping level with the demand for new connections, and this is caused, not so much by the normal growth of the European community, as by the sudden realisation by the native mercantile classes of the fact that the telephone is a valuable aid to business.

Early in the year a commencement was made with the laying of underground paper-insulated cables, the contract for this work having been secured by the Helsby Cable Co. Where the routes run parallel or adjacent to tramway tracks, the cables are laid solid in bitumen and earthenware troughing, but apart from such routes the cables are simply armoured and buried direct, with a tile covering for a warning. These cables will only form the main arteries of the network, local distribution remaining on the overhead system. It is apparently intended to retain the existing magneto system—the C.B. system not yet being a favourite in the tropics.

The proposal for wireless telegraph communication between Colombo and Minicoy has been definitely abandoned in favour of a station in Ceylon only. This station will probably be situated on the south-west coast, somewhere between Colombo and Hambautota. From such a position it will have practically unimpeded communication with all shipping, whether to the west, south, or east.

The new building for the Telegraph and Telephone Department is nearing completion, and will form a worthy addition to the many fine modern buildings now going up in Colombo. It is understood that accumulators will replace the primary batteries now in use for telegraphic purposes.

Electric Lighting for Shops and Shop Windows.—The name of Messrs. Drake & Gorham, Ltd., 66 Victoria Street, London, S.W., should have been included among the list of the firms who lent us illustrations for the various articles on "Shop Window and Shop Front Lighting, &c.," in our last issue. This firm has made a particular speciality of fittings for this class of work, and supplies some of the most suitable designs for the purpose, and they also hold very large stocks of Osram and Tantalum lamps for supplying to central station engineers and the electrical trade generally.

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NEW PATTERN OF PETROL-ELECTRIC OMNIBUS CHASSIS

A NEW pattern of omnibus chassis with petrol-electric drive has been designed by Messrs. W. A. Stevens, Ltd. (Victoria Works, Maidstone), and two have already been despatched to India for public service under a concession granted by the Maharaja of Gwalior. The following is a description of this design, which, we understand, is being adopted, with some slight modifications to reduce the weight, for some public omnibuses for the London street service. It will be remembered that a petrol-electric vehicle under the name of the "Hallford-Stevens" omnibus was fully described in ELECTRICAL ENGINEERING, Jan. 16th, 1908. In that design, there were two electric motors, each driving one of the back wheels through worm gear. A "dead" back axle was employed, and the differential gear was eliminated. This pattern, which has been used by Thomas Tillings, Ltd., has proved highly successful, as regards its running properties and wear. them to consider that the smoothness and charm of the electric drive is spoilt by the introduction of a direct drive at any speed, and that the elimination of the electrical losses by a direct drive is not worth while for the following reason. Under normal conditions of level running at full speed with electric drive, the engine does not require to revolve at the same speed as the cardan shaft, but can be run at a slower and more efficient speed from the point of view of petrol consumption. The efficiency from the petrol tank to the road wheels is claimed to be better than with a direct drive, notwithstanding the electrical losses. With only a light body, a consumption of 11 miles to the gallon has been attained. The reduced engine speed has also advantages as regards comfort of running and wear and tear. As shown in Fig. 1, the dynamo and motor are mounted centrally end to end, and a ventilating fan is attached

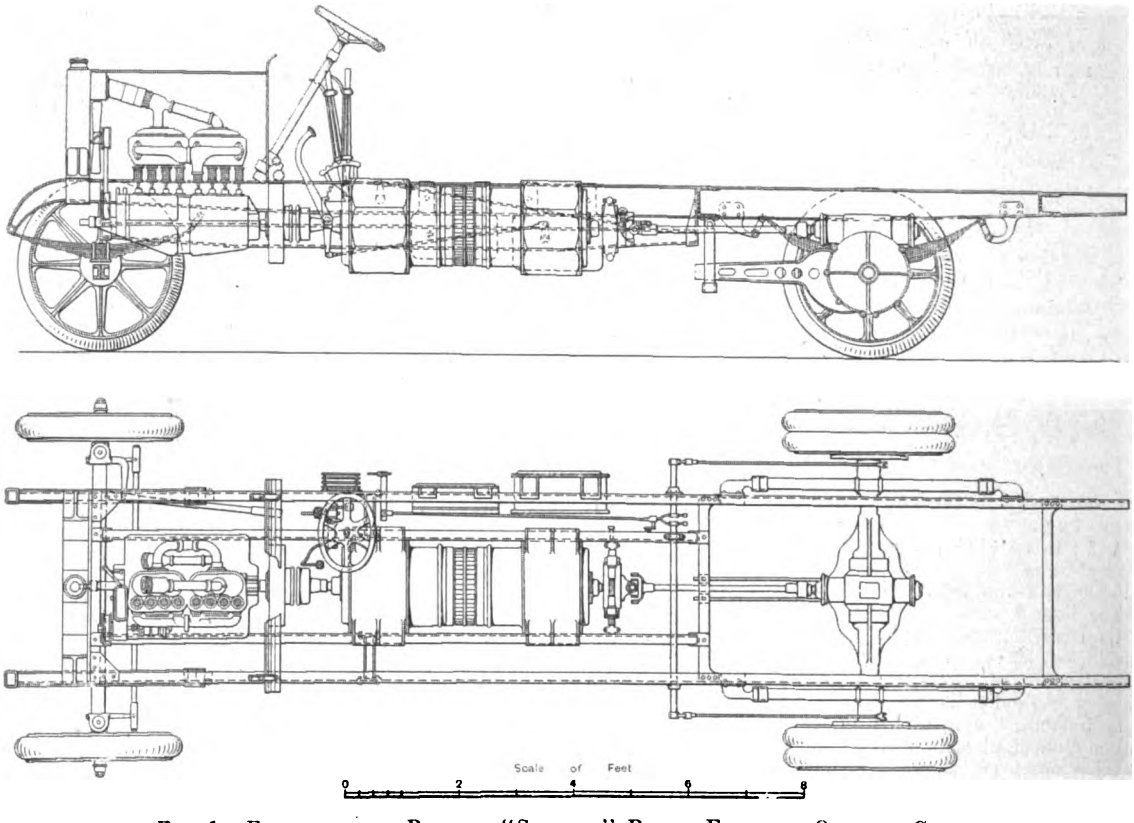


FIG. 1.—ELEVATION AND PLAN OF "STEVENS" PETROL-ELECTRIC OMNIBUS CHASSIS.

The following is an improvement on it as regards efficiency and weight.

In the present design, only one motor is employed, and this is coupled to the road wheels by means of a cardan shaft, differential and worm gear driving on to a "Dennis" 3-ton back axle. The engine is of the four-cylinder (100 mm. bore by 150 mm. stroke) type, developing 35 h.p. at 1,000 r.p.m., and drives a 22 kw. interpole generator through a flexible coupling. The motor, which, like the dynamo, is fitted with ball bearings, is a four-pole enclosed series-wound machine, closely resembling a tramway motor in design, and is controlled without series resistances, by varying the voltage of the generator. A certain amount of control is effected by the engine throttle, however, and on the highest speed the series field is shunted. The transmission is purely electrical even at top speeds, and no direct connection is ever made between the dynamo and motor shafts. Messrs. Stevens' experience has led to the dynamo shaft. The elimination of the clutch and the absence of many of the severe strains associated with direct drive conduce to economical maintenance. The vehicle is provided with a foot brake on the motor shaft, and the ordinary internal expanding side-brakes on the rear wheels.

The main controller and the generator field rheostat are mounted side by side on the outside of the frame, and are easily accessible for cleaning or adjustment. The former is worked by a side lever corresponding to the change-speed lever of a gear-driven vehicle, and has two forward speed positions and one reverse. The generator field regulating rheostat is worked by a small lever moving over a quadrant on the steering column. As can be seen in Fig. 4, the main controller box also contains a main switch actuated by a pedal. This is interlocked with the main controller lever in such a manner that the latter can only be moved when the main circuit is broken, and consequently arcing at the

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controller contacts is entirely avoided. The engine control is effected by an accelerator pedal, by which the throttle can be opened by foot control, and which, on being released, throttles the engine down to such a speed that the dynamo does not generate even with a full field. It might be thought that only two speed positions would not be sufficient, and with mechanical

The control of the speed of the vehicle is effected almost entirely on the accelerator pedal and the field switch, and under ordinary conditions the main circuit is never broken, even at stopping. Before starting, unless the gradient is very steep, the controller lever is put into the second speed position with the engine running slowly and the generator field reduced, and as

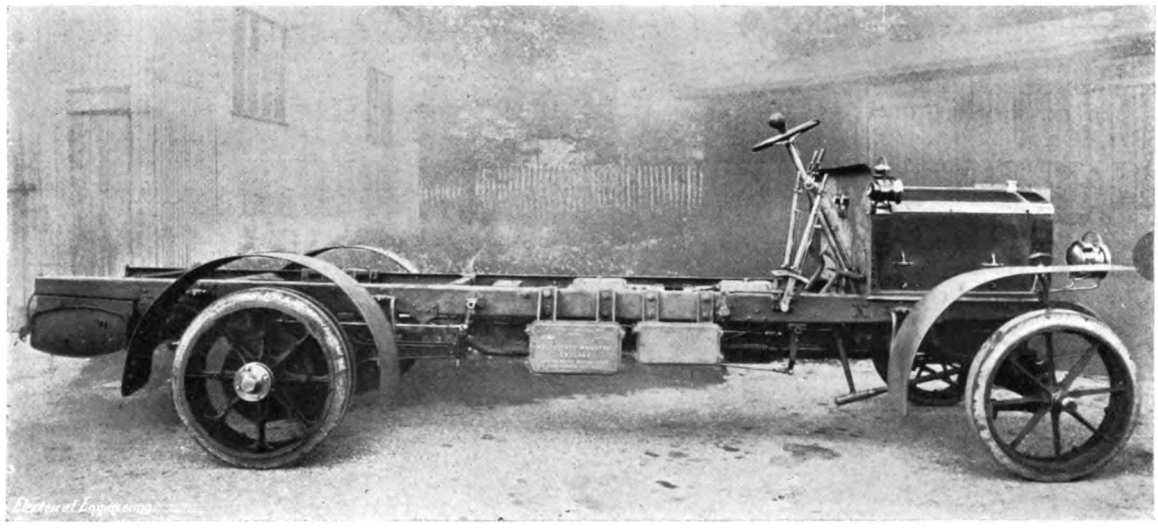


FIG. 2.—"STEVENS" PETROL-ELECTRIC OMNIBUS CHASSIS.

gearing this would certainly be so, but the flexibility of the electrical transmission, owing to the voltage control of the dynamo, and the smoothness with which it takes up its work, go far to eliminate the necessity for a number of steps on the controller. In practice it is found that, except on very steep hills, the controller can be left permanently in the top speed position, upon which all starting and manœuvring in traffic can be done.

The main controller is contained in an aluminium

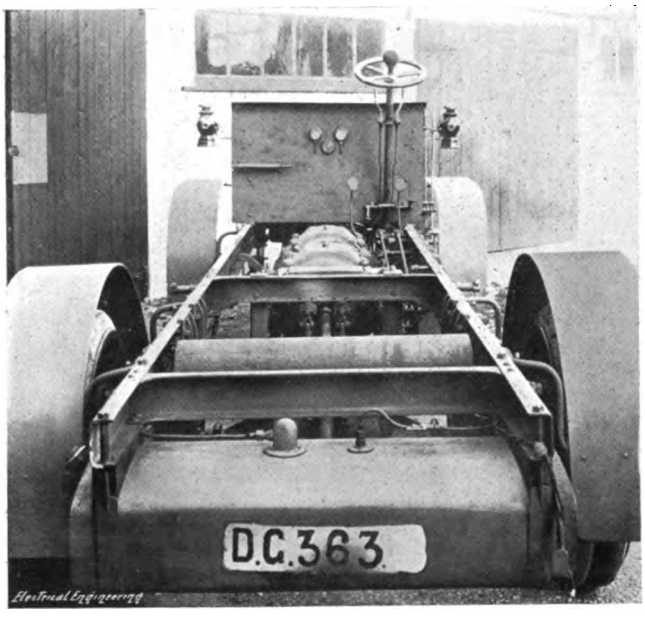


FIG 3.—VIEW OF CHASSIS LOOKING FORWARDS.

case, and consists of an inner and an outer ring of metal contacts on a slate base, arranged as shown. Over these contacts moves a four-arm brush holder connecting the inner and outer rings. The separate main switch, referred to already, is fitted with carbon contacts and a magnetic blow-out. The shunt, which is inserted across the motor fields at the top speed, can be varied to suit the local speed conditions.

no current is generated at this engine speed the vehicle remains stationary. In order to start, the brakes are released, and the engine is accelerated by opening the throttle with the pedal, so that with the increased speed the dynamo excites. The field switch is then gradually brought round to raise the voltage as the vehicle gains speed. The running speed is thus controlled by the throttle pedal. To stop the vehicle, the throttle pedal is released, and the brake applied, without, however, breaking the main circuit. Both the accelerator and main switch pedals are worked by the driver's right foot, and cannot be depressed at the same time. It is thus impossible for the main circuit to be broken when the engine is running fast. Although the prin-

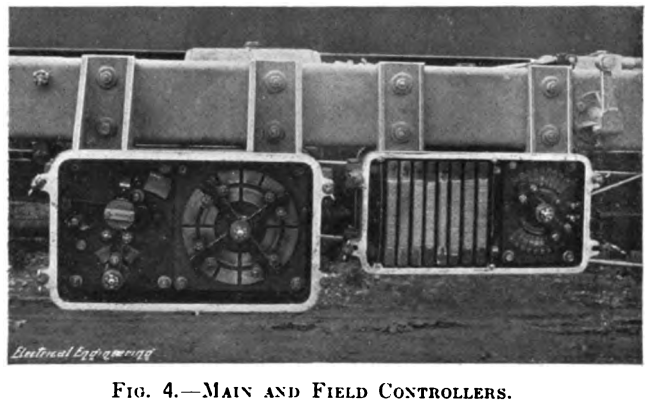


FIG. 4.—MAIN AND FIELD CONTROLLERS.

cipal control is by means of the throttle lever, attention has also to be paid by the driver to the handling of the field switch. If, for example, the field is too strong during acceleration, when the motor is taking a heavy current, the voltage for that particular engine speed will be too high, and the engine will be overloaded. In like manner, when climbing a steep hill at a low speed, a reduction of the field current is necessary in order to allow the engine to get away with the load. A very small amount of practice will enable the driver to know the best position of the field switch for different circumstances. The manner in which it is handled is

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not unlike that of the ignition of a petrol engine, which should be retarded when the engine is running slowly and heavily loaded, and advanced for high engine speeds. We had the pleasure of inspecting one of these chassis, and a short ride on it demonstrated the quietness and smoothness of starting and running. We understand that a speed of 40 miles per hour on the level has been attained with this chassis with a testing body.

The "Hallford-Stevens" omnibus already referred to, run by Messrs. Thomas Tilling, Ltd., of Peckham, S.E., has now covered more than 85,000 miles in London public service, and, according to Mr. P. H. Frost Smith, Chief Engineer to Messrs. Tillings, is giving every satisfaction and showing a considerable saving in cost of running as against the company's gear-driven omnibuses. Vehicles of this type are in use by H.M. War Department, the Brighton, Hove, & Preston United Omnibus Co., Ltd., and the Loughborough Omnibus Service, and others of a rather smaller pattern are now running in public service at The Hague.

The chassis illustrated will carry a char-a-banc body to accommodate 40 persons. The weight of the present chassis is 2 tons 17 cwt., which is too heavy for London omnibus service, but we understand that no difficulty will be experienced in building a chassis which will come well within the chassis weight (2 tons 10 cwt.) required to meet the regulations of the Metropolitan Police, as an engine and electrical equipment of less power of that in the present vehicle will be ample for London conditions.

For the past two years these petrol-electric vehicles have been manufactured jointly by J. & E. Hall, Ltd., of Dartford, and W. A. Stevens, Ltd., of Maidstone, under the patents of Mr. W. A. Stevens and the "S. B. & S" Syndicate, the vehicle being known as the "Hallford-Stevens," but owing to the great increase of the business of Messrs. J. & E. Hall, Ltd., it has been arranged that the whole of the petrol-electric work shall be carried out by Messrs. Stevens, Ltd., who now construct the chassis at their Maidstone works, and hold the whole of the electrical patents relating to the vehicle, which will be known in future as the "Stevens" petrol-electric chassis.

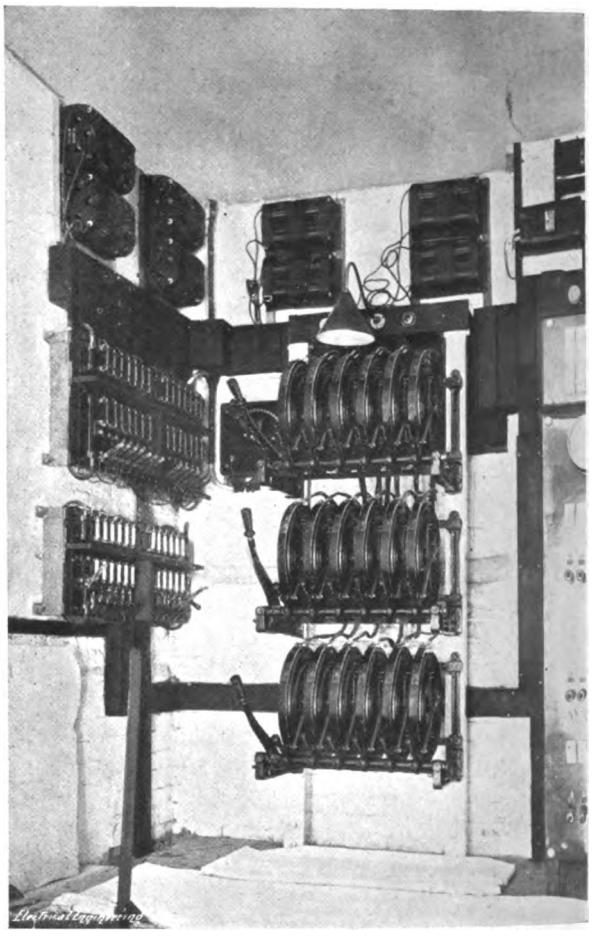
STREET LIGHTING IN HOLBORN

INCIDENTALLY upon consideration of improvements in street lighting by the Holborn Borough Council, a valuable testimony came up in favour of electric lighting. At present Holborn is lighted by gas, and a deputation waited upon the Council, urging the need of improvements, and strongly supporting that the street lighting should be brought up to date by being changed over to electricity. The deputation was headed by Mr. A. W. Gamage, who made a very forceful speech, strongly supporting electricity for street lighting. The testimony is especially valuable, coming, as it does, from one whose successful achievements quite properly give his utterances the weight of authority. Mr. Gamage said that he held no brief for electric light or gas companies, nor had he any interest in either. He simply spoke out of his experience as a large consumer of electric light, as his business spent over £3,000 per annum on electric light. He maintained that electric light penetrated fog better than gas. Walking from Chancery Lane to Oxford Circus (which is electrically lighted), Mr. Gamage said, was like stepping from darkness into sunshine. Where they had light they were bound to get the public. To find the value of electricity over gas, they had only to take the borough of St. Marylebone: during the past year they had changed a part of their street lighting from gas to electricity, and effected a saving of £1,500 (see ELECTRICAL ENGINEERING, August 25th, p. 547). Mr. Gamage went on to ask what would be the opinion of him if he lighted his up-to-date premises with farthing dips instead of electric light? This, he considered to be the case in Holborn. They were lighting the streets with dips instead of modern lights. Light meant prosperity for the tradespeople of Holborn, and where there was prosperity there was happiness.

STAGE LIGHTING AT THE LITTLE THEATRE

WE are able to illustrate the bank of theatre dimmers which control the stage lighting at the new "Little Theatre," which has been established by Miss Gertrude Kingston in John Street, Adelphi. The whole scheme of stage lighting and dimming was designed and carried out by Mr. W. E. Siday, electrician to the theatre, and several new features have been introduced. The dimmers themselves are of the Adams Manufacturing Co.'s "Simplicity" type, and on the switchboard the now well-known Siemens "Zed" cartridge fuse has been used for the first time for theatre work. The whole control gear is very compact. Owing to the very small amount of space available, the ordinary liquid type of dimmer was out of the question, and after several tests the Adams Co.'s "Simplicity" dimmer was chosen as presenting many advantages in compactness and flexibility.

These dimmers are mounted up in banks and are operated by means of levers from the front. These levers are arranged with a very neat interlocking movement, so that the whole



BANK OF DIMMERS AND PART OF STAGE SWITCHBOARD AT THE LITTLE THEATRE.

bank can be operated by means of one master lever, if necessary. This interlocking is achieved by one-half turn of the handle. The drive from the operating handle to the dimmer plate is by means of a rigid rod. The advantages of this over the old-time flexible cable drive or tracker wire are at once apparent.

The other features are easy renewal of any faulty plate. Any one plate can be immediately withdrawn, and a new one inserted, without disturbing any other plate. It is possible with this form of dimmer to obtain an instantaneous flash, an effect which is quite impossible with the old form of liquid dimmer, with its acid pots and long length of tracker wire. Further, the resistances are so designed that they can be kept in circuit for long periods without overheating. Anyone who has endeavoured to do the same thing with the old liquid type must know the trouble and difficulty of keeping a steady light, owing to the boiling of the liquid.

The installation is further noteworthy inasmuch as mercury-vapour lamps have for the first time, been successfully employed to give winter and night effects.

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STREET LIGHTING BY OVERHEAD MAINS AT DOWLAIS

THE new system of public lighting which has recently been inaugurated at Dowlais is interesting as one of the examples, rare in this country, of public lighting by overhead mains, embodying certain modifications and improvements in the construction of the aerial lines, and also as another case where a victory has been won by electricity over gas for street lighting.

Dowlais is by no means an unimportant district, historically or at the present time, having one of the largest iron and steel works in its midst, and being an important coal centre and market town. Three years ago the enterprising Corporation of Merthyr Tydfil (incorporated some five years ago), saw, after some experiments, the advantages of metal filament lamps for street lighting, and straightway gave the Merthyr Electric Traction & Lighting Co. the order to light the two miles of main street connecting the towns of Merthyr and Dowlais, by means of lamps on brackets fixed to every tramway-pole throughout the route between the termini of the tramways—the lamps being supplied with current from overhead wires attached to the tramway poles, arranged to be switched on and off from the works, and forming an entirely separate circuit. Following this came a contract for the street lighting of the main street from Pontmorlais to Cefn Coed, and likewise from Pontmorlais to the north-west boundary of the Corporation area on the Swansea Road. All the lamps in these two branches also are fed from overhead lines, fixed in the case of the route to Cefn Coed on the poles of the Cefn route of the tramways; and in the case of Swansea Road, on wooden poles, and controlled by "Venner" time switches.

At the end of 1909 the company were asked by the Council to tender for the lighting of the whole of the Dowlais district. This was by no means a simple problem, as the area is very congested in Dowlais itself, and it did not seem feasible to design a network to suit the local conditions on the methods of aerial construction usually adopted. A scheme was, however, put forward whereby about one-third of the lamps would be fed from underground mains, and the remaining two-thirds from overhead mains. After considerable local opposition, this scheme went through with only slight modifications.

The area covered by the new network is within four square miles, and in this area there is a multiplicity of streets and cross-streets, into nearly every one of which the mains had to be taken.

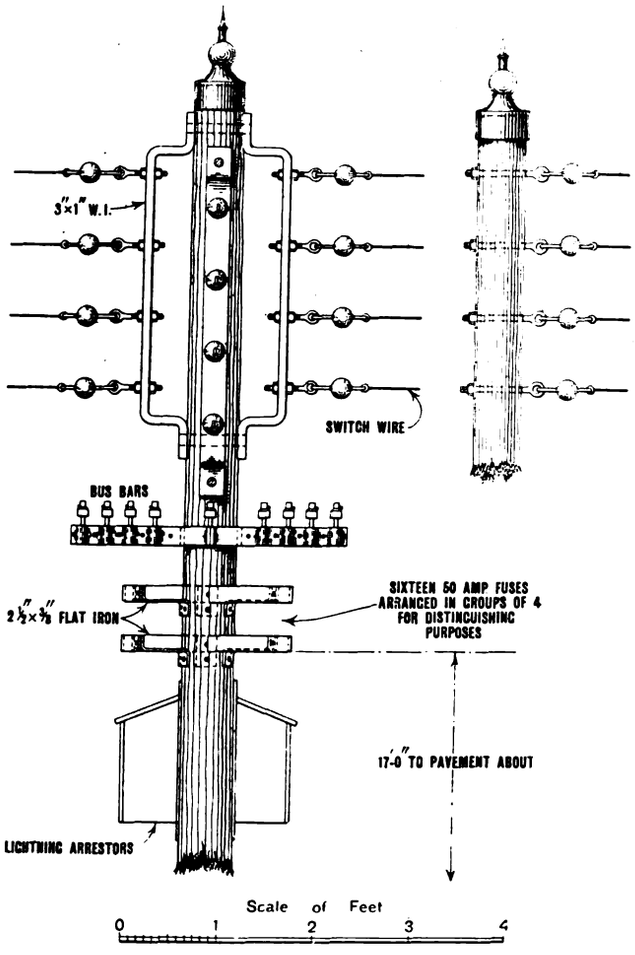


FIG. 1.—FOUR-WAY DISTRIBUTING POLE AND FOUR-WIRE TERMINAL POLE.

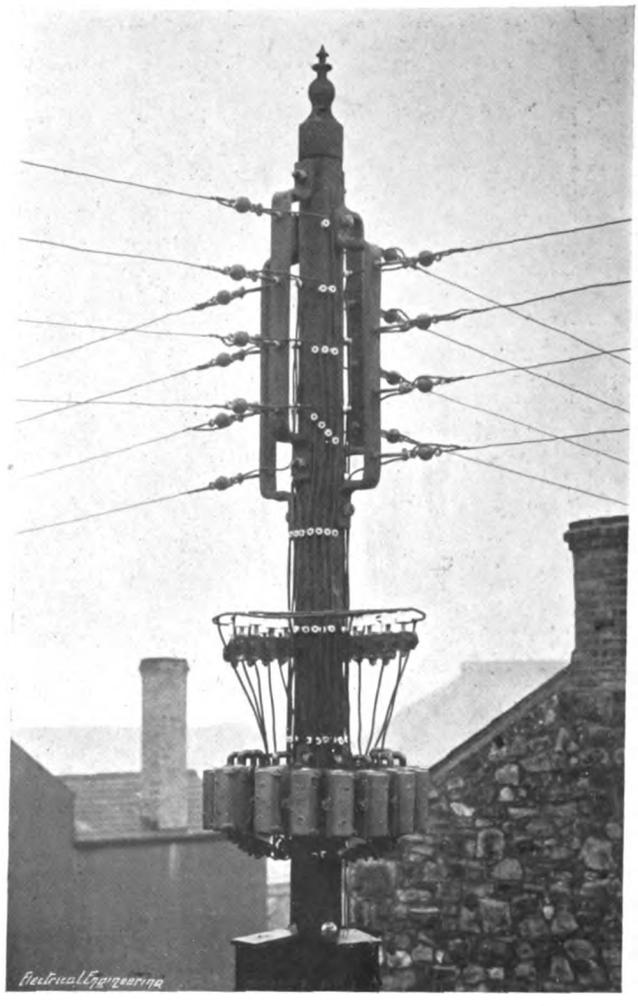


FIG. 2.—FOUR-WAY DISTRIBUTING POLE, SHOWING FUSES, 'BUS-BARS, &C.

The details shown in Fig. 1 will indicate the way in which the difficulty was got over without the use of unsightly cross-arms and shackle insulators that would otherwise be needed to branch a set of wires four or more directions if necessary. It was also the endeavour to make the work look symmetrical, and as pleasing to the eye as possible. The pole illustrated on the left is a four-way pole with fuses and lightning arresters. The 'bus-bars are of 19 18s rubber-covered cable, arranged on their insulators in circular form, and a 50-amp. fuse is provided for each circuit.

The factor of safety of the brackets and the steel bolts attaching them to the poles is very high, but although the work is heavy it does not look out of proportion. The two- and three-way poles are generally

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similar, and the simplest form; the terminal pole is shown on the right.

Fig. 2 is a view of the top of a pole carrying a set of 'bus-bars, fuses, and lightning arresters to deal with the disconnecting, &c., of four sets of wires branching in four different directions taken from a tower-wagon. The fuses are of heavy pattern supplied by Messrs. Johnson & Phillips, with suitably protected porcelain handles. The 'bus-bars will be seen above the fuses, and the lightning arresters underneath. The arresters used throughout the system are the B.T.H. adjustable magnetic blow-out type.

Fig. 3 is a view at Caeracca, showing three wires branching off at right angles from four wires, and an ordinary straight line pole with outrigger stay is shown in Fig. 4. These illustrate some of the methods

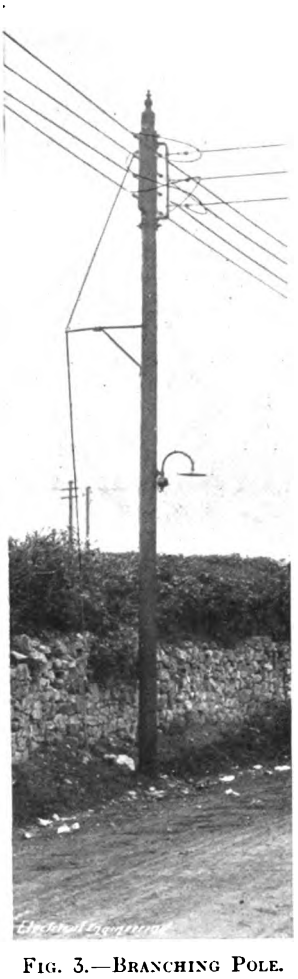


Fig. 3.—Branching Pole.

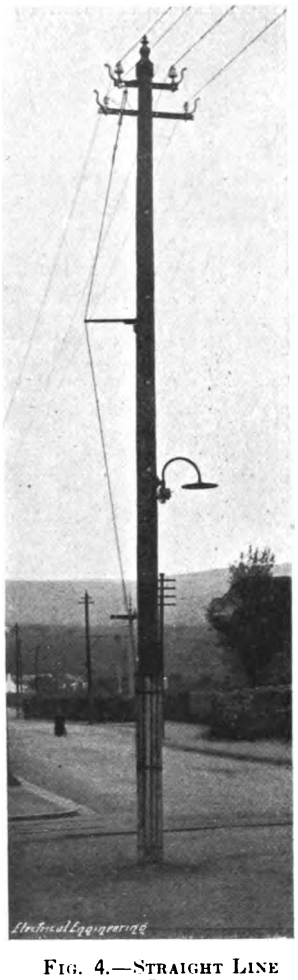


Fig. 4.—Straight Line Pole.

generally adopted, but the types of poles required for the various arrangements of corners are naturally very numerous. It was suggested that some of the mains should be attached to brackets fixed to the houses, but unfortunately time did not permit of the necessary arrangements being made.

The lamps in Dowlais which are fed from the overhead mains are switched on and off from three points. This is accomplished by utilising one of the neutral wires specified in Reg. No. 5 of the Board of Trade, for conductors on the three-wire system, as a switch wire, insulating it from the other neutral wire by means of small ball insulators inserted in the bridles, and connecting one side of the street lamps to it. The process of switching on is then by simply closing a single-pole switch or a time switch, joining the insulated neutral switch wire with the other neutral. In streets where a service of 230 volts is required three wires are used.

The advantage thus obtained is that the networks are always alive for private supply, yet the public lamps can be switched on simultaneously and independently in the different districts.

The total number of lamps in Dowlais is at present 241. Some are single lamps, others double, ranging from two —32 c.p. to two —50 c.p. This, together with the other contracts in Merthyr gives an approximate total of 550 points lit by electricity. Both tantalum and Osram lamps are used with success.

The life of some of the Osram lamps has been known to exceed 3,000 hours, which is very good, considering that no globes are used to protect them. The brackets which are attached to the poles were supplied by Messrs. Lucy & Co., of Oxford, and they include a very practical and serviceable switch-fuse, which a man can re-fuse without any danger of shock. The ironwork has been made at the company's own depot. In fact, everything possible has been done locally by the company.

The whole installation has been put in from the designs of Mr. Lewis W. Dixon, managing engineer, Merthyr Electric Traction & Lighting Co., Ltd., to whom we are indebted for these particulars and the photographs with which this article is illustrated.

AN IMPROVED AMPERE-HOUR METER

An improved type of continuous-current house-service mercury ampere-hour meter has been developed and placed on the market by the British Thomson-Houston Co., Ltd., which is claimed to possess material advantages over other designs, in that its characteristic curve closely approximates a straight line from full-load down to one-twentieth of full-load, the meter starting to register easily with a load equal to half per cent. of its rated capacity.

The design of this meter has been so carefully worked out that it has been found unnecessary to employ the compounding coils which are a feature of many other meters of this type. This meter therefore has the advantages of a very



B.T.-H. Ampere-Hour Meter.

small voltage drop and watt loss, has no hysteresis error, and is unaffected by short-circuit currents.

The meter is calibrated by altering the electrical circuit and not by distorting the magnetic field, so that a very permanent calibration is obtained. All parts of the meter are made of metal which will not warp with changes of temperature or excessive heat, and as they are made standard and interchangeable, any part can be readily replaced from stock. The B.T.-H. mercury ampere-hour meter, which is illustrated herewith, has been approved by the Board of Trade, and is calibrated to read in B.O.T. units at any specified pressure up to and including 600 volts.

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ELECTRIC v. GAS HEATING IN MARYLEBONE

THE Marylebone Electricity Department must be creating a record in the installation of electric radiators in substitution for gas fires, for since the middle of September orders have been coming in on the average for eight radiators per day. The department has standardised, so to speak, the Dowsing lamp radiators as the result of experience, and now fit only these. The sizes being put in are the eight, six, and four lamp. Among the most noteworthy instances of the change from gas to electricity in this connection is that of a doctor who conducts a large nursing home, where gas fires were used throughout. Radiators have been put in on trial and tested for the amount of heat given out, and found to be quite satisfactory. The Borough Council guaranteed the cost based on 1d. per unit, and the doctor has now decided to install radiators throughout. Even on the question of price alone, the price of gas, which is at present 2s. 8d. per thousand in the district, would have to be reduced to 1s. 8d. per thousand in order to compete with electricity. Another instance is that of a large house where a short time ago £50 per annum was paid for electricity for lighting, whilst the gas company's bill for heating was £150 per annum. The Marylebone Electricity Department is now receiving at the rate of £100 per annum for light and heat, and the gas company £50, whilst within the next fortnight Mr. H. H. Holmes, the Sales Manager of the Marylebone Electricity Department, expects that the gas heating will have been done away with. The keenness which is being shown at Marylebone at present in pushing radiators is well justified by the results, as this class of business is so fully occupying the staff that certain developments in regard to electric cooking have had to be put on one side to some extent. Tests made of gas fires have in many instances proved that they were costing as much as 4d. per hour, and it has been amply demonstrated that, under normal conditions, a 12- or 8-light radiator costs less per hour, with electricity at 1d. per unit, than gas.

PETROL-ELECTRIC DRIVE FOR AUTOMOBILES

IN the course of his presidential address to the Institution of Automobile Engineers on Wednesday, October 12th, Mr. F. W. Lanchester made some remarks on the possibility of the usual mechanical change-speed gear, which he admitted was the weakest point in the chain of mechanism, being superseded by other methods. The alternatives which he considered were hydraulic transmission, electrical transmission, and what he defined as electrical auxiliary. On the basis of efficiency alone, purely hydraulic transmission was stated to be far superior to purely electric transmission, and the opinion was expressed that it was improbable that the latter would ever come into use in exceptional cases. He was more hopeful with regard to the use of electrical drive as an auxiliary as applied in the Pieper or "automixte" system, which has often been described in the technical press. In this system a continuous-current machine is coupled direct to the engine, and can act either as a dynamo or a motor.

The petrol-electric installation so constituted is arranged to operate through the medium of a magnetic clutch either on the usual differential, or may be fitted in duplicate and arranged to act by duplicate worm or bevel drives direct on to the road wheels. A storage battery is provided usually of about 5 per cent. of the total weight of the vehicle, which takes up any excess power when going down hill or on a level, and which gives up the energy so stored when required to ascend a gradient. The alternative function of the dynamotor is determined automatically by the speed variation: when the petrol engine is slowed down by excessive resistance the voltage in the armature falls and the battery begins to assist to drive the vehicle; when, on the contrary, the engine attempts to race away, the voltage rises as a consequence, and current flows in the opposite direction and spends itself in the charging of the battery. Likewise when stopping part of the energy is thrown into the battery, and is drawn out again when getting under way.

It will be appreciated, continued Mr. Lanchester, from the detailed discussion of the subject that the future application of the electric auxiliary system more widely than at present in contemplation must rest largely with the question of accumulator weight, not the weight per h.p. hour, that is the energy content, but rather the h.p. output, *i.e.*, the rate of doing work; at present the best results commercially attainable for brief discharges of but a few minutes' duration is the equivalent of one h.p. per 40 lbs. weight. This is reasonably satisfactory for vehicles of moderate speed—less than 20 m./h.—but it is not good enough for the pleasure vehicle. If the battery weight could be reduced to 20 lbs. per h.p. the latter as a proposition would be worthy of serious consideration.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Fortschritte der Elektrotechnik." No. 4. 1909. (Berlin: Julius Springer.) 15 marks.

"Solenoids, Electromagnets, and Electromagnetic Windings." By Chas. R. Underhill, Assoc.Memb.A.I.E.E. 8s. net. (London: Constable & Co., Ltd.) By post in U.K., 8s. 4d.; abroad, 8s. 9d.

"Encyclopædia of Municipal and Sanitary Engineering." By W. H. Maxwell and J. T. Brown. 42s. net. (London: Constable & Co., Ltd.) By post in U.K., 42s. 6d.; British Colonies, 43s. 8d.

"Continuous Current Machine Design," by William Cramp. (London: Harper & Brothers.) 5s. nett. By post in United Kingdom, 5s. 4d.; abroad, 5s. 6d.

"Notes on Applied Mechanics." By R. H. Whapham and G. Preece. (London: Edward Arnold.) 4s. 6d. net. By post in U.K., 4s. 9d.; abroad, 4s. 10d.

"Applied Mechanics for Engineers." Bp John Graham. (London: Edward Arnold.) 5s. net. By post in U.K., 5s. 4d.; abroad, 5s. 5d.

Proceedings of the Incorporated Municipal Electrical Association. 1910. (London: The Secretary, 28 Bedford Square, W.C.) 5s.

"Electric Circuit Problems in Mines and Factories." By Ellis H. Crapper. (London: "Colliery Guardian.") 3s. 6d. net. By post in United Kingdom or abroad, 3s. 8d.

"A Text-book of Physics." By H. E. Hurst and R. T. Lattey. (London: Constable & Co.) 8s. 6d. net. By post in United Kingdom, 8s. 11d.; abroad, 9s. 6d.

"Drying Machinery and Practice," by Thomas G. Marlow. (London: Crosly, Lockwood and Son.) 12s. 6d. net. By post in U.K., 13s.; abroad, 13s. 6d.

"The Indicator Handbook," by C. N. Pickworth. Part I. Fourth edition. (Manchester: Emmott & Co.) 3s. nett. By post in United Kingdom or abroad, 3s. 3d.

"Water Turbine Plant." By Jens Orten-Böving. (London: Raithby, Lawrence & Co.) 10s. 6d. net. By post, in United Kingdom, 11s., abroad 11s. 9d.

"Elektromotorische Antriebe." By B. Jacobi. (Munich: R. Oldenbourg.) 8 marks.

"The Care and Management of Ignition Accumulators." By Harold H. N. Cross. (London: E. & F. N. Spon, Ltd.) 1s. 6d. net.; by post in U.K. or abroad, 1s 7½d.

Glasgow Section of the Institution of Electrical Engineers.—The ninth annual dinner of the Glasgow Local Section of the Institution of Electrical Engineers will be held on Wednesday, December 14th, at the Grosvenor Restaurant, Gordon Street, Glasgow. Tickets, price 7s. 6d., to be obtained of the Secretary.

Single-phase Traction in America.—It is announced that the New York, New Haven, and Hartford Railway have decided upon the electrical equipment on the 11,000-volt single-phase system of the Hoosac Tunnel section of the Boston and Maine line, which is now under their control. This section is double track, and is 25,000 ft. in length. The company have also decided upon the electrification of the New York, Westchester and Boston line, 21 miles in length, partly two and partly four track, and the Harlem River and Stamford and New Haven branches on the same system. The electrification of the terminous and neighbouring lines in Boston is also being considered, but the system is not yet decided upon. Locomotives will be used in the Hoosac Tunnel, and there is room for a clearance of 4 ft. under the overhead conductors. Power will be supplied from a new 6,000 kw. station. The second line mentioned will be run with multiple unit cars, also working direct off the 11,000-volt circuit. Work is commenced upon some of these extensions already.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

ELECTRIC WORKS DRIVING.—Messrs. Dick, Kerr & Co., Ltd. (Abchurch Yard, Cannon Street, E.C.), are issuing a handsome new pamphlet, entitled "The Electric Motor in Various Industries," illustrated with an interesting collection of photographs of motors as applied to a great variety of classes of drive, such as pumps, shafting, individual machine tools, textile and other machinery, lifts, printing presses, air compressors, &c. A number of typical power installations are described, and a series of actual wattmeter records are reproduced, showing the way in which the energy drawn from the mains depends on the work being done, and at the same time giving a good idea of the amount of power required for various classes of machinery, which, like much of the information contained in the pamphlet, should be of considerable use to those seeking economy in the driving of their works.

VERTICAL PUMP MOTORS.—A profusely illustrated *brochure* is to hand from the Allgemeine Elektricitäts Gesellschaft of Berlin, describing several patterns of vertical motors, direct and alternating current, for direct coupling to centrifugal pumps for mines, docks, irrigation and sewage works, and other purposes. The motors may be of the open ventilated type, or of the totally enclosed water-tight pattern, as in the case of pump equipments for shaft sinking. A long list of installations completed by the company is appended.

SEMI-ENCLOSED MOTORS.—A leaflet from the A.E.G. Electric Co., illustrates a "protected," or "semi-enclosed" D.C. motor. The inspection plates are of strong design, and allow of free ventilation. The motors are built in standard sizes from 0·15 h.p. up to 30 h.p. Semi-enclosed motors are not supplied for A.C. circuits, the difference in output over totally enclosed A.C. motors being so small.

WIRES AND CABLES.—A new leaflet, which forms an advance price list supplementary to their catalogue section V., dealing with wires and cables, is to hand from the Edison and Swan United Electric Light Co., Ltd. (Ediswan Buildings, Queen Street, E.C.). In addition to the vulcanised rubber wires and cables described as "made by an associated firm in accordance with the standards of the Cable Makers' Association, and sold under a distinct label," a cheaper make of "non-association" cable is also included.

H.-T. OIL SWITCHES.—A leaflet from the A.E.G. Electric Co. illustrates their latest pattern oil switch for circuits up to 15,000 volts.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

GAS ENGINES.—A handsome new gas engine catalogue (in English) has been brought out by the Maschinenfabrik Augsburg-Nürnberg A.G. (M.A.N.), London office, Caxton House, Westminster, dealing very thoroughly with the Nuremburg type of gas engine, of which many illustrations are given, and with the development and applications of the large gas engine generally. Interesting statistics are given of the utilisation of power by gas engines in different countries, and working costs of steam and gas engines are contrasted. The details of gas producer plants as well as engines are discussed, and information is given as to the running and running expenses of actual installations.

TANTALUM LAMPS.—Messrs. Siemens Bros.' Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.), and a number of firms and local electricians dealing in tantalum lamps are distributing an ingenious folder representing a miniature packing-case and containing a little paper tantalum lamp. The inside of the folder gives "five reasons why tantalum lamps should be used," and an abbreviated price list.

FITTINGS.—A catalogue from the Benjamin Electric, Ltd. (1A Rosebury Avenue, E.C.), contains particulars of a large range of the well-known Benjamin wireless cluster fitting, special lampholders, reflectors, &c., for shop lighting, and a variety of other fittings, shades, accessories, &c.

ARC LAMPS.—A fully-illustrated catalogue with interesting details of the construction and special features of "Excello" arc lamps, is to hand from the Union Electric Co., Ltd. (Park Street, Southwark, London, S.E.). The deposit-free inner globe and the patent system of ventilation now applied to the "Excello" flame lamp are described. These and the Duplex Excello lamp for long burning hours were fully described and illustrated in Electrical Engineering, February 25th, 1909, Vol. V., p. 179. In the present catalogue, particulars are given as to the adjustment and treatment of the lamps to obtain the best results, and a table giving the mean hemispherical candle-powers which can be obtained with the different sized lamps is included. A number of new patterns of covers for special purposes, including some with square and half-ball reflectors for shop-lighting, and one with a protected globe for factory lighting are illustrated.

GLASS SHADES AND FITTINGS.—A new catalogue from Messrs. W. & R. Jacobs (39c King William Street) illustrates a number of new designs of artistic glass fittings and shades. These include small hanging "lanterns," mostly with translucent glass tops, and the lamps covered by a fringe of glass tubes. Drop pendants and hall lamps are also illustrated, in which the glass is also a more important part of the decorative scheme than the metal work. Some table standards with glass pillars and domes of very original designs are also exemplified. There are also very numerous forms of glass shades for the more ordinary styles of fittings. A useful feature of the list is a series of order forms at the end.

METAL FILAMENT LAMPS.—We have to thank the Imperial Lamp Works, Ltd. (Kingsway House, W.C.) for an excellent coloured reproduction of their striking poster representing John Bull carrying a British-made Brimsdown lamp, in an effective frame.

CORRESPONDENCE

COST OF ARC LAMP LIGHTING.

To the Editor of "Electrical Engineering."

Sir,—With reference to your article on "Shop Front Lighting" in last week's issue, and your remarks about the cost of carbons in flame arc lamps, we beg to state that your figures are, firstly, far in excess of the actual cost, and, secondly, that your statement that employing cheaper carbons runs the risk of having rather an unsteady light is quite erroneous, at least for our lamp.

We can supply an 8 amp. lamp to run absolutely steadily with a carbon cost of 0·18d., the carbons being taken in quantities, of course. You also state in your article that flame lamps can be obtained in various sizes from 300 to 600 watts, but we can supply them to consume only 200 watts with most satisfactory results.

The Gilbert Arc Lamp Co., Ltd.,
J. S. Hecht.

Chingford, October 24th, 1910.

[Our rather wide limits of 0·2d. to 2d. per lamp-hour for the cost of carbons consumed in arc lamps were meant to apply to all patterns of lamps, from those burning the cheapest carbons to those necessitating the use of carbons of perhaps a special shape with copper wires to increase the conductivity and special impregnated cores. We are glad to know that a Gilbert lamp can be obtained for which the carbon cost can be reduced to only 0·18d. per lamp-hour, *i.e.*, 0·02d. below the lowest figure we gave, without the steadiness of the light being affected by the necessarily cheap carbons employed. Our figures of 300 to 600 watts were meant to include the loss in the series resistance.—Ed. *E. E.*]

AN ANTI-VIBRATION METAL FILAMENT LAMP

A MODIFIED pattern of the "Metalik" lamp has been introduced by G. M. Boddy & Co. (15 Gray's Inn Road, London). This has a strengthened filament, and is recommended by the firm for situations where the lamp is subjected to a considerable amount of vibration. The composition of the filament itself is the same as that of the original "Metalik" filaments, and the efficiency is the same, namely 1·25 watts per Hefner c.p., but the filament is arranged in a larger number of shorter loops. Thus for a 100-volt 16-c.p. lamp there are seven short loops in series instead of four long ones. The bulb in this case measures 4½ in. long from end of cap to pip, and the maximum diameter is 2 in. (*i.e.*, about the same dimensions as a 16-c.p. carbon filament lamp). Each loop is supported at the bend by a hooked wire with a wave or loop at its centre to give increased elasticity. This lamp is made for voltages up to 125 volts, and in 16, 25, 32, and 50 c.p. sizes. We are informed that Messrs. Boddy & Co. have already supplied a large number of these lamps to a mill-owner in Yorkshire, who has not previously thought it advisable to use tungsten lamps owing to the vibration in the mills. A special apparatus which subjects the lamps to vibration and jolts is being exhibited at the Brussels Exhibition and elsewhere to demonstrate the immunity of the lamps to such treatment.

The South African Institute of Electrical Engineers.—The last number to hand of the Transactions of the South African Institute of Electrical Engineers contains a paper by Mr. E. D. Brunner on the selection and types of induction motors, in which he compares the field of utility of the squirrel cage and slip ring motor, and discusses the various methods of starting. Stator windings are also dealt with, and the developed lap form with former wound coils, the closed slot arrangement with hand wound coils, and the chain and bar windings are described and compared. Contributions to the discussions on various other papers are also included.

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ELECTRIC MOTOR VANS AND OMNIBUSES

Encouragement given by the Marylebone Electricity Department

AS announced in our last issue, the Marylebone Borough Council have had placed before them a scheme for the supply of current to electrical vehicles. The Electricity Committee in their recommendation stated that inquiries are frequently being received in this connection, and, as a result, the Council have approved the following tariff, viz.: A minimum consumption of 100,000 units per annum, to be taken at Aybrook Street, Rathbone Place, or the generating station; the rate to be ½d. per unit between the hours of 11 p.m. and 6 a.m.; this price also to hold good for Saturday afternoons, Sundays and holidays; but no supply to be taken during the evening lighting peak; on other days, between 6 a.m. and 11 p.m., the price to be 1d. per unit, provided that no supply is taken during peak hours. The general manager has the right to turn the current off altogether in case of emergency. For a less quantity than 100,000 units per annum, or for the delivery of current in any other part of the Borough than the stations named above, a higher price will be charged.

We are now in a position to place before our readers some information regarding the circumstances which have led up to this movement on the part of the Marylebone Electricity Department. In short, there is about to take place in London a considerable increase in the number of electrically propelled vehicles, both for private and public use. As a factor in levelling the load curves of electric power stations, a supply for charging the batteries of electrically driven vehicles would prove a boon to central station engineers, and, with characteristic energy, Mr. A. H. Seabrook, Chief Electrical Engineer to the Marylebone Borough Council, is not only making a strong bid for this business at the very inception of what may prove to be quite an important revival of accumulator street traction, but, with the example of Berlin, New York, and other European and American towns to guide him, is taking steps to foster the use of electrically driven delivery vans and travellers' carriages among the large business houses of Marylebone. In spite of the failure of the London Electrobus Co.—which was not wholly attributable to technical difficulties—and the comparative failure of several other forms of electrically driven vehicles in the Metropolis, this problem has been receiving close attention in certain quarters. The conclusion come to is that the running of them is a distinctly commercial proposition, and that, as regards working expenses alone, the margin in favour of petrol driven cars is not so large as is generally supposed. It is in an endeavour to get on the other side of this margin that Mr. Seabrook has evolved his low tariff. As evidence of this, it may be mentioned that a company who are developing the idea, and as a result of whose inquiries the Marylebone tariff has been partly framed, have only just lost by a very small margin a large contract in London, in respect of which a considerable number of delivery vans would have been required. A number of large van users are giving the use of electric vans most serious attention. We understand also that one of the big railway companies have under consideration a scheme for running a service of electric delivery vans in the Metropolitan area.

In regard to public vehicles, a well known firm are going ahead with a project to place a number of electrically driven omnibuses on the routes over which the 'buses of the old London Electrobus Co. used to run. In this case, as with the delivery vans, we understand that Tudor batteries will be used, under special maintenance contracts. As a garage for these 'buses, there is the old boiler house of the Metropolitan Electric Supply Co. at Aybrook Street, which it is intended to reconstruct for this purpose, and then let to the new 'bus company. For ordinary private or traders' vehicles, the Borough Council will provide all the necessary accommodation incidental to the charging of the batteries, in which it is confidently anticipated that a large business will be done in the near future. The opinions of those now moving in the matter are that electrical engineers have not, in the past, given sufficient attention to the working of electrical road vehicles, and have not realised under what conditions they can be commercially successful.

STANDARDS FOR WIRING CONDUIT

THE Engineering Standards Committee have just issued a revised Specification for steel conduits for electric wiring. It is only different in two respects to the previous (1906) edition. In order also to provide a better joint at couplings, the length of the thread on the end of the tube has been slightly shortened so as to prevent the tubes butting inside the connecting piece. The gauging of galvanised iron conduit is to be done after, instead of previous to, galvanising, as difficulties have arisen in the practical carrying out of the Specification owing to the obliteration of the Inspector's stamp by the galvanising process; ordinary conduit is, however, to be gauged at the manufacturers' works before enamelling, as hitherto.

A LODGE WIRELESS PATENT

Application for Extension

THE Lodge-Muirhead Wireless & General Telegraphy Syndicate, Ltd., will shortly petition the Chancery Division of the High Court of Justice for an extension of the term of Patent No. 11,575 of 1897, granted to Sir Oliver Lodge, and any opposition to this extension must be made on or before December 10th, 1910.

The patent in question relates to a syntonised system of wireless telegraphy, in which the receiving apparatus resonates in response to a sufficiently prolonged series of waves of a definite frequency, and various arrangements of transmitting and receiving apparatus are described and illustrated in the specification. For example, a simple oscillating circuit, comprising two capacities with a spark-gap between, is used, and inductance coils are inserted between the gap and each capacity (one of which may be the earth) in order to prolong the oscillations and to secure the emission of a continuous series of waves of a definite frequency. Various methods of setting this circuit in oscillation are described, and a number of constructions for the capacity areas are illustrated.

The first of the eleven claims of the patent is as follows:—"In a system of Hertzian wave telegraphy, the combination with a pair of capacity areas (of which one may be the earth) of a self-inductance coil inserted between them electrically, for the purpose of prolonging any electrical oscillations excited in the system, and constituting such a system a radiator of definite frequency or pitch." The other claims are for means for adapting such an arrangement for the purposes of receiving and giving a cumulative or resonating effect, the use of variable inductances for tuning the circuits to different frequencies, a coherer comprising a needle point resting upon a flat metallic surface, and the use of a transformer in the receiving circuit.

The ground upon which an extension of the term of a patent may be granted is that the patentee has been inadequately remunerated for his invention, and the period of extension may be seven years, or in exceptional cases fourteen years. It will be remembered that Mr. Marconi applied for an extension of his first wireless patent last year, but later decided not to proceed with the application. (See ELECTRICAL ENGINEERING, June 16th, 1910, p. 386.)

Electric Traction on the Prussian State Railways.—According to the last Prussian railway-loan act, a sum of £2.000.000 will shortly be due from the Diet for railway electrification purposes. Of this, £850,000 will be devoted to the equipment of the Lauban-Dittersbach section of the Silesian mountain railway, and £1,150,000 to the continuation of the equipment of the Dessau-Bitterfeld section of the Magdeburg-Leipzig-Halle line, which was commenced last year, a sum of £100,000 having been voted for that purpose.

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ELECTRICAL DRIVING OF REVERSING ROLLING MILLS

In March last Mr. Justice Parker, in the Chancery Division, declared the Ilgner patent for the electrical driving of reversing rolling mills invalid for want of subject-matter, on the ground that it involved nothing more than the Ward Leonard system of control, in which the pressure applied to the motor armature is gradually increased by altering the excitation of the generator supplying the current, plus a flywheel applied in a manner suggested in a patent taken out by Ferranti in 1895. The action which brought about this decision was one for infringement of the Ilgner patent in respect of an installation at the works of Messrs. Hickman, Ltd., Bilston, which was put in by the Electric Construction Co., Ltd. (Electrical Engineering, 1909, Vol. V., p. 305, and February 3rd and 10th, and March 3rd, 1910).

The case was carried to the Appeal Court, and was disposed of on Thursday.

Mr. A. J. Walter, K.C., for the owners of the Ilgner patent, argued that the selection of a motor which dropped in speed as the load increased and thus enabled the flywheel to give up energy, and the combination of such a motor with Ward-Leonard control of the generator coupled to this motor, were new, and were subject-matter for a patent. This selection and combination rendered possible the electrical driving of reversible rolling mills, and no other method could be employed, or had been suggested. The selection of such a type of motor was new, as for other purposes motors were designed so as to prevent as much as possible the drop of speed on load. Further, the Ward-Leonard control enabled the available energy of the flywheel to be spread out over any desired period of time, and thus used to the best advantage. Lord Justice Fletcher Moulton, however, stated that he could see no difference either in the means or the consequences of the systems described in the Ferranti and Ilgner patents; in either case, if the heavy load persisted, it would eventually be thrown direct on to the primary generator. In reply, Mr. Walter pointed out that no special means were provided by Ferranti to produce the necessary drop in speed of the flywheel motor, and that there was no intention of applying Ward-Leonard control to the generator of the flywheel set. It was also pointed out that neither Ferranti nor Ward-Leonard mentioned the use of a flywheel for rolling mill purposes, and that it was hard upon the patentee to read in to these documents something which, even if obvious, was not mentioned at all.

Lord Justice Fletcher-Moulton, who delivered judgment, said he came to the conclusion that Mr. Justice Parker was right. In considering the matter they had to find out whether what Ilgner proposed was due to existing knowledge or did it require invention. If any engineer used the knowledge of the time and did not have recourse to invention, he had no more right to a monopoly than anyone else who judiciously used that which science had put in his hands. He was of the opinion that although the problem of electrically driving reversing rolling mills illustrated on a greater scale than any other a certain type of difficulty, yet the means by which this difficulty had been met in the Ilgner patent did not involve any exercise of invention in the legal sense. Ilgner had taken means known to the world and used them on a suitable scale to meet the difficulties with which he had to contend. The only difference was the addition of heavier flywheels, and he protested against any suggestion that a heavy flywheel was patentable. The whole object of putting in the flywheel was to store up kinetic energy, and that was what Ferranti did. As a matter of fact, he did not think even the Ferranti patent was a good one on subject-matter, as the effect of using flywheels, in his opinion, was well known in 1895. The Master of the Rolls and Lord Justice Farwell concurred, and the appeal was therefore dismissed with costs.

The Municipal Wiring Bill.—The Battersea Electric Light Committee recommend the Council to decline to express an opinion on the proposals of the Bill of the Incorporated Municipal Electrical Association relating to wiring, &c., until it has been drafted, and the Council have had an opportunity of considering its provisions.

New Water-power Station in Sweden.—According to the *Zeitschrift für das gesamte Turbinenwesen*, a water-power station has just been completed at the Bullersfors Falls in Dalafluss by a company which are supplying most of the electrical energy to the Domnarfoet ironworks (where important experiments in electrical smelting and refining have been recently carried out) and to the Kvarnsveden paper mills. The total output of the station will be 24,000 h.p. There are six generating sets of 4,000 h.p. each, running at 180 r.p.m. Three-phase current is generated at 7,000 volts, 60 cycles.

THE PRICE OF CURRENT FOR TRAMWAYS

THE arbitration to determine the price which the Paisley District Tramways Co. shall pay the Paisley Corporation for electrical energy was resumed in London on Tuesday. We reported the previous proceedings on page 649 of our issue for October 13th. It may be remembered that the price now paid by the company averages 1·4d. per unit, which it has been paying for the last seven years under the terms of the Act of Parliament authorising the tramways. The period for revision has now arrived, but the Corporation resist any reduction in the price, hence the arbitration.

On Tuesday the case for the company was completed by figures showing that for a maximum load of 575 kw., one 500 kw. generating set should be sufficient, whereas the Corporation actually have a 720 kw. set, two 500 kw. machines, and a 200 kw. motor-generator; consequently the price charged was said to be excessive owing to the capital charges for this unnecessary machinery. Mr. Balfour Browne, K.C., in opening the case for the Corporation, argued that the only basis upon which the charge could be calculated was the cost of generation at the municipal power station, where special machinery had to be put in some years ago to meet the tramway demand. The fact that if they were dealing afresh at the present time with such a load they could generate more cheaply was totally irrelevant to the issue. If the proposals of the Tramway Company were adopted, the Corporation would be losing £4,000 per annum compared with the present revenue from the tramways, and at the present time the profit upon the sales to the Tramway Company was only 0·65 per cent. on the capital expenditure involved, or £313 per annum.

Mr. C. F. Parkinson, the Borough Electrical Engineer, gave evidence in support of having so much tramway machinery in the station. He admitted that there was more machinery than was absolutely required, but declared that this was due to the requirements of the Tramway Company having been originally put at from 70 to 80 cars, whereas it had not exceeded 50 cars. One of the 500 kw. sets, he said, was reserve to the 720 kw. set, whilst the second 500 kw. set had been put in as an alternative to taking out an insurance policy to protect the Corporation against damages from failure of supply. The lowest price for power supply in Paisley is 1·29d. per unit, whilst the tramways supply is metered at the 'bus-bars, leaving the Tramway Company to bear transmission losses. The company put the actual cost to them, taking these losses into account, at about 2½d. per unit, and argue that this is excessive. In cross-examination, it was pointed out that at one time the Corporation had offered to supply energy for one section of the line at 1d. per unit, and, presumably, would have made a profit upon it, but Mr. Parkinson pointed out that this was on the basis of getting a considerably larger demand than at present, and it was only in respect of the additional units necessary for the particular extension. Another point brought out in cross-examination was that the Tramway Company had to suffer by reason of the fact that whilst the station contained plant having a capacity of 4,200 kw., the maximum load had not exceeded 1,720 kw.

Wireless Telegraph Notes.—The Brazilian Government has erected a wireless telegraph station at Amaralina, close to Rio Bermelho. The Telefunken system has been adopted, and the station has a guaranteed range of 400 miles, although its actual working range is far greater. During the trials recently conducted communication was readily established with the wireless station near Rio de Janeiro (about 730 miles) and with a vessel more than 1,000 miles distant. The height of the mast is 197 ft.

It is stated that wireless telegraphy has been introduced among German fishing vessels.

Wireless telegraph stations have been erected on the Sanday and North Ronaldshay Islands in the Orkney group. By this means, it is hoped to maintain communication between the islands during the winter, which has been very difficult with the ordinary submarine cable, owing to constant damage caused by the rocky nature of the sea-bottom.

Consequent upon the acquisition of the Marconi Company's coast stations by the Government, the one at Waterloo, near Liverpool, has been removed to the Seaforth Barracks, and in future will be used solely for the purposes of coast defence. A new station will shortly be constructed at Formby for ordinary commercial messages.

It is stated that the representation of the colonies at the next International Radiotelegraphic Conference will be discussed at the next Imperial Conference. Votes may be allotted to the colonies on the basis of the representation laid down in the Postal Union Convention. At present Newfoundland is the only British colony not participating in the International Radiotelegraphic Convention.

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A GAS VICTORY EIGHT YARDS SQUARE

GAS lighting has now to be satisfied with very small triumphs in the matter of interior lighting, and in consequence the *Journal of Gas Lighting* has been very jubilant about the adoption of gas in the place of electricity for the illumination of a room about 24 ft. square in London. It seems that this room is occasionally used for meetings, and is sometimes packed with 150 members. It is only 13 ft. high, and, owing to insufficient ventilation, one can hardly be surprised that the temperature and state of the atmosphere in the room became unbearable, although electric lighting was employed;—it would obviously become equally unbearable during meetings held by daylight. It was decided to employ a new system of heating and ventilation, and, for convenience, gas-heated boilers were employed in connection with the Glover-Lyon heating and ventilating system. The owners of the hall (the Society of Medical Officers of Health, of which, according to the *Journal for Gas Lighting*, Dr. Glover-Lyon is a member) probably thought that as they were putting in gas they might at the same time employ it for lighting, and they did so.

In the description published in our contemporary, it is stated that the Society "had for some years been using the electric light, with the result that, on meeting nights, the rooms became stuffy and unbearable." We may point out, however, that a hall such as this could be quite sufficiently lighted with about five 55-watt metal filament lamps, which could not by any conceivable possibility make the room stuffy, and the increase in temperature that they would produce would be negligible compared with that produced by the presence of 150 members, even if the debate were of the most placid description. There can be no doubt, moreover, that the society would have been far better advised had they employed an ordinary system of heating without unnecessary complications, and had put in an electric fan with an outlet into the open air for ventilating the hall during the meetings.

We can, however, understand their desire to experiment with an elaborate system of ventilation, but we shall not be surprised if the members find the hot draughts exceedingly unpleasant in such a small room. They have adopted the precaution of employing a special ventilating outlet duct to take away the fumes from the gas lighting, but nevertheless we are confident that if they had employed metal filament lamps for lighting, an electric fan for ventilation, and simple ordinary steam heating or even coal fires, the results would have been far more agreeable, and far more economical. Two electric motors are used as it is in connection with the Glover-Lyon ventilating system. The initial cost of the ventilating system employed must also have been far greater than the simpler electrical arrangement which we advocate, but possibly as Dr. Glover-Lyon is a member of the society he has made them a present of the installation.

MOTORS FOR MACHINE TOOLS

THE subject of the standardisation of electric motors for machine tool driving has been engaging the attention of American manufacturers, and it appears that negotiations between the National Machine Tool Builders' Association and the Association of Electrical Motor Manufacturers have resulted in certain rules being recommended. The following is a summary of the more important of these, abstracted from a recent issue of the *Iron and Coal Trades Review*, London.

Machine tools should be equipped with motors with standard ratings of 1, 1½ (D.C. only), 2, 3, 5, 7½, 10, 15, 20, or 25 h.p. Motors outside this range of capacity are not yet to be standardised. The standard voltages recommended are 115 and 230-volts for direct-current, and 110 and 220 volts for alternating-current motors, these voltages being the nominal pressures of the system. The rating of the motors shall be the continuous horse-power output, with standard load conditions. For variable-speed motors used for intermittent work, the rated output shall be the maximum continuous output for two hours, within the prescribed heating limits. Such motors shall have the time as well as the horse-power ratings of the motor for high and low speeds on their name-plates. It is recommended that variable-speed motors, with speed ranges of 2 to 1 and 3 to 1, be included with constant-speed motors in the attempt at standardisation. The following speeds are recommended for variable-speed D.-C. motors:—25 and 20 h.p. motors, 900 to 450 r.p.m. and 900 to 300 r.p.m.; 15, 10, 7½, and 5 h.p. motors, 1,200 to 600 r.p.m. and 1,200 to 400 r.p.m.; 3, 2, 1½, and 1 h.p. motors, 1,500 to 750 r.p.m. and 1,500 to 500 r.p.m. These speeds, it is thought, will be within the limits fixed by the gear or chain drive, while at the same time giving the comparatively high speed desired by the manufacturer of the motor. For polyphase 60-cycle induction motors, the following speeds are recommended:—25, 20, and 15 h.p. motors, 900 and 600 r.p.m.; for 10 h.p. motors, 1,200 and 600 r.p.m.; for 7½ h.p. motors, 1,200 and 900 r.p.m.; for 5, 3, and 2 h.p. motors, 1,200 r.p.m.; and for 1 h.p. motors, 1,800 and 1,200 r.p.m. It is recommended that the shaft diameter should be according to a definite formula; that there should be a fixed proportion between diameter and length of shaft; that keyways be made for square keys, and that the key be equal to one-fourth the diameter of the shaft. It is further suggested that all motors should be held down by four bolts, the bolt-holes being drilled one-sixteenth above size of bolt required. The bottom of the motor should be planed parallel with the shaft. It is further recommended that the bolt-holes be placed in a square, and that the dimensions of this square should be made a function of the horse-power divided by the speed, and further that all dimensions be given in the nearest higher ¼ in. The feet of the motor should extend beyond the body sufficiently to allow for drilling and reaming of the dowel pin-hole while the motor is in place.

Automatic Fog Signals on the District Railway.—An automatic fog signal system which has now been installed on all the above-ground sections of the District Railway is described in the *Railway Gazette*. The apparatus consists of a magazine holding 50 detonators, which is provided with an arm interlocking with the signal mechanism. In normal working the fogging apparatus is disconnected from the signal, but on the approach of foggy weather an inspector or other employee pulls the lever actuating the connection with the signal. The automatic signals work on the "normal clear" system, and on a signal reverting to "danger," a detonator is automatically extracted from the magazine and placed on the track. On the signal clearing again, the detonator is replaced in the magazine, whether used or not, thus reducing the risk of non-explosion through damp or other causes. On the stock of detonators in the magazine being reduced to ten, a whistle of peculiar shrillness is set up until the stock is replenished, the whistle serving as an additional safety factor by warning the motorman of the position of the signal.

Telegraph Traffic and Movements of Cable Ships.—The interruptions to land lines in Cuba and Florida still exist, although the route *via* Havana is now again open, messages going by cable to that city.—The cable between Bonny and Duala is down, and telegrams for Cameroon are sent *via* Bonny. Communication between Rome and Constantinople has been restored, but owing to a cloudburst and flow of mud from Vesuvius, telegraphic lines in the provinces of Naples and Salerno are broken.—There is a rumour of difficulties in connection with the new Atlantic cable of the Western Union Co., but even if it be true, they can only be of a temporary nature.—The Anglo-American Telegraph Co.'s c.s. *Minia* had recently to proceed to mid-Atlantic to repair one of the Company's cables.—The cable steamer of the Commercial Cable Co. was engaged in picking up the abandoned cable from Canso to the point where the cable was diverted to Newfoundland, viz., near Flemish Cap. The *Mackay-Bennett* may soon be in home waters.—By order of the Compagnie Française des Cables Télégraphiques, the *Contre Amiral Caubet* has recently repaired the New York-Cape Haiti cable.—The cable steamer *Pouyer-Quertier* is being overhauled at New York, and it is expected she will leave in a day or so for the West Indies, where she is generally stationed.—The cable between French and Dutch Guiana is awaiting repair.—The cable steamer *Colonia*, of the Telegraph Construction & Maintenance Co. arrived at New York at the end of last month after completing the laying of the Western Union Telegraph Co.'s new Atlantic cable.—The Brest-St. Pierre cable has been attended to by the *François Arago*; the repair is likely to be a costly one.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published October 20th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

24,016/09. **Trolley Head for Railless Traction System.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). A trolley head for collecting current from overhead positive and negative wires run parallel consists of a conical or pyramid-shaped head of insulating material which projects upwards between the wires, and is attached to the pole by a ball joint. Two collector shoes attached to opposite sides of this head engage with the undersides of the trolley wires. Three figures.

26,346/09. **Electrical Marine Propulsion.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). The motor on the propellor shaft is used for forward running only, and is connected direct without switchgear to the generator, which is driven by a high-speed turbine. For reversing, a special low-speed turbine is used. This is coupled to the propellor shaft direct or through gearing, and a clutch enables it to be disengaged when the ship is running forward. One figure.

27,335/09. **Standard Resistance Unit.** W. R. Bousfield, K.C. A standard resistance unit suitable for heavy currents consists of a glass tube filled with mercury, and provided with platinum contacts at each end. These contacts extend into glass cups at each end which may contain mercury and serve as connectors to the rest of the circuit. A vertical tube of fine bore is attached to the main tube, and the mercury rises in it according to the temperature of the whole. This tube may be graduated in degrees of temperature or in ohms. One figure.

4,567/10. **Ventilation of Accumulators.** A. B. Pescatore and Tudor Accumulator Co., Ltd. Cells for boats, &c., are provided with a system of ventilation for removing the gases evolved during charging and for cooling the electrolyte. The gases are removed through an aperture in the centre of the lid, and cool air is introduced by means of pipes passing through the lid near this central aperture and terminating in the corners of the cell. Air may be blown in or suction applied, as is most convenient. Two figures.

11,281/10. **Mercury Contact Tubes.** McKenzie & Holland, Ltd., and S. P. Wood. This covers curved tubes of glass with one flattened end, in which are inserted two short pieces of platinum wire. These wires are fused to stout copper connecting wires, the fused junction and short lengths of the copper wires being enclosed in the glass. A globule of mercury completes the circuit on the tube being tilted. Three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Names in italics indicate communicators of inventions from abroad.
Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Hirst and Angold, 24,566/09; Carbone, 5,561/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Marshall [Armouring for cables] 6,706/10.

Dynamos, Motors and Transformers: Crompton & Co., Macfarlane and Burge [Dynamos and motors] 824/10; Siemens Bros. Dynamo Works, Kieffer and Schaeffer [Ventilation of machines] 5,117/10; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Motor control] 13,521/10; Siemens Bros. Dynamo Works and Kieffer [Ventilation of machines] 19,164/10.

Electric Ignition: Chapman [Battery and commutator for starting engines with magneto ignition] 23,319/09; Thompson (*Ernst Eisemann & Co. Ges.*) [Control of ignition period] 9,488/10.

Electrometallurgy and Electrochemistry: Johnson (*Chemische Fabrik Griesheim-Elektron*) [Purification of magnesium] 23,439/09; Hartman [Electrical purification of liquids] 28,552/09.

Incandescent Lamps: Damey, 22,823/09; Ruhstrat [Manufacture of metal filaments] 24,437/09; Westinghouse Metallfaden-Glühlampenfabrik Ges. [Decarbonising of metal filaments] 2,983/10, and [Manufacture of tungsten filaments] 3,610/10; Urbain, Feige and Seal [Electric lamp] 4,098/10.

Instruments and Meters: Armour [Indicating and recording pyrometers] 22,764/09.

Storage Batteries: Taylor [Charging systems] 22,518/09.

Switchgear, Fuses and Fittings: Damey [Lamp-holders] 22,823/09; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Voltage regulation of A.-C. systems] 23,415/09; Hirsch [Switches] 10,474/10; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [A.-C. electromagnets] 11,614/10.

Telephony and Telegraphy: British Radio Telegraph & Telephone Co. and Balsillie [Wireless telegraphy and telephony] 22,930/09; Clarke [Telephone mouthpieces] 30,352/09; Petersen and Sem [Long-distance telephony] 6,895/10; Widegren and Widegren [Control of telegraph apparatus from a distance] 13,991/10.

Traction: Unverricht [Safety devices] 19,265/10.

Miscellaneous: Dobson and Henry Pooley & Son, Ltd. [Electrically indicating weighing machines] 22,539/09; Bouchard-Praceiq [Wave-motion generating plant] 22,725/09; Boult (*Electric Meat Curing Co.*) [Preserving process] 23,059/09; Callender's Cable & Construction Co., and Petersen [Combined cable-drum and jointers' cart] 23,307/09; Schnorrenberg [Operating gas-valves from a distance] 26,217/09; Bumiller [Lighting Christmas trees] 5,127/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: Riese, 22,517/10.

Electrometallurgy: Langbein-Pfanhauser-Werke A.G. [Manufacture of sheets and wire of electrolytic iron] 22,204/10.

Switchgear, &c.: Smith and Larsen [Controllers] 15,343/10; Forsberg [Electromagnetic device] 22,394/10; Case [Motor control] 22,708/10; Milch [Regulating apparatus for induction motors] 22,717/10.

Traction: Westinghouse [Air-brake joints] 21,558/10.

The following amended Specifications can now be obtained.

Schwarz [Exhaust steam plant] 3,881/08; Michaud and Delasson [Filaments of refractory oxides] 8,104/08; Thompson (*Ges. für Drahtlose Telegraphie*) [Wireless oscillation generator] 6,424/09; Rausch [Electric time alarm] 12,195/09.

Application for Restoration of Lapsed Patents

7,526-7/04. **Petrol-Electric Systems.** H. Pieper. The Société Anonyme L'Auto-Mixte has applied for the restoration of these two patents, which expired on March 30th, 1910, owing to non-payment of the renewal fees. Notice of opposition must be given before December 19th, 1910. The first patent covers the employment, in petrol-electric drive, of a single lever or pedal controlling the starting and speed control switchgear, and mechanically connected to the air-valve of the carburetter and the ignition control lever. In an alternative arrangement, a separate lever controls the starting resistances only. The second patent covers a solenoid for automatically regulating the petrol supply. It has two windings, one in shunt, and one in series with the battery, and they assist each other when the battery is being charged.

Application for Extension of Term.

11,575/97. **Wireless Telegraphy.** O. J. Lodge. The Lodge-Muirhead Wireless Co. will shortly apply for an extension of the term of this patent. (See another page of this issue.)

Opposition to Grant of Patent

27,458/09. **Automatic Telephone Exchanges.** Siemens Bros. & Co., Ltd. (*Siemens & Halske A.-G.*). Opposition has been entered to the grant of this patent. It relates to an automatic exchange, in which the subscribers' lines are subdivided into groups, and the line of a calling subscriber is connected automatically with a disengaged first group selector by means of a step-by-step switching mechanism. According to this invention, this switch co-operates with a second step-by-step switch in such a manner that a subscriber's line is connected with a disengaged group selector over both switches, so that a larger number of the first group selectors common to several groups are available for each calling subscriber owing to the two-fold automatic selection.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: Allgemeine Elektricitäts-Ges. [A.-C. commutator motors on D.-C. circuits] 13,706/05.

Electrometallurgy and Electrochemistry: E. Andreoli [Ozone generator] 15,813/97; C. A. Keller [Electric smelting furnace] 24,234/01; W. T. Mercier [Treatment of flour] 14,757/03.

Instruments, &c.: Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Induction motor meters] 13,981/99; C. G. Garrard and Ferranti, Ltd. [Induction motor meters] 15,290/04.

Switchgear, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Fuse boxes] 13,974/05; and [Detectors for indicating live H.-T. wires] 13,976/05.

Traction: G. Hardingham (*Felten & Guilleaume Carlswerk A.-G.*) [Rail bonds] 15,119/02; E. A. Stanley and T. F. Thomson [Tramcar bodies] 14,906/04.

Miscellaneous: B. P. Haigh [Marine steering gear] 13,856/05.

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LOCAL NOTES

Bath: *Electric Lighting Order Extended.*—The Corporation have been granted a provisional order authorising them to supply electrical energy in a larger area, having a radius of three miles from the Guildhall.

Bingley: *Electric Supply.*—The District Council, which is contemplating an electric supply scheme, have decided to apply to the Board of Trade for an Order depriving the Yorkshire Electric Power Co. of their powers to supply electrical energy in the district. The Power Company have had these powers for some years, but have not yet put them into force.

Bognor: *Electric Supply.*—In consequence of the Chichester Electric Light & Power Co. having intimated its intention of applying to the Board of Trade for an electric lighting provisional order, the Council have called in a consulting engineer who reports in favour of the Council carrying out the work itself. A special meeting is to be held to consider the expediency of the Council applying for a provisional order.

Bradford: *Electricity Accounts.*—The net profit from the electricity undertaking for the year to March 31st was £7,399. The number of units sold for bulk supply, power, and heating increased by 1,164,497 units, and the increased revenue of the undertaking during the year is entirely derived from these supplies.

Brighton: *Proposed Worthing Tramways.*—The General Purposes Committee will recommend at to-day's meeting of the Council that the proposal of the British Electric Traction Co. to construct a system of tramways in connection with Worthing, should be rejected, but it is understood that several members on the Council favour the idea, and that an amendment approving the proposal will be moved.

British Columbia: *Electric Traction Development.*—The British Columbia Electric Railway Co. have recently opened a new line between New Westminster and Chilliwack, a distance of 64 miles. Electric traction on this railway substitutes steam traction.

Bushey: *Trolley Omnibuses.*—The Committee, who, in conjunction with four representatives of the Watford Urban District Council, visited the Continent to inspect various systems of trolley omnibuses, presented its report at the last meeting of the Council. The report recommends the Council to pass a resolution approving the principle of railless traction, and that subject to certain conditions, the Council should agree to support any application which the Hertfordshire County Council may make for powers to work a service of cars on this system in the Bushey district. After discussion it was decided to postpone any action until after a conference with the County Council.

Carnoustie: *Provisional Order Revoked.*—The Board of Trade have revoked the electric lighting Provisional Order granted to the Council in 1902.

Greenock: *Power Supply.*—The question of the Council supplying electrical energy in Port Glasgow has advanced a stage. A meeting of power users in Port Glasgow will be held shortly, and afterwards Mr. J. A. Robertson, the Borough Electrical Engineer, will report to his Council.

Heywood: *Tramway Accounts.*—The tramway accounts for the year to March 31st show a deficiency of £1,188 after meeting capital charges. The General Manager points out that the interest and sinking fund charges on the award to the old Tramway Company practically accounts for the whole loss. The number of passengers carried was 2,181,751, against 2,291,147 in the previous year.

Hull: *Tramways Assessment.*—The assessable value of the Tramways Committee's property in Sculcoates has been increased by £4,574, and the rateable value by £3,473, and an appeal is to be made.

Kingston-on-Thames: *Electricity Accounts.*—In his report upon the electricity undertaking for the past year, when a loss of £1,644 was incurred, Mr. J. E. Edgcome, the Borough Electrical Engineer, attributed it to the use of metal filament lamps, the lighting load at Kingston being nine-tenths of the whole. He believes, however, that the lowest point of this set-back has now been reached, as indications point to an appreciable increase in revenue from the new consumers now being connected.

Launceston: *Provisional Order Revoked.*—The Board of Trade have revoked the electric lighting Provisional Order granted to the Council in 1903.

London: *London County Council: Tramways.*—The Highways Committee recommend that the assembly, fitting, and testing of the car ploughs required for 250 additional electric tramcars be carried out by direct labour.

At the ordinary weekly meeting of the Council on Tuesday the recommendations of the Highways Committee to apply to Parliament for powers for new tramways next session was discussed. The proposals, which have already been given in ELECTRICAL ENGINEERING, involve an expenditure for construction and equipment of £832,040, whilst street improvements will cost £346,860. In the discussion Sir John Benn complained that the Highways Committee were not going on to work expeditiously enough with the tramways, and pointed out that whereas Glasgow carried its entire population 222 times in the year, Manchester 172 times, and Sheffield 165 times, in London the population was only carried 86 times. Mr. Hayes Fisher, M.P., referred to the disadvantage which the Council were suffering under by reason of the veto given to the London Borough Councils, and suggested that a conference should be held to discuss this matter. The report of the Committee was eventually adopted.

City of London: New St. Paul's Bridge.—The proposal to construct a new bridge over the Thames, commencing near St. Paul's Cathedral, at an estimated cost of £1,646,983, was adopted at the City Corporation meeting on Thursday. During the discussion upon it, the terms proposed by the London County Council for the construction of tramways over the new bridge were commented upon in severe terms. As the matter at present stands, the City Corporation threaten to proceed with the scheme for the construction of the bridge, and bar the running of tramways over it.

Menston (Yorks.): *Electric Lighting.*—A Company is being formed for erecting a generating station.

Newark: *Electric Supply.*—As certain firms desire to set up works in Newark, but are prevented from doing so owing to lack of a supply of electricity, the Council are endeavouring to make arrangements with a Company to work the Council's existing electric lighting provisional order.

Ogmore: *Proposed Tramways.*—It is proposed to hold a conference of the Ogmore, Maesteg, Bridgend, and some other neighbouring Councils with a view to preparing a joint tramway scheme.

Preston: *Tramway Accounts.*—The report and accounts of the Corporation Tramways Department for the year to March 31st show a net profit of £3,994, after meeting capital charges, all of which is transferred to reserve fund. The revenue per car mile was 10d., against 9·95d. last year, whilst the working expenses were 6·16d., compared with 6·09d.

Southend: *Street Lighting.*—The Highways Committee have adopted a scheme of public lighting, which provides for fixing 100 c.p. lamps on the traction poles.

Sunderland: *Electric Power at a Shipyard.*—The electricity department have arranged for a supply to the shipyard of Messrs. J. L. Thompson & Sons for driving a 280-h.p. motor, which is being installed to take the place of a Diesel engine.

Wakefield: *Electricity Accounts.*—There was a loss of £802 upon the working of the electricity undertaking for last year. The Borough Electrical Engineer says the bulk of this is attributable to the use of metal filament lamps.

Worthing: *Position of Electricity Undertaking.*—As the result of certain statements recently made by some members of the Council regarding the position of the electricity undertaking, Mr. G. Porter, the Council's Electrical Engineer, has written stating that these statements are derogatory to his professional reputation in the highest degree, and demands a full inquiry at the hands of an independent expert. The statements in question allege gross mismanagement, although not directly against Mr. Porter or the Committee. The Electricity Committee state that any such allegation is entirely without foundation, and it will be left to the Council to decide whether an inquiry shall be held. Notice of a motion has been given suggesting the engagement of an engineer to make an exhaustive survey of, and full report upon, the electrical undertaking, and its management, and that a special committee should be appointed to deal with the matter.

Proposed Tramways.—The British Electric Traction Co. are putting forward a scheme for constructing tramways from Worthing and through Portslade to Hove. Inter-communication with the Brighton Corporation tramways is proposed.

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TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Accrington.—An inquiry was held last week concerning a loan of £16,041, mainly for the supply of Haslingden. Mr. C. D. Taite, Chief Engineer of the Lancashire Electric Power Co., was present in order to oppose, as Haslingden is within their area of supply, but their tender was not so advantageous as that of Accrington. Mr. H. R. Hooper, the Inspector, held that the company had no *locus standi*.

Argentine.—An electric power-station is to be erected in connection with some large extensions of the military port near Bahia Blanca.

Austria-Hungary.—A loan of £725,000 is to be taken up by the Town Council of Reichenberg for various public works, including an electric power-station and tramways.

Birmingham.—A Local Government Board inquiry was held last week concerning a loan of £143,250, for the purposes of the electric supply undertaking. Of this sum £129,450 are required for the Summer Lane power station, and £13,800 for sub-stations. It is expected that this sum will suffice for three or four years, but it does not take into account the possible development should the scheme for extending the boundaries of Birmingham be passed. The proposed extensions will bring the capacity of the Summer Lane power station to 31,500 kw., and in addition there is generating plant of the capacity of 2,000 kw. at the Water Lane power-house. The present capacity is 15,260 kw.

Brazil.—A scheme for the conversion to electric traction of the Victoria-Diamantina Railway has been approved. The cost of conversion is estimated at about £3,950,000.

Edinburgh.—The Electric Lighting Committee recommend the acceptance of estimates amounting to £14,000, in connection with the installation of three cooling towers at Dewar Place power-station.

Gillingham.—A Local Government Board inquiry was held on Saturday concerning a loan of £3,500 for additional plant and mains.

Hayti.—A concession has been granted for a railway from Port-au-Prince to Pétion-Ville. Interest on the cost of construction, amounting to about £44,600, is guaranteed by the Government.

London: *Islington.*—A loan of £19,365 has been granted by the L.C.C. for electrical extensions.

Southwark.—A loan of £1,830 has been granted by the L.C.C. for electrical extensions.

Woolwich.—A loan of £5,285 has been granted by the L.C.C. for electrical extensions.

New Zealand.—The New Zealand Government propose to borrow £50,000 per annum for a number of years in order to develop the water power sources of the country for generating electrical energy. If the proposal is sanctioned, one scheme will be developed in the North Island, and one in the South Island to begin with.

Oldham.—The Borough Electrical Engineer has prepared a long report upon the electricity undertaking, in which he points out the need of further extensions. A mixed pressure turbo-generator is suggested, whilst additions to the mains and switchboards are also proposed with the object of generating all energy in future at the Greenhill power station.

Pembroke.—A loan of £14,000 has been sanctioned for electrical extensions.

Peterborough.—The Electricity Committee require 4,716 yards of distributor cables. Particulars from the City Electrical Engineer, and tenders by November 3rd.

Sheffield.—Tenders are invited for roof principals and supports for extensions to Neepsend power station. Particulars from Mr. S. E. Fedden, and tenders by November 22nd. (See an advertisement on another page.)

Southend.—A loan of £17,859 is to be applied for to meet the expenditure on a new battery storage room, and the supply of electricity to the extreme eastern and western portions of the borough.

South Wales.—The South Wales Electrical Power Distribution Co. have been granted permission to carry overhead wires through Llanbradach for street lighting purposes.

Warrington.—The Electricity Department require a twelve months' supply of motors and transformers. Particulars from the Borough Electrical Engineer, and tenders by November 15th.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Re-arrangement of Reception Hall, Basement, &c., Clarendon Restaurant, Broadway, Hammersmith.

County Skating Rink, Plumstead Road, Woolwich.

Cinematograph Chamber and installation of motor-generator at Holloway Empire.

Installation of electric lighting, motor-generator, and electric radiators at Mitcham Lane Picture Palace, 127 Mitcham Lane, Streatham.

Holy Trinity Church Hall, Rotherhithe.

Proposed Coliseum in High Road, Kilburn. Messrs. F. Matcham & Co.

Additions to Edmonton Co-operative Society's building, 156 Stoke Newington Road.

PROVINCES.

Ayr.—New school.—New Library Club premises.

Belfast.—Baths at Ligoniel. Architect, Mr. S. C. Hunter, Scottish Provident Buildings, Wellington Place.

Birkenhead.—Extension to Nurses' Home. Architects, Messrs. E. Kirby & Sons, 5 Cook Street, Liverpool.

Brentford.—Additions to Workhouse buildings.

Brighton.—Winter Garden on Palace Pier, and alteration to Electric Theatre and Restaurant.

Chester.—City and County School in Queen's Park.

Clydebank.—Model Lodging House at McArthur Street, Yoker. Builder, Mr. H. Nicol, Hamilton.

Coatbridge.—Additions to Clifton Model Lodging House.

Croydon.—Eight Houses. W. Darnell, Balham.—Conversion of shop to electric theatre, London Road. S. Marsland, 19 Tylecroft Road.

Darwen.—Proposed school at Spring Bank.

Doncaster.—One hundred and forty houses. Town Council.

Dublin.—Police barracks and station at Fitzgibbon Street. Office of Public Works, Dublin.

Eastbourne.—New Post Office. H.M. Office of Works, London.

Halifax.—Church of St. Matthew, Northowram.

Leeds.—Enlargement of Head Post Office. H.M. Office of Works, London.

Liverpool.—Extensions to Engineering Laboratory at University.

Lowestoft.—Drill Hall in Beccles Road for Suffolk Territorial Force Association. Architect, Mr. F. W. Richards, 14 Stanley Street.

Manchester.—New Elementary School. Architect, Mr. H. Littler, 16 Ribblesdale Place, Preston.

Convalescent Ward Pavilion at Monsoll Hospital.

Redruth.—New bottling department at the Redruth Brewery.

Rhondda.—New school at Ynyswen. Town Clerk.

Torquay.—Municipal buildings, New Town Hall and Pavilion.

West Bromwich.—Proposal to erect Sanatorium for Midland Local Authorities. Association of Midland Local Authorities.

MISCELLANEOUS

Argentine.—The Government of the Province of Salta have granted a concession to Mr. E. Barvil for electric tramways.

Beckenham.—The lighting of the Shortlands district has been referred to the Electricity Committee for consideration.

Bradford.—The Tramways Department require stores during the coming year, including lamp fittings, tractor lamps, insulating material, &c. Particulars from the Manager, and tenders by November 12th.

Canada.—A proposal has been made to extend the electric tramways system in Toronto. New lines to the length of 10 miles are suggested, at an estimated cost of £154,000. Particulars can be obtained from the Board of Trade, 73 Basinghall Street, London, E.C.

Faversham.—A small street lighting scheme is under consideration.

TENDERS RECEIVED AND ACCEPTED

Argentine.—The Colon (Buenos Aires) Municipality have received two tenders for the erection of an electric power station.

The tender of Messrs. Casella & Salvetti has been accepted for the erection of an electric light station at Maipú (Buenos Aires).

The Santa Fé Municipality have signed a contract with Messrs. Winby & Co. for the electrification of the tramways, and the construction of power-house.

Chelmsford.—The tender of the Electrical & Motor Co., of

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Banbury, has been accepted for the electric lighting of the Trinity Road School at £156.

Johannesburg.—The British General Electric Co., Johannesburg, have recently secured a contract for 4,000 Osram lamps, which are to be used for the entire equipment of the incandescent street lighting scheme adopted by the Johannesburg Municipality. The General Electric Co. inform us that this selection was made after very severe and lengthy tests of all the best-known makes of lamps, the Osram having been adopted exclusively for the purpose named.

Ireland.—An order has been placed with Messrs. Mirrlees, Bickerton & Day, Ltd., for the supply to the Curragh Military Camp, of three Diesel oil engines coupled to 55 kw. generators.

Leatherhead.—Messrs. Siemens Bros. Dynamo Works, Ltd., have secured a maintenance contract for the ensuing twelve months for "Onewatt" high c.p. lamps for street lighting for Leatherhead and district.

London: *London County Council.*—Messrs. Kirk & Randall are to be allowed to sublet to the Lahmeyer Electrical Co., Ltd., or the Forest City Electrical Co., the copper bonds required in connection with the alteration of the existing tramways in Highgate Road.

The Highways Committee recommend that the horse tramways running from Holloway Road to the Angel, Islington, via Liverpool Road, should be abandoned, and the lines taken up. Their reason for this is that the lines being to a large extent parallel with the existing electric tramways to Islington via Highbury, the extra traffic likely to be carried would not justify the large expenditure involved.

The following tenders have been received for the electric lighting of school buildings now in course of construction in Hoxton:—F. Troy & Co., £615; E. Morgan, £708; Tilley Bros., £738; Johnson & Phillips, Ltd., £870; G. Weston & Sons, Ltd., £895 10s.; E. Newbald & Co., £934; Central Motor Engineering Co., £1,041 4s.; E. Lawrance & Sons, Ltd., £1,147 18s.

Battersea.—The Foster Engineering Co., Ltd., have obtained the order for Arding & Hobbs for 60 Brockie-Pell B.E.M. type enclosed lamps. The lamps have to burn two in series on 230 volts direct.

Hackney.—The following tenders were received for a supply of white open-type arc lamp carbons:—The Radium Electric Co., £9 8s. 6d. and £7 17s. 9d. per 1,000 pairs; Siemens Bros. Dynamo Works, Ltd., £6 8s. and £5 7s.; General Electric Co., Ltd., £4 10s. 6d. and £3 8s. 9d.; British Westinghouse Co., Ltd., £4 5s. 6d. and £3 11s. 6d.; Crompton & Co., Ltd., £3 16s. and £3 3s. 6d.; Johnson & Phillips, Ltd., £3 16s. and £3 3s. 4d.; H. G. Mayer & Co., £3 15s. 3d. and £3 2s. 10d.; Electrocarbon A.G., £3 16s. and £2 16s.; Sloan Electrical Co., Ltd., £3 8s. 5d. and £2 17s. 2d.; W. Geipel & Co., £3 8s. 3d. and £2 15s.; and Ship Carbons, Ltd., £3 6s. 11d. and £2 15s. 10d. The last tender is recommended for acceptance.

Mountain Ash.—The following tenders for a year's supply of electrical stores have been accepted:—Single-phase meters, auto-transformers, &c., British Westinghouse Co., Ltd.; single-phase meters, Ferranti, Ltd.; metal filament lamps, The General Electric Co., Ltd., and Cryselco, Ltd.; vulcanised cable, Liverpool Electric Cable Co.; flexible wire and lamp holders, the General Electric Co., Ltd.

Southend.—The tender of the Chloride Electrical Storage Co., Ltd., has been accepted for a new storage battery at £3,861.

Overhead v. Underground Telephone Wires.—At the Barnet County Court on Tuesday last week, a dispute was heard between the Finchley Urban District Council and the Postmaster General with regard to the installation of telephone wires in five streets. The Postmaster General wished to put up overhead wires at a cost of about £53, whilst the District Council desired that the wires should be placed underground, which it was stated would cost £335. The roads in question are all branch roads, from the point of view of telephones, and it has been the policy of the Postmaster General to deal with these by means of overhead wires branching off the main roads where the underground mains are laid. As a justification for this policy it was pointed out that in Finchley 77½ per cent. of the cost of a telephone installation is represented by the outside work, the remainder being in respect of the construction. In Finchley, no less than £47,000 have been spent on underground work, and only £738 on overhead work, and the doubtful possibility of an increase in the number of subscribers does not warrant the Postmaster General putting in further underground wires. The case against the proposition was that the overhead wires would run through residential estates, and that all the occupiers had protested against their use. The poles would be 24 feet high and 70 yards apart. The decision was reserved.

APPOINTMENTS AND PERSONAL NOTES

Mr. G. Basil Barham, who has been for a short time engaged upon other work for his firm, has again taken over the management of the Publicity Department of the Edison & Swan United Electric Light Co., Ltd.

Mr. Alexander Gray has been appointed Assistant Professor of Electrical Engineering at the M'Gill University, Montreal. Mr. Gray, who is a native of Edinburgh, has for several years been on the staff of the Allis-Chalmers Co. in America.

The salary of Mr. John Senior, Borough Electrical Engineer at Mexborough, has been increased from £200 to £250 per annum.

The late Mr. E. Clapham, a director of the City of Buenos Aires Tramways Co. (1904), Ltd., left estate valued at £112,109, with net personalty £111,825.

Mr. W. R. Watt, of the Aberdeen Corporation Electricity Department, has secured an important post upon the staff of the Electric & Ordnance Accessories Co., Ltd., Birmingham.

An engineering canvasser, salary £156 per annum, and a showrooms attendant, salary £91, are required at Bristol. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 to £59 5s. per ton (last week, £59 5s. to £59 10s.).

Bankruptcies.—J. W. Barnett, trading as Barnett & Hyde, 25 Waterloo Road, Burslem, electrical engineer, has been adjudicated bankrupt. The unsecured liabilities amount to £531, and the estimated net assets to £70. The trustee is Mr. R. E. Clark, chartered accountant, Hanley.

Exhibition Award.—Messrs. R. Wolf, of Magdeburg-Buchan, have been awarded a Grand Prix at the Centenarian Exhibition at Buenos Ayres for their exhibit of locomobiles, which were at work producing a considerable share of the electrical energy for the exhibition.

Reduced Prices of Carbon Lamps.—Messrs. Siemens Bros. Dynamo Works, Ltd. (Tyssen Street, Dalston, London, N.E.), inform us that they have recently reduced their prices for carbon filament lamps to the trade, and will be pleased to quote higher discounts than formerly. Large stocks of these lamps are held.

Electrical Exhibition.—An electrical exhibition is to be held in Belfast. (See an advertisement on another page.)

Water-power in Sweden.—The *Board of Trade Journal* gives the following particulars from an official report on the Swedish waterfalls:—The total water-power in Sweden is estimated at approximately 10,000,000 h.p., available during from six to nine months of the year, and 2,500,000 h.p. available during the time of low water. Of this amount 75 per cent. is in North Sweden, 15 per cent. in the province of Svealand, and 10 per cent. in Göteland. In the near future 600,000 h.p. will be in use, including 340,000 h.p. for the generation of electrical energy. At the present time the State possesses, or is part proprietor of, waterfalls of about 880,000 h.p. Only 63,000 h.p. is now in use by the State, including some 40,000 h.p. at the power station at the Trollhättan falls. Work is now in progress at Trollhättan by which a further 40,000 h.p. may be used there. At the great Porjus fall on the Lulea river, in Lapland, a power station is to be erected with a capacity of 50,000 h.p. In addition, the Swedish Government proposes to set up works at Alfkarleby, in Upsala län, Uppland, and at other places. Preparations are in hand with a view to utilising the waters of Lake Waner and Lake Siljan. The Government is also turning its attention to the use of the water-power in the centre and south of Sweden for providing power for the electric railways, and has to this end purchased waterfalls at a cost of about £280,000. If the electrification of the line on the northern Swedish boundary proves satisfactory, electric traction will be extended eventually to the whole of the State railways. The falls in the upper Lulea river are to be rendered accessible by the construction of a railway from Gellivare to Porjus, and the Trollhättan canal also is being made capable of taking vessels drawing 13 ft. to 16½ ft. The present law as to the right of disposal of waterfalls is stated to be unsatisfactory, and the Waterfalls Commission is preparing a draft for a more suitable law.

OSRAM LAMPS

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COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

J. G. White & Co.—An extraordinary general meeting was held on Thursday to consider a proposal to divide the existing preferred £10 shares into 10 shares of £1 each. The proposal was only put forward to test the feeling of the shareholders, as some opinions were held that the £1 share would be more readily saleable, but on being put to the meeting the resolution was lost.

Rosario Electric Co.—The accounts for the year to June 30th show a sum of £53,582 available. A final dividend of 8 per cent. per annum is proposed on the ordinary shares, £25,000 being added to reserve, and £9,306 carried forward. The Société Financière de Transports et d'Entreprises Industrielles (of Brussels) has acquired the bulk of the shares of the Company under the agreement entered into early this year, and the Société d'Electricité de Rosario has now been formed to take over the undertaking. The Company is open until December 31st to purchase the remaining shares of the Company.

At the annual meeting on Tuesday the report and accounts were adopted.

Montreal Light, Heat, & Power Co.—A dividend at the rate of 7 per cent. per annum is declared for the three months to October 31st.

Companies Struck off Register.—The names of the following have been struck off the register of joint stock companies, and are declared dissolved :—Dorchester Electric Light & Power Co., Electrical Vehicles Development Co., Macclesfield Tramways Syndicate, Newark Electric Supply Co., and Railway & Tramway Concessions Syndicate.

Cleveland & Durham Electric Power Co.—At a special meeting on Tuesday, the proposals to reduce the capital of this company referred to in our last issue were adopted.

Metallic Seamless Tube Co.—There was a net profit of £1,640 for the year to June 30th, in addition to which £4,157 was brought forward. A dividend of 5 per cent. is recommended, carrying forward £4,572.

Auckland Electric Tramways Co.—The accounts for the year to June 30th, after setting aside £7,500, show a surplus of £24,100. £6,000 are placed to reserve, a 6 per cent. dividend declared on the ordinary shares, and £6,100 carried forward.

Drake & Gorham.—At the annual meeting on Tuesday the report and accounts were adopted. Mr. Bernard Drake, who presided, referred to the large number of private installations carried out during the year. The trade department of the company increased its turnover by 50 per cent., and it has been necessary to take additional stores to cope with this business.

Lima Light, Power & Tramways Co.—An issue of £1,200,000 5½ per cent. first mortgage debentures at 97 have been offered during the week. This company has recently been formed to take over and work a number of electric railway, tramway, water-power, and lighting undertakings, as well as the lease of the Lima Railway Co.

Ferranti.—There was a trading profit for the past year of £31,236, compared with £29,218 in the previous year. Depreciation is allowed for to the extent of £7,500 against £5,000, and after wiping out the adverse balance, a sum of £1,161 is carried forward.

Clyde Valley Electrical Power Co.—At the half-yearly meeting on Friday, Mr. A. Bonar Law, M.P., the chairman, drew particular attention to the rapid progress which this company is making. For the six months to June 30th there was a profit of £10,519, which is within a few hundred pounds of the profit of the whole of 1909, whilst in 1908 the loss was £1,149. A new 5,000-kw. turbo-alternator is now nearly completed, bringing the capacity of the two power houses at Yoker and Motherwell to 18,000 kw.

New Aluminium Alloy.—In the course of his presidential address to the South Staffordshire Iron and Steel Institute on October 15th. Mr. W. Macfarlane referred to the new alloy "Duralumin." It contained over 90 per cent. of aluminium, and its specific gravity varied between 2·77 and 2·84, but in tensile strength and elongation it was as good as mild steel. It was not recommended for castings, but could be forged, rolled, and drawn. The alloy took a high polish, withstood atmospheric influences, and was non-magnetic. Its present high cost, however, stood in the way of its extensive adoption. Referring to electric furnaces, Mr. Macfarlane pointed out that a furnace in which a high temperature could be easily controlled and maintained without introducing impurities, and which did not tend to oxidise the product, had much in its favour. It might be premature to speak of its prospects for smelting, but for refining it had ample scope. In Sheffield, electric furnaces were making high-class tool steel, and were working in conjunction with open-hearth plant. Fluid dephosphorised metal was transferred to the electric furnace, and was there desulphurised and deoxidised. In the preparation of ferro alloys the electric furnace must take a foremost place. It was the ideal furnace for the production of aluminium.

NEW COMPANIES

BRUSSELS IMPROVEMENTS (1910).—Registered by Ashurst, Morris, Crisp & Co., 17 Throgmorton Avenue, London. Capital, £10,000. To construct railways, tramways, electric light, telephone, telegraph and power supply works, &c.

PERRY & LAWSON.—Prudential Buildings, Market Place, Wednesbury. Capital £1,000. Manufacturers of and dealers in electrical apparatus.

NEW DEVELOPMENT CO.—Bedford Circus, Exeter. Capital £5,000. To promote and finance companies, syndicates, &c., in carrying on electric light or electrical undertakings. The subscribers are W. Allnutt, Hamilton House, Victoria Embankment, London, and E. H. Reeves, Salisbury House, London, E.C.

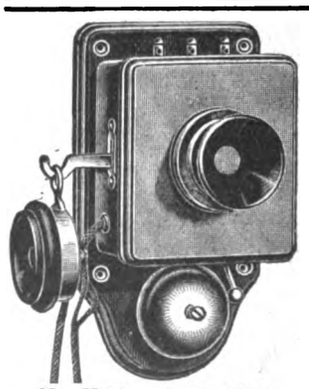
New Foundry Journal.—We have received a copy of the first number of the European edition of *Castings*, a monthly illustrated journal of American origin devoted to foundry practice, and issued by Page's Publishing Co., Ltd., London. The contents include a description of a foundry especially designed for motor-car work, a paper on the testing of metals, an article on metal pattern making, a paper on the cost of steel manufacture in foundries, and various short notes and articles of interest to pattern-shop and foundry men.

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ELECTRICAL ENGINEERING

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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

OFFICIAL NOTICES and TECHNICAL COLLEGE ANNOUNCEMENTS are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*
Small Advertisements and Official Announcements, *Wednesday first post.*
Displayed Advertisements, *Tuesday first post.*
Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 208-206, TEMPLE CHAMBERS, LONDON, E.C.
Telegrams: "Circling, London." Telephone No.: 5509 Holborn.
Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

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SUMMARY

OUR monthly supplement on Electrical Engineering in Mines is included in this issue. It opens with a critical article on the Association of Mining Electrical Engineers, and contains an illustrated description of the electrical equipment of the Oakdale Collieries. Notes are given on mining electrical patents of interest published during September. We are able to publish a report of one of the branch discussions of the Association of Mining Electrical Engineers. The causes of some recent electrical accidents are also dealt with.

BRITISH incandescent lamp manufacturers have been approached with a request to pay royalties to the owners of two patents relating to the manufacture of lamp caps with glass or "Vitrite" fillings. It appears that a company formed for the purpose have purchased a British patent taken out in 1902 by Mr. A. Swan, of the General Electric Co., of America, describing a process and machines for manufacturing such caps, and contend that the manufacture and sale of them is an infringement of their rights. We understand that the British manufacturers will unitedly oppose the demands of the company, and will indemnify their customers in respect of any action for infringement. (Page 695.)

MR. ALEXANDER SIEMENS delivered his Presidential Address to the Institution of Civil Engineers last Tuesday, and dealt with a number of aspects of engineering matters. (Page 696.)

THE Presidential address of Mr. J. S. Peck to the Manchester section of the Institution of Electrical Engineers took the form of a review of recent electrical progress in America, and a consideration of some differences in the conditions obtaining here and in the United States. (Page 696.)

A FEW notes are given on the work of the Exhibition Branch of the Board of Trade in assisting British firms participating in International Exhibitions. (Page 697.)

ELABORATE arrangements are being made for the lighting of the new Palladium Theatre of Varieties, for which special fittings have been designed. (Page 697.)

WE publish an article dealing with the meetings of the Institution of Electrical Engineers, and also of the Local Sections during the coming Session. (Page 697.)

THE arbitration regarding the price of the current for the tramways in Paisley was concluded in London on Thursday, and Mr. Robert Hammond, the arbitrator, is now considering his award. This will be awaited with interest, as the arguments employed on both sides are to some extent applicable to a large number of other cases where similar cases are pending. (Page 698.)

ATTENTION is called to recent articles in the American press indicating the progress which has been made in the adoption of electric vehicles in that country. (Page 699.)

OWING to the resignation of Mr. J. H. Rider, Chief Electrical Engineer of the L.C.C. Tramways Department, a rearrangement of the staff has been made, involving the abolition of this post and the appointment of a Deputy Chief Officer and an Electrical Assistant. (Page 699.)

A SHORT article refers to an exhibt of rubber-preparing plant shown at the Brussels Exhibition. (Page 699.)

AMONG the Specifications published by the Patent Office on Thursday was one by C. Damey for a locking lamp-holder and cap, in which spring plungers in the cap enter holes in the holder. Two patents by A. E. Angold and T. L. Carbone respectively relate to enclosed flame arc lamps with special cooling chambers in which the fumes are deposited. The Westinghouse Metallfaden-Glühlampenfabrik Ges. cover processes for the manufacture and decarbonising of tungsten fila-

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ments. An arrangement of microphones for long-distance telephony is claimed by A. Petersen and G. Sem.—The patent recently refused to B. Seacombe for a magneto massage machine has now been granted with certain amendments. Opposition has been entered to the grant of a patent for a vacuum cleaner.—A patent by the Babcock & Wilcox Co. for a sectional water-tube boiler expires during the current week after the full life of fourteen years. (Page 700.)

Bournemouth Council have decided to abandon the conduit system.—The price for tramway energy at Brighton has been reduced from 1·35d. to 1·2d. per unit.—Eccles Council are making the experiment of supplying electricity to a block of cottages at 6d. per week.—A competitive scheme of street lighting by gas and electricity is to be carried out in Gower Street.—The Board of Trade have renewed the licence for the Dolter system in Torquay, pending the conversion to the overhead system.—The Acton ratepayers are endeavouring to prevent the sale of the electricity undertaking to the Metropolitan Electric Supply Co. (Page 701.)

Loans have been sanctioned at Barking (£11,000); Peterborough (£2,000); and Portsmouth (£20,586). Mains are to be extended at Stoke-on-Trent (£1,000), and extensions are contemplated at Greenock (£16,000) and Gloucester (£14,000). The Portrush Council propose to erect an electric power station, and generating plant is to be installed at the Sittingbourne paper mills. (Page 701.)

At the statutory meeting of "Metalite, Ltd." last week, it was stated that new works are to be erected at Derby. It was said that orders for 980,000 lamps have had to be refused.—The accounts of the Edison & Swan United Electric Light Co. for the year to June 30th show a loss of £3,184. (Page 704.)

ARRANGEMENTS FOR THE WEEK

TUESDAY, NOVEMBER 8th.

National Electrical Manufacturers Association.

2.30 p.m. Committee meeting at Balfour House, Finsbury Pavement, E.C.

Institution of Electrical Engineers, Manchester Section.

7.30 p.m. At University. "Irregularities in the Rotating Field of the Polyphase Induction Motor," by C. F. Smith.

Institution of Electrical Engineers, Glasgow Section.

8 p.m. At 207 Bath Street. Address by Mr. Sam Mavor.

Institution of Civil Engineers.

8 p.m. At 25 Great George Street, Westminster. "The London County Council Holborn to Strand Improvement, and Tramway Subway," by G. W. Humphreys.

THURSDAY, NOVEMBER 10th.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. Presentation of scholarships and premiums, and inaugural address of the President, Mr. S. Z. de Ferranti.

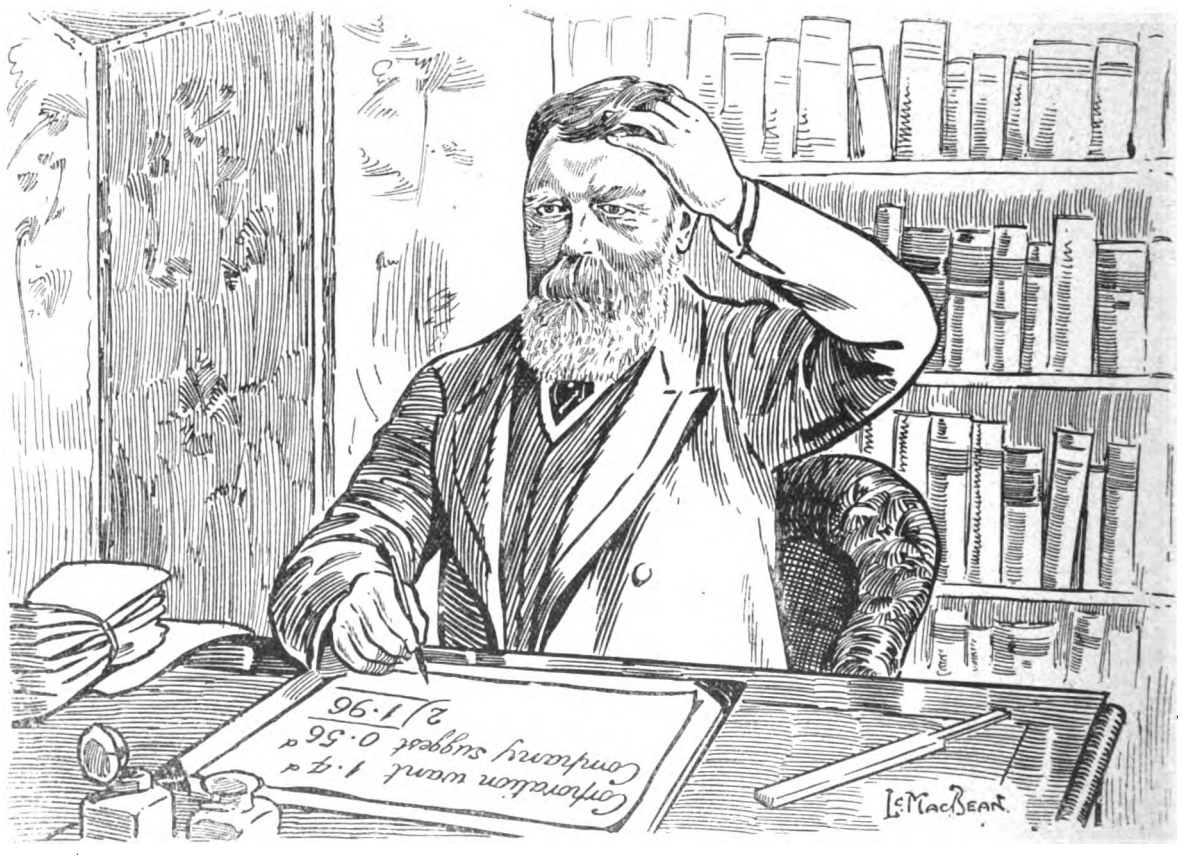
ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to The Editor, Electrical Engineering, 203-6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.

Answer to Several Wiring Contractors.—You will find the explanation of the letter which you have received given in an article on another page.

L. Heward.—Other metals than platinum have been employed for the leading-in wires, but we believe that all or nearly all the lamp manufacturers still employ a short-length platinum for passing through the glass, jointed to wires of less expensive metal at both ends. In a recent patent process, however, very thin copper strips have been employed with, it is said, good results, and another inventor has suggested a method of employing iron wires.

R. Jenner, Jr.—The lamps are connected in series-multiple.



Mr. Robert Hammond, who has been sitting as arbitrator to determine the price per unit that the Paisley District Tramways Co. should pay the Corporation for electrical energy, is considering his award. **(See page 298.)**

Mr. ROBERT HAMMOND (*to himself*)—**It's very tempting!**

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BRITISH LAMP MAKERS AND THE SWAN LAMP CAP PATENTS

MANY of our readers have received, and are somewhat mystified by, the following communication from the General Electric Co., Ltd.:—

DEAR SIRS,—It has recently come to our notice that some of our customers who buy from us incandescent electric lamps manufactured with Vitrite caps have been threatened by certain makers of such lamp caps with legal proceedings for what they claim to be an infringement of their patent rights.

We desire that our customers should be free from the anxiety, annoyance, and expense of patent litigation in connection with goods manufactured and supplied by us, and, therefore, have pleasure in handing you the enclosed indemnity.

[A formal document is enclosed indemnifying the recipient in respect of legal proceedings as indicated above.]

It appears that a letter has been sent round by the British Vitrite Works (Swan's Patents), Ltd., to the principal incandescent lamp manufacturers of this country, calling their attention to the fact that the company are the owners of certain lamp cap patents which, it is claimed, cover the process and machinery employed in the manufacture of the caps used by British manufacturers, and suggesting compensation and the purchase of licences.

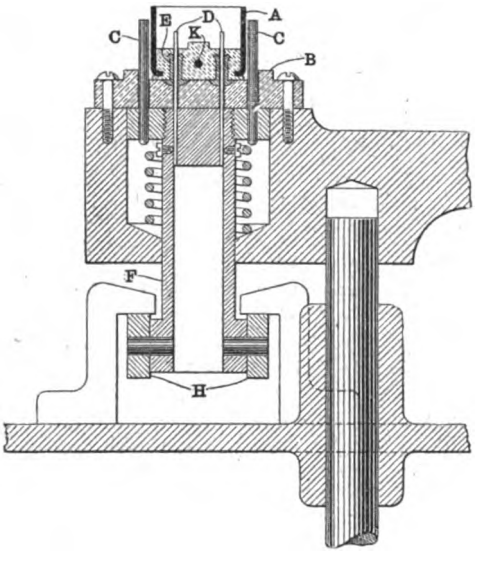
There are two patents concerned, the first of which (taken out in 1902) is in the name of Mr. A. Swan, of the General Electric Co. of America. The British rights in this case, however, did not become the property of the British Thomson-Houston Co., but were retained by Mr. Swan, who, on March 30th, 1909, assigned them to a company which had been formed in London under the name of Swan's Patents, Ltd., together with the second patent for £2,000. He guaranteed the validity of the first patent for three years, and stated that no caps were at that time being manufactured in the United Kingdom under the patent, and that no person or company had a right to use the process and machinery described in the patent. Further, Mr. Swan undertook to supply any number of the machines required for the manufacture of these caps at the price of £70 apiece. In April, 1909, Mr. Swan had been allowed to amend the first two claims of the first patent to limit the scope of the invention (see ELECTRICAL ENGINEERING, Patent Record, March 4th and April 29th, 1909), and Swan's Patents, Ltd., obtained a further amendment of these claims in February of this year (see ELECTRICAL ENGINEERING, Patent Record, December 30th, 1909, and February 17th, 1910). On February 3rd the rights of the patents were transferred to a new company called the British Vitrite Works (Swan's Patents), Ltd.

The first patent is No. 12,739 of 1902, and relates to a lamp cap in which the metal shell is interlocked with a glass filling uniting the contacts. The specification describes a machine for making such caps. This comprises a gas-fired furnace in which the glass mixture is fused and kept in a liquid condition, and automatic mechanism for filling and moulding the caps. The metal cylinder or shell, *A*, is placed on a plate, *B*, at the end of an arm of a rotary head, which moves the several shells under the furnace opening and the die in succession. The shell is held in position by pins, *C*, and the contact studs, *E*, are placed in position over two vertical pins, *D*. After the proper amount of glass has been poured in, the shell is moved automatically underneath the die which moulds the glass web into shape, and is then rotated into a third position. Here the rollers, *H*, are depressed under a rail, and the pins *C* and *D* drawn down so as to release the completed cap which is swept off the plate into a box. In the figure (which is one of 24 in the specification) the piece of rod forming the bayonet pins of the cap is represented at *K*. Wires to connect the filament to the contact studs are passed through the holes left by the pins *D*, and the cap is then cemented to the lamp bulb.

There are nine claims to the patent, of which the first and third are representative. These are as follows:—

(1) The improved incandescent lamp base, characterised by a metallic shell interlocking with a binding button formed from a stream of highly fluid or liquid glass, automatically fed in measured quantity into a succession of moulds containing the assembled metallic parts, the glass being subsequently by a further automatic movement moulded, pressed, or otherwise formed so as to unite the metallic terminals, substantially as described and shown in the attached drawings.

(3) The improved machine for forming incandescent lamp bases, embracing a glass melting furnace, having an opening which forms an exit therefrom, through which the molten glass may flow, in combination with means which, by a movement, will successively bring moulds containing the assembled metallic portions of the bases adjacent to the opening to permit a proper



quantity of glass to flow therein, and by a further movement will bring the parts within the sphere of action of a moving die to press and form the glass in the proper configuration, substantially as described and illustrated . . .

The second patent is No. 14,597 of 1903, and covers certain improvements in the machine described in the previous patent. A somewhat simpler mechanism is employed, and means are provided for protecting the parts from the great heat. For example, the die is provided with a water-jacket. To ensure a free opening for the connecting leads, a punch is forced through the holes left by the pins, and compressed air is employed to eject the finished caps from the moulds. Provision is also made for cutting away any surplus glass, and means are provided for varying the speed of the machine according to the fluidity of the glass. There are 12 claims to this patent.

We understand that the present position is by no means a surprise to some of the lamp manufacturers at least, who had been expecting it for some long time. After inquiry, not only at the offices of the General Electric Co., but also of other leading manufacturers in this country, we are able to state that they will unitedly oppose the demands of the British Vitrite Works. They do not admit that any British lamp manufacturers use caps made according to the process or by the machinery covered by the Swan patents. An extremely large proportion of the caps used on British-made lamps are purchased abroad, and there is reason to doubt whether the British Vitrite Works (Swan's Patents), Ltd., are in a position to manufacture in this country the large supply of lamp caps that are needed from week to week. If, therefore, legal proceedings are instituted against the lamp manufacturers, it is evident that the latter will not only plead that they do not infringe, and also contest in the usual manner the validity of the patent, but that they will also apply for the revocation of the patent under Clauses 24 and 27 of the new Patents Act.

So far as the retail lamp buyers and the general public are concerned, we cannot but think that the letter which we have quoted at the commencement of this article over-estimates the extent of the aggressive action which the owners of the Swan lamp cap patents are taking at present. In the only cases brought to our notice, the British Vitrite Co. have been shaking their fists only at the lamp manufacturers and not at the trade generally. In any event, however, those who buy their lamps from the leading British firms have nothing to fear, for our inquiries have established that these firms are prepared to indemnify their customers from any possible legal proceedings.

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MR. ALEXANDER SIEMENS' PRESIDENTIAL ADDRESS TO THE INSTITUTION OF CIVIL ENGINEERS

MR. ALEXANDER SIEMENS commenced his Presidential Address to the Institution of Civil Engineers with a few words on the present by-laws and ways in which they had been modified from time to time.

He then passed on to a comparison of conditions in ancient and modern times, and said that although in literature and art or in philosophy we could not boast of being greatly superior to the ancients, as far as engineering problems were concerned we had enormously advanced, thanks to the practical application of scientific theories. This progress he attributed mainly to the improvement of the means of communication and to the saving of manual labour by the introduction of mechanical power, which main features had caused a general lowering of the cost of "obtainables." Everybody readily agreed that improving the means of communication was a desirable form of progress, but, curiously, the consequences of improved communication were not yet fully appreciated, and the saving in manual labour was still looked upon askance by those most concerned. The development of the manufacture of glow-lamps was a striking example of the advantage of labour-saving machinery; at first the lamps were made by a few skilled workers at a high cost, so that they could not be sold for less than twenty-five shillings each. This excessive cost naturally restricted their sale, but the efforts of the manufacturers to devise labour-saving machinery were not relaxed until the selling price of glow-lamps had diminished to its present level, when they are sold by the million. Can anybody doubt, he asked, that the introduction of labour-saving machinery into this industry, far from diminishing opportunities for employment, has not only benefited the skilled workers, but has opened new avenues for profitable employment to the so-called unskilled labour? Coupled with this anomalous attitude regarding machinery was another fallacy equally difficult to eradicate, indicated by what is usually called "restriction of output." Lowering of cost should be the guiding principle of all engineering design; and by accepting this we admit that successful engineering must be based not only on technical knowledge, but on the proper understanding of economic laws.

With regard to contractors' work, the conditions of which had not changed much during the last sixty years, the consulting engineer must be the real expert with a varied practical experience of similar work, in possession of all the necessary preliminary data for designing the complete works. This was different with manufactured produce which was utilised in engineering works, the variety of which was constantly increasing, so that it was perfectly hopeless to expect every engineer to be acquainted with every detail of their manufacture. Trained technical experts were nowadays entrusted with the task of directing industrial operations in factories, and it was inevitable that they should know more about manufacturing methods and requirements than outsiders.

Complaints had been made that some engineers had taken advantage of this circumstance by specifying results only and inviting manufacturers to submit detailed descriptions of the means proposed by them for obtaining the specified results. This procedure implied that six or seven complete specifications have to be worked out by the manufacturers invited to tender instead of only one by the engineer, and, it was complained, this enabled a person who was not competent to draw up a satisfactory specification by himself, to act as superintendent of works to the exclusion of really competent engineers. In fact, it was alleged that sometimes the first proposals were not accepted, but their details were utilised by the engineer for drawing up a complete specification of his own. Mr. Siemens submitted that a solution to the problem had been to some extent found in the establishment of the Engineering Standards Committee. By referring to their publications the consulting engineer could rely upon obtaining apparatus that would pass the tests therein specified, and the manufacturer could adapt his processes to the requirements set out by the Committee without the risk of being invited to quote to specifications which might upset his methods of manufacture without benefit to anybody.

The task was made more difficult by the international character of the competition in manufactured articles, which accentuated the necessity not only of doing all that was possible to increase economy of production, but also to facilitate in every way the introduction of new industries, and in this the new Patent Act had been productive of great benefits. In this connection, he considered that Parliament would be quite justified in regarding the commercial success of a patented invention as a proof of its benefitting the community, and therefore making it unassailable except by prior commercial use.

The same reasons that had led to the establishment of the Engineering Standards Committee in this country held good for international dealings, so that we might look forward to the time when international standard specifications will be accepted all over the world. A beginning was made when the British Association introduced in 1861 the C.G.S. system of electrical units, which, since that time, had been adopted internationally, and a further step had been taken at the St. Louis Exhibition of 1904, when the International Electro-Technical Commission was called into being. It was a very significant circumstance that it had been found necessary for this Commission to associate itself in some branches of its activity with the Engineering Standards Committee, and it was not unreasonable to expect that such joint international action would gradually extend beyond the field of electricity.

MR. J. S. PECK'S PRESIDENTIAL ADDRESS TO THE MANCHESTER SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

MR. J. S. PECK (British Westinghouse Electric & Manufacturing Co.) said in his presidential address delivered at last Friday's meeting of the Manchester section of the Institution of Electrical Engineers that he believed that, with a single exception, he was the only American to occupy the position of chairman of a section of the Institution. He had recently returned from a trip to the United States, and would devote his address to a review of the condition of electrical engineering in America.

There had been great advances in electric traction, and the traction department of a manufacturing company presented a very different appearance from that of a few years ago, for while one still saw the usual standard type of tramway motor, there were also large motors for the enormous electric locomotives which were now being used by many of the main steam roads for drawing trains in and out of their terminal stations, and for hauling trains through tunnels. These motors resembled slow-speed engine-type generators more than tramway motors, and the sight of cranks, jack shafts, and connecting rods on electric locomotives was new to anyone who was not closely associated with this work. He referred to the continuous-current system of the New York Central, and the single-phase system of the New York, New Haven & Hartford Railway, the extensions to the latter of which were really the prelude to electrical working all the way from New York to Boston, a distance of 250 miles. The electrification of the Pennsylvania system into New York City was well under way on the direct-current system, and the locomotives were the most powerful that have yet been built. With regard to tramways, commutating pole motors were now largely employed, cars were becoming larger and more powerful, and "pay as you enter cars" were much seen.

Passing on to high-tension transmission, he remarked that several plants are operating successfully at 110,000 volts, and 200,000 volts appears much nearer than did 100,000 ten years ago.

Difficulties with lighting were much reduced by earthed metal rings round the insulators, and the electrolytic arrester was being almost universally adopted. Steel towers and long spans were the rule, and the towers were often made flexible in the direction of the line.

In turbo-generators the tendency was to higher and higher speed. The generators were not usually designed for close inherent regulation, but external automatic regulators were used. External methods of ventilation were not much used. Progress in D.-C. turbo machines had been greater in Great Britain than in America. He also referred to some features of American transformers, which were mostly of the shell type. With regard to motors, the manufacturing companies had been devoting a great deal of time and money to increasing the demand and assisting the supply companies in their power canvassing. He had been struck with the quantity as well as the quality of the measuring instruments turned out. With regard to arc lamps, the great majority of the arc lamps in use in America were of the enclosed type, but the flaming arc was coming into more general use. For street lighting, the lamps were usually run in series from a constant-current generator, or from a constant-current transformer. The magnetite lamp was also coming into use.

The prosperous condition of the large companies enables them to carry large engineering staffs, to support research and experimental laboratories, and to undertake the development of new lines of apparatus, and of new electrical systems, on a scale quite impossible for the manufacturers of this country.

The latter part of the address was devoted to a consideration of some of the factors which have contributed to the more flourishing state of the electrical industry in America than in this country. America was a rapidly growing country, and its business men were more daring; technical education was more advanced and more appreciated; the restrictions imposed by labour organisations were not so severe, and municipal control of electric supply and tramways was not so general. The comparative absence of Government restrictions left engineers a freer hand, and in America consulting engineers did not bind the manufacturers down to details. He also was of opinion that, regardless of whether a tariff would help Great Britain or not, there was no doubt that it has greatly helped the American electrical manufacturer.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

THE ASSOCIATION OF MINING ELECTRICAL ENGINEERS

SINCE the publication of last month's supplement on ELECTRICAL ENGINEERING IN MINES, the Association of Mining Electrical Engineers has held its first annual general meeting. Mr. W. Maurice, the President, occupied the chair.

In the annual report it was announced that Mr. E. Kilburn Scott had been appointed editor of the transactions of the Association, and the council recorded its appreciation of the services of Mr. J. H. C. Brooking, who had hitherto acted as honorary editor. The accounts are also published, and it is satisfactory to note that each of the eight branches has a balance in hand. The formalities in connection with the registration of articles of association and the incorporation of the Association are not yet complete.

The President's Address referred to the good progress made by the Association, and emphasised the need for the co-operation of every section of the mining industry. It then passed on to a consideration of the proposed scheme of holding examinations and granting certificates, for which the Council were about to establish an Examination Board, and Mr. Maurice invited opinions on the standard of knowledge which should be required. Some discussion on the point ensued, and finally a sub-committee, consisting of Messrs. Maurice, Thornton, and Fisher, was appointed to draw up and to issue for discussion by the Branches a model examination paper. The annual dinner was held in the evening.

After the adoption of the report, and before the President read his address, he invited general discussion and criticism of the work of the Council. Mr. Justus Eck, of the Union Electric Co., Ltd., who is a member of the London Section, took advantage of this invitation to complain of the difficulty he had in keeping in touch with the other branches of the Association. The London branch, he explained, was neither very large nor very active, and as notices of meetings in each branch are only sent out to the local members, he was given no opportunity of hearing what was going on in the branches throughout the country. Mr. Eck is perfectly justified in his complaint. We attended one meeting of the London branch, at which the number present was three: the Chairman, the London Honorary Secretary, and our own representative. This was, we believe, the second meeting of the session, and it may also have been the final one for all we know, for the Association has recently initiated the policy of refusing to admit representatives of electrical newspapers to its meetings. For this account of the annual meeting even, we have to be indebted to the official report. This attitude towards the electrical journals is much to be regretted, and we are convinced that the policy which dictates it is short-sighted. So far as we ourselves are concerned, we have done our utmost to further the interests of the Association from its very inception; our articles on the aims and objects of the Association were the means of obtaining a large influx of members at the outset, and as soon as the local branches were inaugurated we took considerable trouble to make arrangements to give our readers prompt and accurate reports of the meetings all over the country. Cases arose, however, at which our representatives were asked to refrain from reporting the meetings, although they had sometimes travelled from a distance for the purpose, and at some branches they were actually refused admittance on instructions from the headquarters. Finally, after some correspondence, we were officially informed that these efforts of ours to spread the knowledge of the doings of the Association were not desired. We still endeavour—for the convenience of members desiring, as Mr. Eck, to attend the meetings of other branches than their own—to notify the dates of forthcoming meetings in our "Arrangements for the Week" column, but it is only some of the local honorary secretaries who are able to give us notices of meetings by the previous Wednesday, and these do it of their own initiative, as they are not encouraged to do so by the Council.

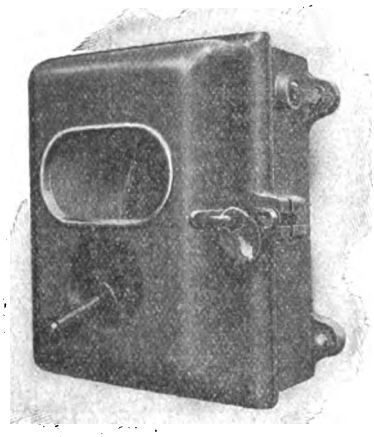
We have reason to believe that the general body of members are not in agreement with the Council's attitude upon this matter. The technical Press can be of the utmost use to a young and, we may say, struggling body such as this; and we cannot see that the Association can in any way better its position by an independence which rejects offers of friendly assistance, or by a diffidence which fears the publication of accurate reports of its discussions in the independent and representative papers of the industry. The Council should profit by the examples of the Institution of Electrical Engineers and the Institution of Mechanical Engineers, and many other similar bodies, who have consistently followed the policy of advising the Press of all their meetings well in advance, and of giving every facility for the full and prompt reporting of papers and discussions. It is largely to this policy that these institutions owe their present influential positions.

It would be a matter of great regret if, after the self-sacrificing manner in which Mr. Maurice has devoted himself to the evolution of the Association of Mining Electrical Engineers, and the able support given him by the other members of the Council, their efforts should be crippled by the adoption of the policy which we have taken the liberty of criticising. It is rumoured that the Council has committed itself to this policy by a business arrangement for the purposes of temporary economy, the disastrous results of which they had failed to foresee, and, if this is so, the sooner this arrangement is cancelled or modified the better. Those who are not permitted to penetrate into the sanctity of the Council Chamber can see no excuse for the ungracious and even discourteous refusal to accept the assistance which has been so cordially and ungrudgingly offered by the electrical engineering press.

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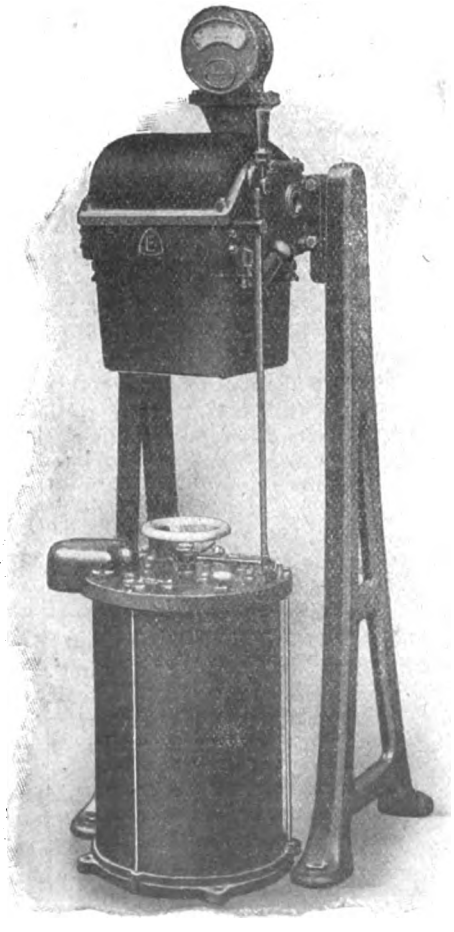
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ELECTRICAL EQUIPMENT OF THE OAKDALE NAVIGATION COLLIERIES

THE Oakdale Collieries, in the Sirhowy Valley, near Blackwood, Mon., are about 600 feet above the sea-level, and when fully developed will be amongst the largest in the South Wales and Monmouthshire Coalfield. At the present time there are two shafts, but ultimately a third shaft will be sunk in connection with the house-coal seam. In addition to the present shafts, a level—called the Waterloo level—containing some electrical plant is being worked.

The generating station is about midway between the two pits. It is a large and substantial structure, well ventilated, and lighted by arc and incandescent lamps at night. On one side of the generating station is an annexe, in the basement of which are the cells containing the high-tension switchgear. The upper part of this annexe gives ample room to get behind the main switchboard, the front of the switchboard being in a line and flush with the front wall and facing into the building. The wall above the switchboard, which is, of course, also above the annexe, is carried by substantial arches. The basement floor is just above the ground-level, and the engine-room floor is about twelve feet above it. This gives ample room for the high-tension cells and switchgear, also for the 375 k.v.a. transformer, and for the large-diameter exhaust pipes and valves. In the engine room, a view of which is given in Fig. 1, are two 1,000 kw. Willans-Dick Kerr mixed-pressure turbo-alternator sets of standard construction. 3,300 volts, 50 cycles, 1,500 r.p.m. These turbines are each fitted with motor-controlled governors. The main steam pipes are on the other side of the engine-room and above the engine-room floor. The high-pressure inlet pipes to the turbines are taken off the main range, and the low-pressure inlet pipes pass up through the engine-room floor from the basement beneath. The foundations for these turbine sets are of very substantial build, consisting of local stone, the corners being faced with brick. These sets have been working continuously day and night for the past twelve months, and we are informed that since the date of starting up, they have never given the slightest trouble. Under service conditions, one set is working continuously day and night for one week, the other during this time acting as a reserve. At each week-end they are paralleled and changed over, the reserve set taking up the running for the ensuing week. These sets were working under high-pressure steam only, but lately the exhaust pipes from the winding engines and the accumulator have been completed, and the turbines are now working under normal conditions with "mixed pressure." The exhaust steam from the winding engines is being taken full advantage of whilst the pits are being sunk, enabling a great economy in steam and fuel consumption to be obtained while sinking is in progress. Each turbine has a jet condenser of Körting Bros. manufacture placed immediately outside the generating station. They are complete with the necessary stop valves to isolate either or both condensers, and also with automatic atmospheric exhaust valves in case either condenser should fail. There is a natural draught cooling-tower in connection with the condensing plant. This, and the tank immediately beneath it, are on a considerably higher level than the condensers, this arrangement giving the necessary amount of "head" to the injection water. The injection water, after passing through the condensers, is discharged into a large hot well, and then delivered to the top of the cooling-tower by means of three centrifugal pumps driven by means of alternating-current motors, 500/550 volts, 50 cycles. The pump house containing these pumps and motors is at the side of the main building. High-pressure steam is supplied to the turbo sets by six Babcock & Wilcox water-tube boilers at 200 lbs. per sq. inch. They are situated in the boiler house, at a considerable distance from the generating station and near the South pit. There is a large brick chimney in connection with these which carries the smoke and gases well clear of the collieries, a most important point with regard to the ventilating of the mines. The boilers are fitted with the "Underfeed" type of stokers. The coal is delivered into a travelling belt conveyor by means of a hopper in the basement, and then carried up and over the coal shutes, whence it is delivered, and so gravitates down to the stokers. The low-pressure steam from the winding engines is carried to the heat accumulator through an oil

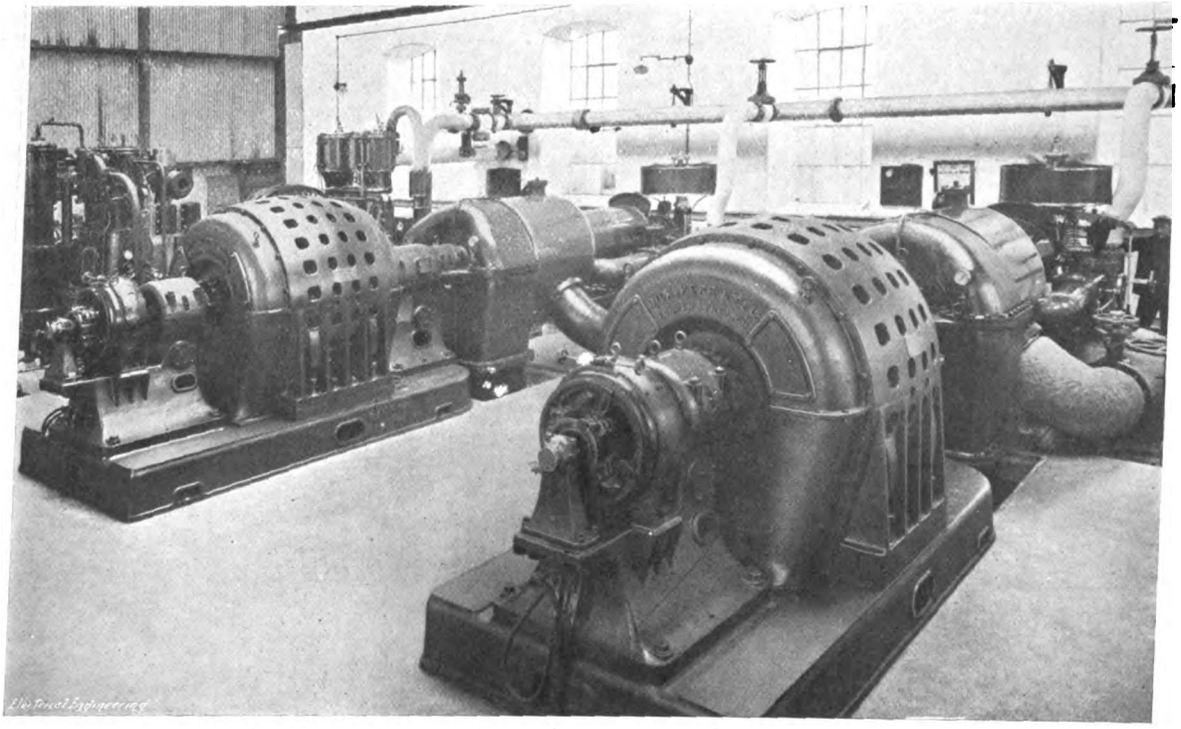
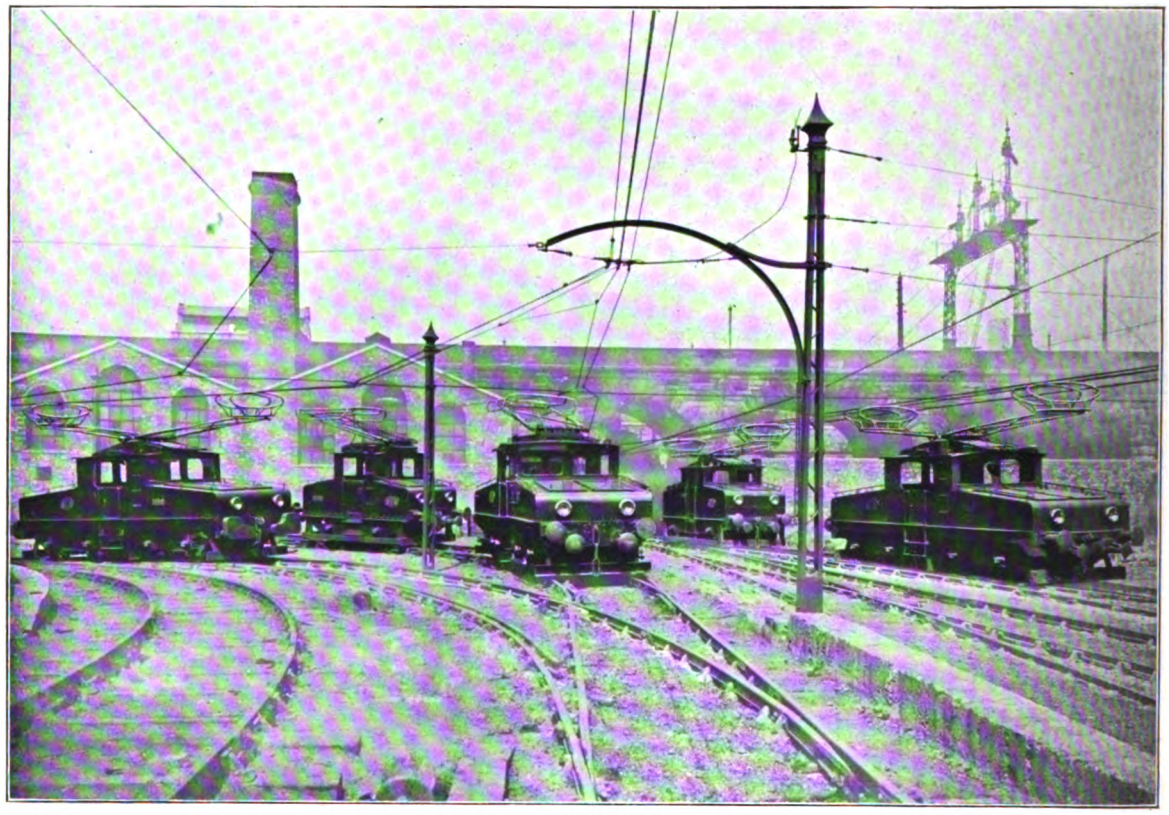


FIG. 1.—MIXED PRESSURE TURBO-GENERATORS IN GENERATING STATION.

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separator, and before it reaches the turbines, through an automatic isolating valve. This valve comes into operation should any exhaust steam be obtained from the winding engines. The turbo-alternators supply the whole of the power and lighting, both for the surface and for the sinking operations, and, of course, will

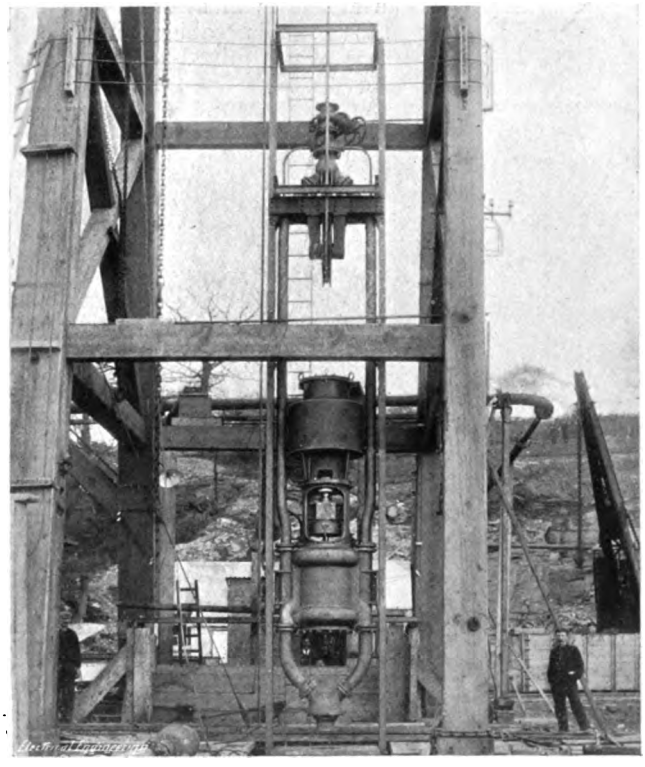


FIG. 2.—ELECTRICALLY-DRIVEN SINKING PUMP.

ultimately supply the necessary power for the fan motors for ventilating the underground workings as the pit develops. Direct-current is used in connection with the arc and incandescent lamps on the whole of the surface and in the various buildings. This is supplied by means of a motor generator-set in the generating station at 220/230 volts. The power for the surface, and also for the sinking operations, is obtained from the step-down transformer of 375 k.v.a. capacity already mentioned, which transforms the pressure from 3,300 volts to 550 volts. This pressure has been adopted for the whole of the motors on the surface; also for the motor-driven air-compressor (situate in the generating station), and for the sinking pumps. The air-compressor supplies the necessary compressed air for working the drills used in connection with the blasting whilst sinking the pits. There are two sinking pumps, one in each shaft, and these are of Messrs. Sulzer Bros. manufacture; one of them is shown in Fig. 2. They are guaranteed to deliver 36,000 gallons of water per hour against a head of 500 feet. The motors driving these pumps are of 175 h.p. each. These sinking-pump motors have now been working day and night since sinking operations commenced, without giving the slightest trouble. One is dealing with, roughly, 20,000 gallons per hour in the North pit, and the other about 10,000 gallons per hour in the South pit. These pumps were originally taking the water from the bottom of the pit, where the men were working, and delivering it into a temporary pump lodge above, until they had sunk the shafts to the depth decided upon for the permanent pump lodge. In the temporary pump lodge there was originally installed a 600 b.h.p. motor direct-coupled to a Sulzer pump, and this, up to the time of its removal, had been for many months delivering about 40,000 gallons of water per hour from this temporary pump lodge to the surface, a distance of 180 yards. This was only a small temporary lodge, and contained the necessary switchpillars, liquid starter, &c., in connection with the motor. The Colliery Co. have now completed their permanent pump lodge, mentioned above, which is 293 yards below the surface; the pump and its motor, which has dealt with the water up to the time of the completion of the permanent lodge, has now been dismantled and permanently erected in the latter lodge, together with a duplicate set as a standby, so that the pumping sets have not only served a useful purpose as a temporary measure during the early part of the sinking, but have now been put into permanent operation, for which they were originally intended, thereby, it will be noted, saving the extra expense of temporary sets, a most important saving from the colliery owners' point of view; and in this point alone proving its superiority over the old-fashioned steam pumping sets, which, in most if not all cases, had to be thrown aside when the sinking operations were completed. The 600 h.p. pump motors which are at present working in the permanent pump lodge, are designed for 3,000/3,300 volts, and the high-tension feeder to this runs from the main switchboard in the generating station down to the pump lodge. It is three-core, double-wire armoured, and is securely cleated to the side of the shaft. There is also a 500/550 volt three-core cable taken down each shaft for the purpose of supplying the current to the sinking-pump motors. The cables are lowered by means of cable drums as the shafts get deeper. The sinking pumps and motors are carried in special frames, and are designed so that they can be raised and lowered at

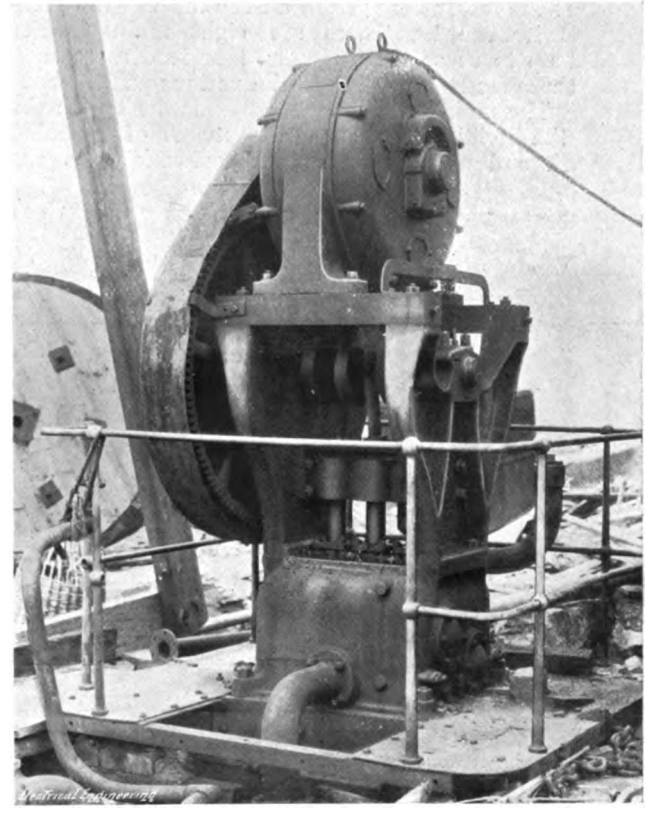


FIG. 3.—ELECTRICALLY-DRIVEN SURFACE PUMP.

will. It has been found by actual practice that these sinking pumps are superior in every way to the old-fashioned steam-driven sinking pumps, there being no heat, no escaping steam, no noise, no undue vibration or knocking due to the hammering effects of the rams, as is the case with steam-driven pumps, not taking

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into consideration the very much smaller space and the rapidity of handling which can be obtained by means of the motor-driven type of pump. For lighting the bottom of the shafts during sinking operations, a direct-current cable is taken down, the necessary current being supplied by the motor generator in the generating station. The lighting for the pump lodge is obtained by means of a small transformer in the switchpillar in the pump lodge itself. The 500/550-volt motors on the surface include one 55 h.p. motor working a Sturtevant fan for ventilating the shaft during sinking operations; a similar size motor, working the haulage at the Waterloo level, dealing with about ten loaded trams per journey, and running the trams from the level up to the screens, a distance of, roughly, 300 yards. There is also a 20 h.p. motor working the three-throw pump on the surface, seen in Fig. 3, and another of the same size working a mortar mill. In fact, practically everything which needs driving is driven electrically.

Referring again to the generating station, there is a main switchboard consisting of two generator panels complete with main switches with time-limit relays, wattmeters, ammeters, and voltmeters for each unit. There is also one spare generator panel. In connection with this switchboard, there are also three Thury regulators on one common shaft; two regulators are at present coupled up to the two turbo sets, the remaining one being a spare for a future turbo set. These regulators are shown in the foreground in Fig. 4. They are capable of being driven by a motor at either end of the shaft, one motor always standing as spare. There are three high-tension feeder panels, two of which are in use, the third being a spare. These are complete with ammeters and voltmeters and earth detector, the latter being fixed on the top in the centre of the switchboard. There are eight main feeders coupled up to these three panels, four feeders to each panel, three feeders running to the various points about the pit. The main switchboard, which is flush with the wall of the building, is protected by means of expanded steelwork and also an expanded steelwork door, the

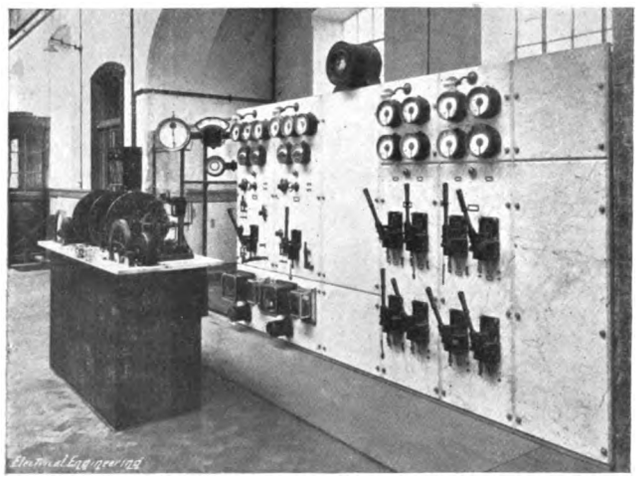


FIG. 4.—MAIN SWITCHBOARD AND THURY REGULATOR.

latter being locked and under the control of the engineer in charge of the station. The high-tension chamber is in the basement, immediately beneath the H.T. switchboard. This chamber comprises sixteen cells, some of which are shown in Fig. 5, all these being in connection with the high-tension feeders and the alternators. The cells have expanded steelwork doors, and these are also kept locked and under the charge of the engineer on duty. Furthermore, it is impossible to open any of these doors unless the isolating switch is previously opened, thus doubly safeguarding the attendant or any other person who may be in the basement. It will, therefore, be seen that the whole of the high-tension gear is secure from access by any unauthorised person.

Messrs. Dick, Kerr & Co. were the principal contractors for the work, and we are indebted to them for technical particulars of the plant and for the photographs with which this article is illustrated.

Further developments at this colliery include a 3,000 kw. turbo-generator of the mixed-pressure type,

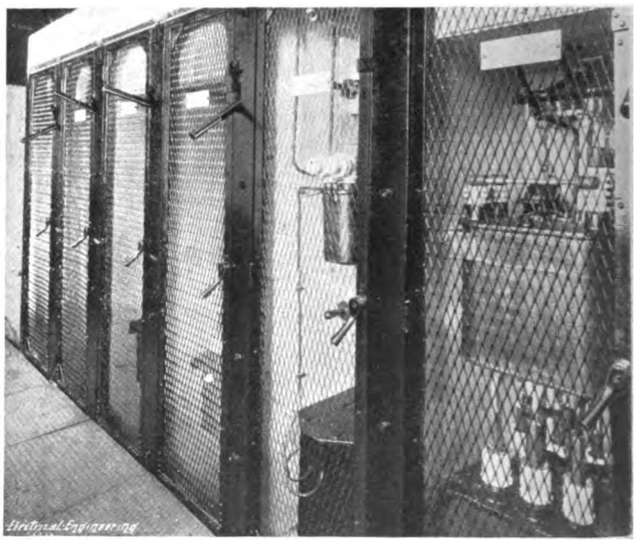


FIG. 5.—CELLS FOR H.T. SWITCHGEAR IN BASEMENT.

and transformers for supplying the whole of the electrical power, including two large electrical winders, at the Markham pits, about two and a half miles distant from the Oakdale pits. The transmission line will be in duplicate, and will work at 6,600 volts.

The Markham pits will be operated entirely by electrical power. No steam boilers will be erected at this pit, which will have an output of from 2,000 to 3,000 tons per day.

The whole of this work has been carried out to the specifications of Messrs. Scott & Leggat, Cardiff, the consulting engineers to the Company, to whom our thanks are due for revising and adding to this description.

ELECTRICAL MINING PATENTS OF OCTOBER

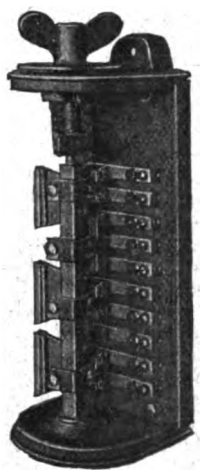
AMONG the Patent Specifications of interest to electrical mining engineers published during the past month is No. 19,359/09, by J. G. Patterson, of Darlington. This covers the combination with a portable electric miner's lamp of a miniature oil lamp for indicating the presence of gas or fire-damp. The oil lamp is not intended to give light, but merely to act as a detector of fire-damp. It is mounted on the electric lamp case in such a way that it cannot be opened while the cover of the electric lamp is in place. Normally it is not alight, but to test for gas, the switch of the electric lamp (which is inside the flame lamp) is turned so that the electric lamp is switched off and a platinum spiral above the wick of the oil lamp caused to glow and ignite the wick. When the electric lamp is again switched on the oil lamp is automatically extinguished.

Patent No. 23,739 09, by G. M. Capell, of Passenham, Bucks, describes means for turning an exhaust fan into a blowing fan without changing the direction of rotation. A reversing passage following the volute of the fan casing is provided. It is above the fan and a door is provided to close it when blowing.

Improvements in the boxes for holding the cutters of coal-cutting machines of the disc and chain types are covered by Patent No. 26,064/09, by F. Eckersley and W. Creswick, of Wakefield, and a construction for a cutting-wheel for a disc machine is described by Anderson, Boyes & Co., Ltd., of Motherwell, in Patent No. 29,762/09.

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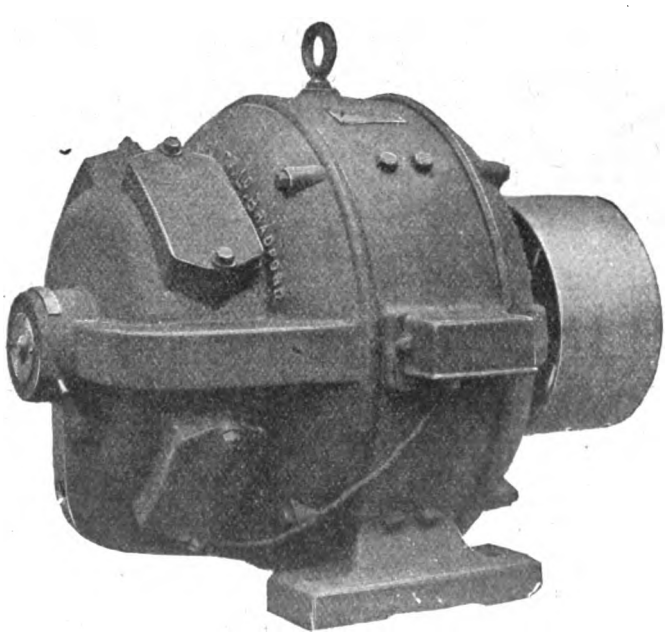
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ELECTRICAL ACCIDENTS EXAMINATIONS FOR COLLIERY ELECTRICIANS

Discussion before a Branch of the Association of Mining Electrical Engineers.

At a meeting of the Cumberland Branch of the Association of Mining Electrical Engineers on Saturday, October 22nd, at Workington, a discussion was held on the causes of four colliery accidents, of which reports had been sent to the branch secretary. The first was that described in ELECTRICAL ENGINEERING IN MINES, October 6th, p. cii., in which a man at the South Rhondda Colliery received a fatal shock from a loose signal wire which had come in contact with a defective joint in a main cable. The discussion was confined chiefly to the chairman (Mr. T. P. Martin) and the secretary, Mr. J. Glynn Williams, who expressed the opinion that there was contributory negligence on the part of the electrician responsible for the joint. One or two similar cases were mentioned. The next accident to be discussed, in which a man had opened up a 3,000-volt oil switch without seeing that the current was off (see ELECTRICAL ENGINEERING IN MINES, August 4th, p. lxxxvi.), was productive of a plea for juries composed of men of technical knowledge, but it was finally agreed that the fatality was due to pure carelessness. The third accident to which the secretary drew attention was one at Normanton, the circumstances of which were given in ELECTRICAL ENGINEERING IN MINES, July 7th, p. lxxxii. This accident was, he said, due to rising water breaking down the insulation of the trailing cable of a coal cutter. He advocated men wearing clogs instead of boots in such cases as lessening the risk of shock. Finally, the details of the Wingfield Colliery fatality (see ELECTRICAL ENGINEERING IN MINES, May 5th, p. lix.) were put before the meeting. This appeared to have been due to faulty connections at a gate-end box, and a verdict of accidental death was returned. Some discussion ensued upon the nature of coroner's juries' verdicts. Mr. Williams repeated his plea for technical jurymen, but the Chairman pointed out that the Electrical Inspector of Mines was present to guide the jury. A case, however, was referred to in which a man who died from heart failure had his death attributed to electric shock.

The following dates for meetings of the branch were decided upon :—November 19th (Whitehaven), December 17th (Workington), January 21st (Whitehaven), February 18th (Workington), March 18th (Whitehaven), and April 22nd (Workington).

Mr. Williams then opened the discussion on the question of examinations for members, and mentioned that Prof. W. M. Thornton (Armstrong College, Newcastle) had offered to look the papers through for the first twelve months, and make the awards free of cost. Mr. Williams was himself in favour of the examination being conducted by a body independent of the association, and suggested that the papers should be divided into four classes, comprising mining rules and conditions, wiring, theory, and practical work. Various proposed details were spoken of, and the inclusion of ironworks electricians was suggested. The discussion then turned on the qualifications of a mining engineer, and it was generally agreed that qualification for the association's certificate should include so many years of practical experience. It was recommended that each candidate should serve or have one year's practical experience and third stage science and art of mining certificate, or two years as electrician underground. One or two other recommendations as to matters of detail were also made.

ELECTRICAL MINING ACCIDENTS

On September 20th last an assistant winder, J. Peel, at the winding-engine house of the Denaby Main Colliery, Mexboro', was killed in circumstances which point to electric shock being the cause of death. The winding-engine in question is driven by a 3,000-volt motor, with a liquid starter in the rotor circuit. It appears that the engineman had sent Peel to fill up the tank of the starter, and that shortly afterwards he heard an exclamation, and then found Peel lying insensible across a rail near the tank. It is supposed that Peel had put his hand in the water to see if it was hot, and that the motor had been switched in while his hand was in the water. He would have received a pressure of about 360 volts. The doctors' evidence pointed to heart failure as the cause of death, but the postmortem showed nothing to account for it, and no signs of burn. At the inquest on September 30th, the jury returned a verdict of accidental death by electric shock, sustained by Peel putting his hand into the liquid starter. Surprise was expressed by the engineers of the colliery that the engineman and Peel made a practice of testing the temperature of the water with their hands. Mr. R. Nelson (H.M. Electrical Inspector of Mines) was present at the inquest.

At the Hamilton Court, on October 14th, Sheriff Thomson and a jury investigated the case of T. Aitken, a miner of Home Farm Colliery, Ferniegair, who was killed while operating an electric coal-cutter of the disc-type. A verdict was returned to the effect that Aitken was killed while guiding an electric coal-cutter along the face, but it was stated that there was no satisfactory evidence as to the cause of death. Mr. R. M'Phail, electrical engineer at the colliery, and Mr. R. M'Laren, H.M. Inspector of Mines, both stated that they had thoroughly tested the coal-cutter, and had found nothing wrong with it. There was a complete system of earthing in use in the mine, and any leakage would have been indicated. Mr. M'Laren asserted that the man was killed through being drawn in between the skid and the haulage rope, and that the latter had crushed him so that his neck was broken. The doctor had first certified that Aitken's neck was broken, but later suggested something about electric shock.

An inquiry was held in Manchester, on October 24th, into the circumstances attending the death of T. Merrick, a "jigger" employed at the Bradford collieries, who was killed on October 19th by electric shock received by grasping a signal wire. It appears that the signal wire was in contact with the armouring of a cable, and that the armouring was alive. The electrician of the colliery stated that after the accident he found a leakage in a switch-box at the far end of the cable which would account for the armouring being alive. The pressure was 525 volts D.C. The current should not have been on at the time, but it was not discovered who had closed the switch. The jury returned a verdict of accidental death, adding that they considered the switch was too easy of access to unauthorised persons. Mr. T. H. Dixon, manager of the colliery, stated that this was the first trouble the company had had with the electrical plant, which had been employed in the collieries for eight years. He suggested that the switches should be placed under lock and key.

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Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during October.

Oct. 6th.—Monthly supplement on ELECTRICAL ENGINEERING IN MINES, opening with an account of the electrical installation at the Broxbourne Oil Co.'s shale mines, and a special article on electric lighting in mines also appears. A report is given of a recent case in which the Home Office prosecuted a mine manager for contravention of the special rules, and a short article summarises a few of the most important electrical mining patents published in September. Another article describes examples of electric power installations at New Zealand gold mines, and some interesting experiences with an electric pumping plant are described, showing how various difficulties were overcome.

Oct. 13th.—Standard Lampholders. Descriptions of new electrical supplies and accessories.

Oct. 20th.—The cost of lighting by metal filament lamps. Description of a new locking lamp holder. Engineering and Machinery Exhibition in Manchester. Portable ventilating set.

Oct. 27th.—Illustrated article on the arrangement of overhead mains at Dowlais. Appeal with regard to the Ilgner patent. Motors for machine tools.

BRITISH PARTICIPATION IN INTERNATIONAL EXHIBITIONS

WITH the close of the exhibition season it is interesting to call to mind the part that has been played by the recently formed Exhibition Branch of the Board of Trade. The work of the branch has been carried on quietly and unostentatiously, but has been of the greatest assistance to exhibitors. An organisation has been created capable of dealing with any number of exhibitions at which it is decided that it will be for the benefit of British trade to be represented. The trades and industries of Great Britain and Ireland which have any chance of extending their business in the country in question are made aware of the possibilities, and then are given an opportunity of purchasing space at a moderate figure. There are special rates for carriage by rail and by sea, and at the exhibition gates the British authorities take charge of the packing cases, assist in unpacking, provide stands, and arrange the exhibits if asked to do so. Suitable colour schemes are arranged for the different buildings, and every effort is made to ensure that each stand contributes to make the whole effective. Contracts are also made on a wholesale scale for the supply of gas, water, and electricity, for the benefit of exhibitors. Their packing cases are stored during the exhibition, they are assisted to re-pack, and have special transport facilities for the return of what has been unsold.

The work of the branch in organising a new British exhibit after the fire at Brussels will be fresh in the memories of many, and with regard to this, as well as the portions of the display that were unharmed, we understand that the results have been very satisfactory to many of the exhibitors. The awards at Brussels also, considering the number of firms exhibiting, show an unprecedented proportion of prizes to British exhibitors.

In addition to Brussels, the Exhibitions Branch of the Board of Trade has also taken part in an exhibition at Vienna, and in the four distinct exhibitions forming part of the centenary celebrations at Buenos Aires. It is noteworthy that in the Railway and Land Transport Exhibition forming one of the latter Great Britain controlled more than half the entire exhibit area.

Junior Institution of Engineers.—At the annual general meeting of this Institution, held recently, the retiring Chairman, Mr. Geo. T. Bullock, presiding, the Council's report was presented. The total membership at the end of the session was 1,089, and the report makes reference to nine ordinary meetings, at which the average attendance was 114; a large number of visits have been paid to engineering works, and special reference was made to the summer meeting in Ireland, when works in and around Dublin and Belfast were seen. The gatherings, which take place on Friday evenings at the rooms of the Institution, 39 Victoria Street, Westminster, have been well attended, informal discussions on matters of interest to the members having taken place; the library and other features of interest were alluded to, and reference made to the acceptance of Sir J. J. Thomson, F.R.S., of Cambridge University, of the position of President for the ensuing year. The ballot for officers and members of Council for the new session resulted in the election of Mr. J. Wylie Nisbet, M.I.Mech.E., as Chairman, and Messrs. B. E. Dunbar Kilburn and S. Bylander as Vice-Chairmen, and Messrs. A. H. De Ritter, J. H. Pearson, H. P. Philpot, and W. A. Tookey, as members of Council succeeding those retiring by rotation.

ELECTRIC LIGHTING FOR THE PALLADIUM THEATRE OF VARIETIES

WE understand that this building in Argyle Street, Regent Street, which is said to be the largest of its kind in London, will, when complete, also be second to none in regard to the lavishness of its illumination and the handsome designs of the hand-made electric fittings. Whilst certain minor details of the lighting are still undecided, it can be stated that the fittings in the auditorium will be chiefly of the Georgian type in a dull brass finish. The main ceiling will have two 50-light electroliers, eight 10-light electroliers, and other fittings; corresponding designs of brackets, three-light pendants, and ceiling fittings will be employed for the fronts, ceilings, and walls of the various circles. The stalls, saloon, lounge, and landings will be lighted by electroliers and other fittings of specially heavy Georgian design, whilst fittings of Louis XV. style in gilt and crystal have been selected for the dress circle saloon. The floats, battens, hanging lengths, proscenium lights, bunches, &c., for the stage lighting are all of the most modern types, and efficient provision has been made for the lighting of the passages, dressing-rooms, and other similar situations. The fittings for the interior allow for an aggregate of approximately 1,200 lights, whilst a large number of special signs and arc lamp brackets will be mounted on the exterior. "Tantalum" and "Onewatt" lamps and Siemens' arc lamps will be employed exclusively for the lighting, and the whole of the fittings are being supplied by Messrs. Siemens Bros. Dynamo Works, Ltd. (Fittings Department, Tyssen Street, Dalston), whose own artist is responsible for the accepted designs.

THE INSTITUTION AND LOCAL SECTION MEETINGS

THE opening meeting of the 1910–11 session of the Institution of Electrical Engineers will be held at the new home, Victoria Embankment, London, on Thursday, November 10th, at 8 p.m., when the premiums awarded for Papers read or published during the session of 1909-10 will be presented, and afterwards the President, Mr. S. Z. de Ferranti, will deliver his inaugural address. The meetings will be held fortnightly as usual.

The Manchester Local Section commenced its meetings on October 28th, and an abstract of Mr. J. S. Peck's inaugural address will be found on another page of this issue. The Manchester Section stands alone in holding more than one meeting a month, but the session at Manchester ends earlier than at any of the other Local Sections except Newcastle-on-Tyne, in March. The November meetings at Manchester will be held on the second and fourth Tuesday of the month, but this day is not adhered to throughout the session. The following is the programme:—November 8th, "Irregularities in the Rotating Field of the Polyphase Induction Motor," by C. F. Smith; November 22nd, "The Conditions affecting the Life of Electrical Machinery," by A. B. Mallinson; December 6th, "The Methods of Braking in Electric Winding Engines," by Dr. E. Rosenberg; December 20th, "Merz-Price and other Discriminative Protective Apparatus for A.C. Circuits," by K. Faye-Hansen and G. Harlow; January 17th, 1911, "Electric Heating as applied to Cooking Apparatus," by Harold Gray; January 31st, "Breaking High and Low Potential Circuits," by A. G. Collis; February 14th, "Pertinent Features in the Insulation of Electrical Machines," by A. P. M. Fleming and R. Johnson; February 24th, Annual Dinner; February 28th, "Heating Effects in Cables," by C. J. Beaver; March 14th, "Electricity Meters," by H. A. Ratcliff and A. E. Moore; and March 28th, Annual General Meeting. Lecture by Prof. J. A. Fleming.

The Birmingham Local Section holds its meetings on the second or third Wednesday in the month, and commences on November 16th. At Dublin, Thursday is the meeting day, the first being on November 10th; whilst the Glasgow Local Section usually meets on the second Tuesday of the month, and commences on November 8th. At Newcastle the next meeting is on Monday, November 21st; and the Yorkshire Section meets on November 16th at the Leeds University, but the meetings of this Section alternate between Leeds and Sheffield.

Embezzlement.—J. Downes, formerly Traffic Superintendent of the Lanarkshire Tramways Co., was sentenced to three months' imprisonment at the Glasgow Sheriff's Court last week for the embezzlement of about £550, which had been lodged with him by applicants for shares in respect of the Company's recent tramway extensions.

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THE PRICE OF CURRENT FOR TRAMWAYS

THE arbitration to determine the price which the Paisley District Tramways Co. shall pay the Paisley Corporation for electrical energy was concluded on Wednesday and Thursday last week. The price now paid by the company averages 1·4d. per unit, which it has been paying for the last seven years under the terms of the Act of Parliament authorising the tramways. The period for revision has now arrived, but the Corporation resist any reduction in the price, and the matter has been referred to Mr. Robert Hammond to arbitrate upon. The previous proceedings were reported in our issue for October 13th and 27th.

The remaining witnesses were Mr. James Townley, the station engineer at Paisley, and Messrs. S. L. Pearce (City Electrical Engineer, Manchester) and W. M. Mordey. It may be remembered that Mr. Pearce has been one of the representatives of the Incorporated Municipal Electrical Association in the conference with the Municipal Tramways Association to settle a basis upon which charges for tramway energy should be formulated. This arbitration has attracted a considerable amount of attention, not because in itself it involves any great amounts either of money or energy, but on account of the fact that Mr. Hammond's award will come at a moment when considerable dissatisfaction is being expressed all over the country at the charges made for tramway energy, both by tramway companies taking a supply from municipalities and by tramway committees who are supplied by electricity committees.

As already stated, the present charge at Paisley is an average of 1·4d. per unit; the company suggest a substitution of a new sliding scale for the present one, which will reduce the average price to 0·56d. per unit. The Corporation say that if this latter were adopted, it would not cover the present works costs, and would mean a loss of revenue amounting to £4,000 annually, whereas the whole undertaking only brings in about £300 profit after meeting capital charges. Mr. Pearce and Mr. Mordey, each working at the problem from different points of view, state that the total costs at Paisley for tramway purposes must be put at 1·3369 and 1·321 respectively, whilst, if the costs of 1904—when the tramway load was first added—were taken, and the extra cost of generating the tramway units adopted as the basis of calculation, the charge would be 1·02d., after adding capital charges. But both think the latter is the wrong method.

With regard to the amount of plant available for tramway purposes—and the price is necessarily affected by this, owing to the capital charges—Mr. Pearce did not think a 750-kw. and two 500-kw. sets, as well as a 200-kw. motor generator, which is partly used for tramways, excessive for a load of at most 850 kw., although he admitted he was unable to point to an instance in which the proportion of plant to load was so great. Likewise, Mr. Mordey had no fault to find on this ground, but in his speech for the company Mr. Talbot, K.C., ridiculed the idea of having to pay the capital charges on 1,720 kw. of plant when the whole load on the station, tramways, power, and lighting had never yet exceeded 1,312 kw. A point strongly relied on by the Corporation, however, is that the Corporation are under financial penalties should a failure of supply occur, and that the large reserve of plant is necessary on this account.

A curious feature in Paisley is that, instead of being able to induce the few large works there to come on to the mains, these are actually leaving the Corporation supply and putting in private generating plants. Taking advantage of this unfortunate state of affairs, Mr. Balfour Browne, K.C., for the Corporation, argued that the arbitrator must not proceed on the lines of a possible decrease in the works costs during the next seven years, as an increase in the power load could not be relied upon. He said the only basis of calculation must be the present cost to the Corporation, having in view the special plant installed for tramway purposes, and he hinted that if the arbitrator dealt with the question in any other way, he would have to ask him to state his award in the form of a special case for the Court of Sessions. He also contended that any question of the price at which the company could purchase from another authority or could generate for themselves must be put on one side, as they were bound by Act of Parliament to take their supply from the Corporation. The fact that the capital expenditure per kw. at Paisley, viz., £38, compared with such large towns as Glasgow and Manchester was also emphasised.

In his reply for the company, Mr. Talbot, K.C., twitted the Corporation upon having kept the Clyde Valley Power Co. out of their area originally by the argument that they could supply as cheaply as the company, and yet they now frankly confessed they could not, because the company were actually supplying the tramway company at 0·65d. per unit, and would supply on these terms to the whole of the tramways if they were allowed. He claimed that the Corporation should be kept to the argument they put before Parliament. He also wanted to know how it was, if the Corporation were making a profit on power supply at 1·19d. per unit, they would lose if the tramway supply were charged at less than 1·4d. per unit. The tramway company were entitled to the same terms as a power user taking the same quantity, but the evidence was that power users taking less were charged a lower rate.

Mr. Hammond reserved his award.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

OSRAM LAMPS.—A brightly coloured card which is being issued by the General Electric Co. (67 Queen Victoria Street) represents the exterior of a brilliantly lighted first class railway carriage. Opening the door of this, we are met with a reproduction of the well-known Comet Osram poster and an inscription on the inside of the door to the effect that 1st class light can be obtained at 3rd class cost by using Osram lamps. A larger reproduction of the poster forms the cover of a folder pointing out the advantages of these lamps, and both, which are certainly very effective, are arranged so that the name and address of any dealer can be added.

ALUMINIUM WIRE AND ROD.—A leaflet from the British Aluminium Co., Ltd. (109 Queen Victoria Street, London, E.C.), contains a comparative table of the physical, mechanical, and electrical properties of aluminium and copper, and tables of dimensions, weight, resistance, and current-carrying capacity of aluminium rod for switchboard and machine connections, and of aluminium wire, both hard-drawn and annealed.

DRUM TYPE CONTROLLERS.—The British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), has just issued a new catalogue of reversing drum type controllers for series shunt and combined wound motors, cranes, hoists, winches, machine tools, textile and printing machinery, general industrial work, &c. These controllers are of the single-handle type, built on the metal and mica principle as supplied to the British Admiralty. Each part is standardised as a detachable unit in itself, so that replacements and repairs may be effected from stock parts. The parts are so arranged that the controller is easily opened up for inspection and cleaning. The drum rings, finger bases, and switch parts are clamped on to mica insulated steel bars producing a rigid and fireproof construction, withstanding severe climatic conditions without deterioration.

STORAGE BATTERIES.—A new leaflet from the Hart Accumulator Co., Ltd. (Stratford), gives prices of their lighting type cells, with illustrated particulars of the construction of the plates, which combine the advantages of the Planté and Faure types, and of the Hart patent non-corrosive terminal.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METAL FILAMENT LAMPS.—The latest list of "Mazda" lamps has an attractive coloured cover reproducing the idea of the British Thomson-Houston Co.'s well-known poster in which the sun, his only rival, is seen peeping round the earth at a Mazda lamp. Full particulars are given of all sizes of these metal filament lamps, and they are rated throughout in British candle-power. The 200-volt lamps are now made in sizes down to 22 c.p. (32 watts), and the smallest 100-volt lamp is 14 c.p. (17 watts). Smaller lamps of lower voltage are also made, and the large sizes range up to 360 c.p. (400 watts). Special 24-volt train-lighting lamps are also supplied, and a series of candle lamps with miniature holders has been prepared for running two or three in series on the ordinary supply voltages for the conversion of candelabra fittings from carbon to metal filament lamps. Other special lamps include 6-watt 5-c.p. 20 to 25 volt sign lamps and Magda automobile lamps. It is important to notice that the company undertakes to defend all claims in actions for infringement of British patents in respect of the sale or use of Magda lamps.

INCANDESCENT LAMPS.—New pamphlets have lately been issued by the Rugby Lamp Co., Ltd. (London agents, J. L. Cateaux and Co., 10 Bush Lane, E.C.), giving prices of the "Rugby" metal filament and carbon lamps made at the company's works at Lower Hillmorton Road, Rugby. The metal lamps are supplied in sizes up to 55 watts for all ordinary voltages, and down to 32 watts at 200/260 volts and 17 watts at 100/135 volts low voltage, and candle lamps are also made.

LANTERNS AND REFLECTORS.—Two new cards from Siemens Brothers Dynamo Works, Ltd. (incandescent lamp and fittings department, Tyssen Street, Dalston, N.E.), deal respectively with the new Holophane stilette reflectors, indicating for which size of tantalum and "one-watt" lamps each shade is suited, and the form of outside weather-proof lantern illustrated on page 651 of ELECTRICAL ENGINEERING of October 13th.

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ELECTRICAL VEHICLES IN AMERICA

IN connection with the encouragement now being given to the use of electrical vehicles in London by the Marylebone Electricity Department, who are offering to supply current at special rates for battery charging (see ELECTRICAL ENGINEERING, October 27th, page 685), it is of interest to note the activity of the electrical vehicle interests in America. The issue of the *Electrical World* (New York) for October 20th, for example, contains no less than five articles dealing with the subject. One of these is an account of the first annual Convention at New York of the recently formed Electric Vehicle Association of America, to which is affiliated several local organisations with the same objects. The President in his address dwelt on the necessity for standardisation of voltages, charging arrangements, and equipment, and spoke of the improvement in the behaviour of batteries. A paper was read on "Problems Involved in Advancing the Use of Electric Vehicles," by Mr. W. P. Kennedy, and the most recent performances of the Edison battery were recounted by Mr. F. L. Dyer. A paper on the relation of the central station to the electrical industry was read by Mr. T. A. Furguson, and the question of heavy electric vehicles was dealt with by Mr. Hutchings. Another address was recently delivered before the Electric Club of Chicago on the increasing importance of the electric vehicle.

A short article in the same issue describes arrangements for vehicle battery charging in Detroit, where there are about 400 electric pleasure vehicles and 25 large vans, and the cost of current to the owners works out at about 2½ cents (1¼d.) per unit. In Toledo, according to another article, there are 700 electric vehicles (for a population of about 170,000). Current is here sold to the large garages at 2·5 to 3 cents per unit (1¼d. to 1½d.). Private garages are charged 5 cents (2½d.).

In the fifth article a new type of accumulator omnibus is described, which is the first to be equipped with Edison batteries. This seats 30 passengers on a single deck, and is intended to run 56 to 75 miles on one charge. The weight of the vehicle is said to be under 8,000 lbs., of which 20 per cent. is that of the battery, and it is propelled by two 7 h.p. motors.

RE-ORGANISATION OF THE L.C.C. TRAMWAY STAFF

CONSEQUENT upon the resignation of Mr. J. H. Rider from the post of Chief Electrical Engineer to the Tramways Department, the Highways Committee of the London County Council proposed certain rearrangements of the staff (effecting a saving of £300 per annum), which were duly authorised at the meeting of the Council on Tuesday night.

As at present organised there is an official in charge under the Chief Officer of Tramways of each section of the department, but there is no one in the position of deputy to take charge of the whole department in the Chief Officer's absence, and to relieve him of any of the vast amount of detailed work which the position involves. Mr. J. K. Bruce, the present Traffic Manager, is now appointed to the post of Deputy Chief Officer at his present salary of £950 per annum, rising on April 1st next to £1,000 per annum. In order to fill the vacancy thus created in the Traffic Department, a Traffic Assistant is to be appointed at a salary of £600 per annum, and applications for this appointment will be invited by public advertisement.

With regard to the electrical work of the department, the Committee think, now that the Greenwich power-house is practically completed and the electrical equipment of the lines is well advanced, that the post of Chief Electrical Engineer should be abolished, and that Mr. J. Shepherd, at present Assistant Electrical Engineer with a salary of £600 per annum, should be promoted to Electrical Assistant in the Tramways Department to take charge of the electrical section, at a salary of £800 per annum. In addition, the salary of Mr. W. P. Farquharson, the General Assistant, is to be increased from £500 to £600 per annum.

THE PREPARATION OF RUBBER

MESSRS. DAVID BRIDGE & CO., Castleton, Manchester, inform us that they have been awarded a grand prix at the Brussels Exhibition for their exhibit of rubber preparation machinery in connection with the Colonial section of the Exhibition at the Parc de Tervueren. The firm had a complete installation in the Exhibition itself, and in the basement they had a second plant actually at work in which the raw latex from the trees was coagulated by the Da Costa patent smoking system, put through the various machines, and prepared ready for manufacture in crêpe, sheet, and block form. The various methods of extraction and cleansing of wild rubber were also demonstrated.

The Da Costa process is designed to supersede the old native method of coagulation by smoking, and an outline of its nature may be of interest.

The latex, being brought from the field, is strained if it is found to contain mechanical impurities, and then poured into the coagulating tanks. Steam is meanwhile being raised to about 30 to 35 lb. in the boiler, forest woods alone being used for fuel. On to the burning wood in the furnace are then thrown green palm leaves, nuts, or any green twigs of tropical trees, the distillation of which produces acetic acid, whilst the fumes of the green foliage will be found to contain creosote to some extent. These fumes are accumulated in a special receptacle after being cleared of cinders, &c., and they are then forced into the coagulating tanks by a steam injector. The force of the steam violently agitates the latex, and during this operation every particle of it is reached by the smoke. In about ten minutes, or rather more if the quantities to be dealt with are very large, the caoutchouc globules coagulate and separate from the lyes and rise to the surface. The coagulating substance, after being allowed to cool off in the tanks, is immediately cut up into suitable sizes and passed through the macerating, crêping, and sheeting machinery. With the Da Costa system it is not necessary to subject the newly coagulated rubber to excessive maceration, because it does not contain strong manufactured acetic acid. Crêping or sheeting is only necessary for quick drying. After being dried in an open and well-ventilated room or steam-heated drying chamber, or by the vacuum drier, the rubber is ready for exportation, unless it is required to be blocked, when it can be taken to a small press and turned out in the shape of flat block rubber.

Messrs. David Bridge & Co. have for long specialised in rubber-preparing machinery. A handsome souvenir of their exhibit at the Brussels Exhibition illustrates a number of types of machines both for the preparation of rubber and for its treatment by manufacturers, the latter class including hydraulic vulcanising, rubber belt presses, calenders, grinders, mixers and sheeters, hose-making machines, rubber-proofing machinery, cable-making machinery, lead presses, and examples of the application of their well-known friction clutches.

AN OSRAM ADVERTISING DEVICE

THE accompanying illustration represents a new translucent paper shade, which the General Electric Co. (67 Queen Victoria Street) are distributing among contractors throughout the country to call attention to Osram lamps. These shades can



NEW OSRAM ADVERTISING SHADE.

be attached to any lamp-holder with the usual shade ring, and from the brightly coloured sample with which we have been favoured we can say that they are certainly most effective.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published October 27th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

22,823/09. **Locking Lamp Holder.** C. DAMEY (London). The liner of the holder has a bell-shaped mouth and two holes instead of the usual bayonet slots. The lamp cap is provided with plunger pins pressed outwards by spiral springs within the cap. On inserting the lamp, the pins are pressed inwards by the bell-shaped mouth, and the lamp is then turned until the pins coincide with the holes, when they spring out and lock the lamp. A special tool is provided for pressing in the pins in order to remove the lamp. Six figures.

24,437/09. **Tungsten Filaments.** E. RUHSTRAT. (Goettingen, Germany). In order to obtain finer and stronger filaments by such processes in which the tungsten is mixed in the form of a powder with a binding material and then squirted, the tungsten is reduced to a very fine powdered state by first heating to a temperature higher than its melting-point in an arc, and then suddenly cooling it. The product is extremely brittle, and can be ground so fine that it approaches the colloidal state. One figure.

24,566/09. **Enclosed Flame Arc Lamp.** H. HIRST and A. E. ANGOLD (Salford). In a vertical carbon enclosed or semi-enclosed flame lamp the upper carbon is surrounded by a tube of sufficient diameter to produce a good upward draught, and this tube is surrounded by a second fixed tube, there being communication between the tubes at top and bottom. The inner tube is automatically fed downwards, so that its mouth is always just above the arc. The condensed fumes from the arc are deposited on the outer tube. Two figures.

824/10. **Armature Cores.** CROMPTON & CO., LTD., J. C. MACFARLANE and H. BURGE (Chelmsford). To assist cooling, the radiating surface of the armature is increased by using core-discs of two different diameters, one slightly greater than the other. By threading these discs on alternately, the larger ones give radiating surface at the sides as well as at the edges. Two figures.

2,983/10 and 3,610/10. **Tungsten Filaments.** WESTINGHOUSE METALLFADEN-GLUHLAMPENFABRIK GES. (Vienna). The first specification describes a method of decarbonising tungsten filaments, consisting in heating a large number together in a vacuum furnace to a very high temperature. An electric resistance furnace for this purpose is described. It is stated that with a good vacuum and a temperature of about 1,200° C. the carbon content can be reduced to 0·04 per cent. The second specification claims the process of adding a quantity of pure powdered tungsten (from 40 to 50 per cent.) to a paste of tungsten dioxide and binding material before squirting. Strong filaments can be produced from such a mixture without raising the temperature above 1,000° C. during the reduction of the dioxide.

4,098/10. **Geissler Tube Lamp.** E. URBAIN, A. FEIGE and C. SCAL (Paris). A high-efficiency lamp consists of a Geissler tube containing phosphorescent sulphides painted on the inside surface of the tube or fixed on a support. The tube may contain a rarefied gas, helium being suitable. The sulphide is excited by the action in the tube, and emits a white light.

5,561/10. **Enclosed Flame Arc Lamp.** T. L. CARBONE (Berlin). A globe for enclosed flame lamps of the converging carbon pattern has a small hemispherical lower portion close to the arc, and an upper portion made in the shape of a double umbrella extending laterally over the periphery of the lower chamber. The hemispherical part keeps hot and clear while the fumes are condensed in the cool, upper annular chamber, which thus acts also as a reflector. One figure.

6,895/10. **Long Distance Telegraphy.** A. PETERSEN and G. SEM (Christiania). Two or more microphones are used, each having a separate battery of cells in series with it. The several sets of microphones and cells are connected in parallel with the primary of the induction coil. One speaking trumpet leads to all the microphones. One figure.

Opposition to Grant of Patent

12,844/09. **Magneto Massage Machine.** B. SEACOMBE. The Comptroller has given a supplementary decision granting this patent on condition that certain amendments are made. The patent was refused in the first place as the result of opposition. It describes an apparatus consisting of a roller with a corrugated metal surface, driving a magneto-generator through a gear train. By means of a contact-making device, an intermittent current is passed from the roller through the part being massaged.

18,494/09. **Vacuum Cleaner.** T. WIEDERMANN and J. H. TEMPLIN. Opposition has been entered to the grant of this patent. It covers a self-contained vacuum cleaner comprising a single-acting diaphragm pump driven by an electric motor.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: NEU, 23,014/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MAVOR and MAVOR & COULSON, LTD. [A.-C. power-plants] 27,478/09; SIEMENS-SCHUCKERTWERKE GES. [A.-C. power transmission] 3,117/10.

Dynamos, Motors, and Transformers: HEYLAND [Single- and polyphase motors] 22,932/09; LEAKE [Motor control] 23,217/09; STERN [Windings for A.-C. motors] 23,553/09; LIPPELT [Machines] 23,756/09.

Heating and Cooking: PLETTS and BELL [Cooking and heating apparatus] 23,818–9/09; COOPER [Heat-insulating composition for ovens] 25,084/09.

Incandescent Lamps: VITANOFF [Portable lamps] 23,808/09.

Instruments and Meters: LANCASTER [Prepayment meters] 20,638/09.

Storage Batteries: ACCUMULATEURS TUDOR SOC. ANON. [Packing charged negative plates] 18,398/10.

Switchgear, Fuses, and Fittings: SIMPSON [Chain pendant fittings] 22,988/09; HORSTMANN and EDGAR [Time switches] 23,161/09; MALEY [Resistances] 23,216/09; HARRISON [Supports for lamps] 23,980/09; DEY [Motor controllers] 24,208/09; REASON MANUFACTURING CO. [Automatic flash-light device] 30,000/09; BROOKS and ALSTON [Switches] 800/10.

Telephony and Telegraphy: THOMPSON (*Ges. für Drahtlose Telegraphie*) [Apparatus for strengthening weak electrical impulses] 10,210/10; O'HARA [Sanitary telephone mouthpieces] 15,448/10; EISENTEIN [Oscillation generator for wireless telegraphy] 16,356/10.

Traction: WHITELEY [Tramcar life-guards] 30,457/09; AIKMAN [Automatic signalling] 12,172/10.

Miscellaneous: BARNES and JENSEN [Lifts and hoists] 4,715/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: GES. FÜR MASCHINEN- UND METALL- INDUSTRIE, 22,841/10.

Distribution Systems, &c.: GEB. SIEMENS & CO. [Fireproof conductors] 19,866/10.

Electrometallurgy: MASSIP [Electric steel furnaces] 22,777/10.

Incandescent Lamps: WESTINGHOUSE METALLFADEN GLUHLAMPENFABRIK GES. [Metal filament lamps] 22,852/10.

Switchgear, &c.: DASSENOY [Starter for synchronous motors] 23,174/10.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

24,617 of Nov. 4th, 1896. **Sectional Water-tube Boilers.** W. FAIRWEATHER (*Babcock & Wilcox Co., U.S.A.*). This patent covers means for securing circulation in the tubes, and a construction enabling the boiler to be suspended and providing for the longitudinal expansion of the tubes. The first of the thirteen claims is for "a transverse water-box connected to upright columns which support said box and to front headers and drum by short tubes or nipples, whereby the boiler is suspended at the front to said box and columns."

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: ELEKTRICITÄTS A.-G. VORM. W. LAHMEYER & CO. [Polyphase commutator machines] 14,317/05; L. J. HUNT and SANDYCROFT FOUNDRY CO. [Variable-speed induction motors] 14,401/05.

Heating and Cooking: A. VOELKER [Heating elements] 14,256/05.

Instruments, &c.: C. H. HUTCHINSON [Prepayment meters] 14,456/05.

Switchgear, &c.: C. G. GARRARD and FERRANTI, LTD. [Reverse current and overload relays] 15,403/03; VERITYS, LTD., and A. E. GOTT [Fuse and distribution boxes] 15,646/04; SIEMENS BROS. & CO. (*Siemens-Schuckertwerke Ges.*) [Regulating switch gear for transformers and storage batteries] 14,210/05; C. RUZICKA [Resistance units] 14,400/05.

Traction: G. M. HARDINGHAM (*Kelten & Guilleaume Carlswerk A.-G.*) [Rail bonds] 12,466/00.

Miscellaneous: K. J. RAMSPECK [Electromagnet coin sorter] 14,176/01; HELE-SHAW PATENT CLUTCH CO. and W. WALLACE [Reversing gearing] 15,352/04; W. P. THOMPSON (*Maschinenfabrik Augsburg, Nürnberg*) [Gas tester] 15,706/04; E. E. RIETER-BODMER [Insulating material] 15,795/04; J. J. RAWLINGS and RAWLINGS BROS. [Conduit bending device] 14,372/05.

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LOCAL NOTES

Acton: *Proposed Sale of Electricity Undertaking.*—A meeting of ratepayers has protested against the manner in which the Council propose to sell the electricity undertaking to the Metropolitan Electric Supply Co., and the Board of Trade, the Local Government Board, and Mr. H. Neild, M.P. for the district, are to be asked to use their efforts to prevent the Bill authorising the transfer being passed by Parliament.

Bournemouth: *Conduit System Abandoned.*—The report of the Tramways Manager in favour of substituting the overhead system for the conduit system in the centre of the town (ELECTRICAL ENGINEERING, May 12th, 1910), which had already been adopted by the Tramways Committee, was passed by the Corporation last week.

Bradford: *Smoke Prevention.*—A deputation of the Bradford Electricity Committee paid a visit to the Glasgow Smoke Exhibition a short time ago, and have now reported to the Committee. The deputation think it would be advantageous if the Bradford Gas and Electricity Departments combined to hold a similar exhibition.

Brighton: *Proposed Tramway Running Powers.*—The recommendation of the General Purposes Committee not to agree to the proposal to allow tramcars from Worthing to run over the Corporation lines was adopted at the Council meeting last week. The proposal was to construct tramways from the terminus of the Corporation lines through Hove and on to Worthing, the work being carried out by the British Electric Traction Co.

Price of Tramway Energy.—A joint Sub-Committee of the Lighting, Tramways & General Purposes Committee, which has been considering the price to be paid by the Tramways Department to the Lighting Department for electrical energy, has decided to reduce it from 1·35d. to 1·2d. per unit.

Burnley: *Speed on Tramcars.*—An inquiry was held last week by the Board of Trade concerning an application by the Corporation to increase the speed on various sections of the electric tramways to a maximum of 16 miles per hour.

Devonport: *Through Tramway Facilities.*—The Devonport and District Tramways Co. have asked the Council to appoint a small Committee to discuss the question of through running.

Eccles: *Charges for Electricity.*—The Council have decided as an experiment to supply electricity to the tenants of a selected block of cottages at a charge of 6d. per week. It is estimated that the actual cost to the Corporation will be 4d. per week per tenant. The cottages in question contain three and sometimes four lights.

Glasgow: *Tramway Extensions.*—The Kirkintilloch Council are again urging the Corporation to extend their tramways to that district.

Halifax: *Proposed Tramway Extensions.*—The Corporation will apply for powers to construct tramways to Staniland, Elland, and Ripondon on condition that the respective District Councils will guarantee an annual contribution of £300 per route mile. It is also proposed to extend the tramways to Wainstalls, and to seek powers to run trolley omnibuses in Queen's Road.

London: *Holborn: Street Lighting.*—The Metropolitan Electric Supply Co., the County of London Electric Supply Co., and the Gas Light & Coke Co. are putting in a competitive scheme of street lighting in Gower Street in order to assist the Holborn Borough Council to come to a decision upon the question of street lighting generally, concerning which there has been considerable controversy recently.

Bermondsey: Competition with Companies.—The Council have decided to apply for a Provisional Order authorising them to supply electricity in the parishes of St. Olive, St. Thomas, St. John, and Horsleydown. At present both the County of London Electric Supply Co. and the London Electric Supply Corporation are supplying in the district, and already three applications by the Council for similar powers have been refused by the Board of Trade, partly on the ground that competition of this character is not permissible under the Electric Lighting Acts, and partly for the reason that the companies are supplying in some cases more cheaply than the Borough Council is in its own district. The proposal to make a further application was passed by a vote of 28 to 23.

Hammersmith: Underground Wires.—The Council have refused their consent to the erection of an overhead telegraph line in Ravenscourt Park.

Marylebone: Charge for Radiators.—With reference to our article on the rapid development in the installation of radiators in Marylebone, the Electricity Committee now recommend that the annual charge of £2 2s. on the telephone system be abolished, and only the charge of 1d. per unit for energy consumed imposed.

Middlesex: *Tramways.*—The report of the Light Railways & Tramways Committee for the year to March 31st shows a capital expenditure to date of £1,672.440. The traffic receipts from the Middlesex tramways during the year were £326,441, and the rents received have been sufficient to pay the full interest on the capital expenditure.

North Berwick: *Electric Lighting.*—An agreement has been completed with Messrs. Crompton & Co., Ltd., for the erection of an electric power-house.

Scarborough: *Proposed Stoppage of Tramways.*—A Board of Trade inquiry was held at Scarborough last week in connection with the proposal of the Scarborough Tramways Co. to suspend their service altogether during the winter months. It was stated that during 1909 the company lost over £2,000, that nothing had been set aside for depreciation since the commencement, and that no dividends have been paid. The Corporation appear to prefer that the undertaking should be abandoned altogether rather than that the cars should be run during the summer months only. Mr. F. E. Gripper, on behalf of the company, said that whereas in the winter the running costs were 8·5d. per car mile, the total receipts had never been more than 5·5d. per car mile. If the Board of Trade refuses to allow the winter service to be discontinued, Mr. Gripper said that the company would be obliged to close down the trams altogether.

Stockton: *Suggested Tramway Extensions.*—The local Chamber of Commerce propose to wait upon the Town Council to suggest extensions of the tramways in various directions. The Middlesbrough, Stockton & Thornaby Tramways Co., of which Sir Clifton Robinson is Chairman, are disposed to consider the proposal if an extension of the present purchase period is conceded.

Torquay: *The Dolter System.*—In view of an arrangement between the Corporation and the tramway company to substitute overhead traction for the Dolter system, the Board of Trade have decided to renew the licence for the Dolter system until the conversion has taken place.

Willesden: *Electricity Accounts.*—The accounts of the electricity undertaking for the year to March 31st show a net profit, after meeting capital charges, of £1,600. The number of units sold for all purposes was 2,324,689 against 2,227,086 in the previous year. The load factor has improved from 17·35 per cent. to 19·02 per cent. The total costs, including interest and sinking fund, were 2·680d. against 2·741d.

Worthing: *Management of Electricity Undertaking.*—The Electricity Committee have reported that the allegations as to the mismanagement of the electricity undertaking, to which reference was made in our last issue, are absolutely without foundation. Consequently it has been decided not to hold an inquiry as was asked for by the Electrical Engineer. Mr. G. Porter, the Borough Electrical Engineer, received considerable praise from the Electricity Committee for the manner in which he carries out his duties.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Barking.—An application is to be made for a loan of £11,000 for extensions at the electricity works.

Bispham.—Sanction has been received for the erection of an electricity works in Redbank Road.

Gloucester.—A loan of £14,000 for electrical extensions is to be applied for.

Greenock.—Extensions involving an expenditure of £16,000 are contemplated.

Peterborough.—A loan of £2,000 has been sanctioned for electrical extensions.

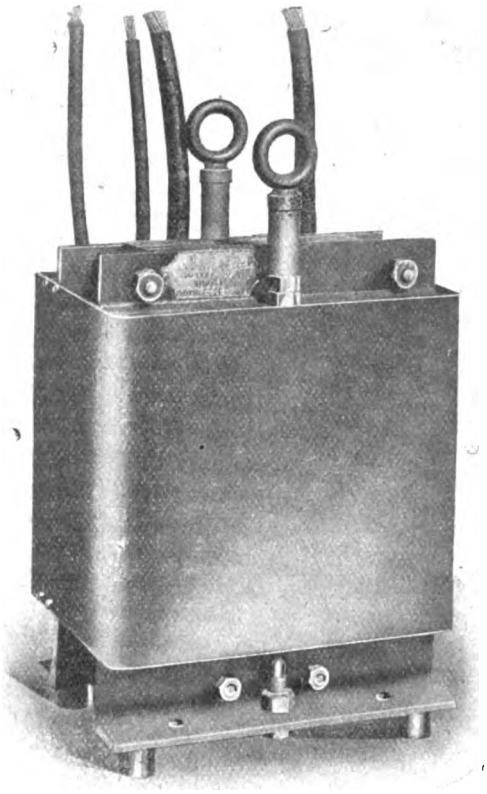
Portrush.—The Council have under consideration a report by Messrs. Miller, Wilson & Pegg, of Belfast, for the erection of an electric power station at an estimated cost of £5,475.

Portsmouth.—A loan of £20,586 has been sanctioned for electrical extensions.

Sittingbourne.—Power-house at the Sittingbourne Paper Mills.

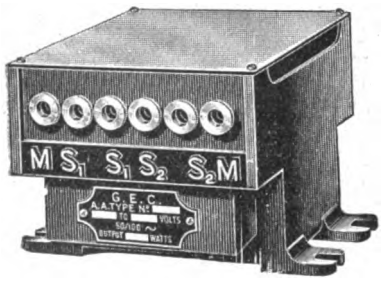
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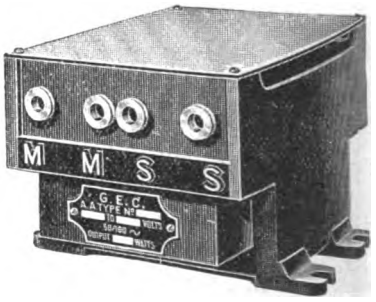
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BRANCHES:

Manchester: Victoria Bridge.
Glasgow: 71, Waterloo Street.
Birmingham: 42, High Street.
Newcastle-on-Tyne: 30, Gallowgate.
Cardiff: Womanby Street.
Dublin: 16, St. Andrew Street.
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PARIS, MADRID, MILAN, CAPETOWN, and JOHANNESBURG, &c., &c.

WORKS: Witton, Birmingham, Manchester, London.

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Stoke-on-Trent.—In order to provide duplicate mains for certain large power users, another feeder is to be laid from the Burslem works at an estimated cost of £1,000.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Whiteley's new store. Architects, Messrs. George Belcher, R.A., and J. J. Joass.

Extensions of Avenue Telephone Exchange. H.M. Office of Works, Storey's Gate.

Fulham Empire. Mr. Oswald Stoll.

New schools or extra accommodation for additional children are proposed by the London County Council in Stepney, Poplar, Greenwich, Lewisham, Camberwell, and Battersea.

Alteration of Nos. 42 and 43 Cranbourne Street, Westminster, into residential flats.

Coroner's Court at Poplar.

New Court-house at Hendon.

PROVINCES.

Aberdare.—Central Free Library.

Acton.—Pavilion at Isolation Hospital.

Ashington.—New municipal buildings.

Barnsley.—Extension to Beckitt Hospital.

Birmingham.—New church at Perry Bar. Birmingham Mission.—New police station in Allison Street.

Bishop Auckland.—New post office. H.M. Office of Works, Storey's Gate, London.

Blackpool.—Reconstruction of Opera House in Winter Gardens.

Bootle.—Balliol Council Schools. Specifications from Borough Electrical Engineer.

Bradford.—Rebuilding of premises in Thornton Road. Architect, Mr. A. R. Hill, 23, Piccadilly, Bradford.

Bridgend.—New Council Offices.

Buxton.—Cottage hospital.

Cardiff.—Technical school in Cathays Park.

Christchurch.—New Workhouse Infirmary.

Colwyn Bay.—New Drill Hall.

Darlington.—Cinematograph theatre. Darlington Cinematograph Co.

Deal.—New Bank Premises.

Dover.—Electric theatres at Dover, Deal, and Folkestone. Local Company.

Dundee.—Additions to Fever Hospital.

Edinburgh.—Four-storey building at the Vennel. Salvation Army.

Additions to married quarters at barracks in Johnstone Terrace. Alterations to Board School in Lauriston Place.

Exeter.—Extensions to Sanatorium. Borough Surveyor.

Folkestone.—Considerable additions to Grand Mansions, The Leas.

Frome.—Manual Instruction Centre for the County Council.

Guildford.—Alterations and additions to "Cannon Inn." Friary Brewery Co.

Harwich.—Proposed Technical Institute.

Hull.—Alterations to Park Street Barracks.

Leicester.—New elementary school in Hinckley Road.

Liverpool.—Conversion of Seafield House into Asylum. Lancashire Asylums Board.

Loughborough.—St. Peter's Church.

Maidstone.—Proposed extension of West Kent Hospital.

Manchester.—Conversion of Institute at Droylsden into public offices, &c. Mr. C. Hill, Council Office, Droylsden.

Northampton.—Girls' secondary school.

Plymouth.—New Territorial buildings at Millbay Barracks.

Radcliffe.—Proposed new buildings at Infirmary.

Ross.—Secondary school for boys and girls. Architects, Messrs. Ashton & Small.

St. Anns-on-Sea.—Proposed Cottage Hospital. Mr. J. T. Clifton.

Scarborough.—Hospital for treating phthisis cases.

Sheffield.—Girls' club and concert hall in Solly Street.

Stockport.—New Carnegie Central Library.

Swansea.—Factory and stores, New Orchard Street. Mr. Emmanuel Thomas.—Twenty-four houses, Pant Street. Mr. D. Austin.

Wakefield.—Theatre. Wakefield Theatre, Ltd.

MISCELLANEOUS

Canada.—An application is to be made for the incorporation of a company to construct a railway between Niagara, Welland, and Lake Erie, says the *Board of Trade Journal*.

Dunoon.—Some private promoters have under consideration the construction of a tramway scheme in the district.

Hull.—An important scheme of tramway extensions is under consideration by the Tramways Committee.

London: *London County Council.*—The construction of tramways in Hammersmith Broadway for the purpose of linking up Putney and Harlesden is to be put in hand at an estimated cost of £2,000.

Rochdale.—Meters are to be fitted to fifty-nine cars.

Southend.—Application is to be made for powers to extend the tramway system considerably.

Wakefield.—The Wakefield & District Light Railway Co. require various stores, including electric lamps and fittings, overhead fittings, &c. The Manager, Wakefield.

TENDERS RECEIVED AND ACCEPTED

Glasgow.—The tender of the Lahmeyer Electrical Co. for copper rail bonds has been accepted by a Sub-Committee of the Works and Stores Committee.

Sheffield.—The tender of Messrs. Willans & Robinson, Ltd., for a 5,500-kw. turbo-alternator at 1,000 r.p.m. (Dick-Kerr alternator) has been accepted. The tender of the Stirling Boiler Co. for three water-tube boilers has also been accepted.

APPOINTMENTS AND PERSONAL NOTES

Mr. E. J. Fox is resigning his position with Messrs. Willans & Robinson, Ltd., of Rugby, to take up an appointment in London with Messrs. Stewarts & Lloyds, Ltd. Mr. Fox has been some nine years with Messrs. Willans & Robinson, Ltd., and must be very reluctant to leave the firm with which he has been so long connected. We have reason to believe, however, that the inducements offered him were such that he could not, in justice to himself, have refused them.

On Friday last, Mr. A. G. Seton-Chisholm, of Messrs. Siemens Bros. & Company, Limited, was married to Mrs. Ella Smith at St. Margaret's, Whalley Range, Manchester. Mr. Chisholm has many friends in the electrical industry, who will wish him every happiness.

Mr. D. Neill Keith, Assistant Electrical Engineer in the Southern Nigeria Public Works Department, has left that colony for similar work in Ceylon.

An engineer canvasser with commercial experience is wanted at Barrow-in-Furness. (See an advertisement on another page.)

We are informed that Mr. P. J. Pringle, Borough Electrical Engineer and Tramways Manager at Burton-on-Trent, has accepted an important appointment in Australia, and is leaving in the course of a few weeks.

Mr. A. Barbour has been appointed Mechanical Engineer-in-Charge at the Whiston Street power-house of the Shoreditch Borough Council. There were 170 applicants for the post.

A repairs engineer is required in a three phase H.T. generating station in N.W. London. (See an advertisement on another page.)

South London Single-Phase Railway.—Owing to the increasing patronage of the single-phase line between London Bridge and Victoria, it has been decided to increase the number of trains during the morning and evening.

Warwickshire and South Stafford Branch of the Institution of Mining Electrical Engineers.—A meeting of this branch, at which seven members were present, was held on Saturday last at Birmingham. The discussion on a paper by Mr. Wm. Foster was continued, and afterwards Mr. Foster replied to the various questions raised. A curve was also shown by Mr. J. R. English on the resistance of the human body to electrical currents, based on Mr. Foster's tests. The discussion on Mr. Maurice's Presidential address at the annual general meeting was then taken up.

The Batti-Wallahs' Society.—A smoking concert, which proved highly successful, was held by the Batti-Wallahs' Society on Monday last at the Holborn Restaurant. Arrangements have been made for fortnightly meetings to be held at the Bedford Head Hotel, Tottenham Court Road, W.C., throughout the winter. A private billiard room has been reserved for members with the free use of the table from 7.30 p.m. until 12 o'clock. The dates of forthcoming concerts are December 9th, February 24th, and April 21st, and the annual dinner takes place on March 17th next.

OSRAM·LAMPS

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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 to £59 10s. per ton (last week, £59 to £59 5s.).

Agency.—The Rugby Lamp Co., Ltd., Rugby, have appointed Messrs. J. A. Rudd & Co., 68 Gordon Street, Glasgow, as their agents in Scotland for the sale of "The Rugby" metal filament and carbon filament lamps.

Siemens' Lamp Works.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, London, N.E., ask us to announce that they have made arrangements for additional telephone lines, which will shortly be in operation, and for the time being tender their apologies to those customers whose calls have been delayed owing to the excessive rush on their present lines.

Canadian Agencies Wanted.—A Midlands firm, manufacturing electrical storage plant, generators, and electric specialities, desire to appoint Canadian resident agents for the sale of their goods. Particulars from the Board of Trade, 73 Basinghall Street, London.

Branch Office.—The A.E.G. Electrical Co., Ltd., of Pembroke House, Oxford Street, London, have opened an office in Birmingham at Winchester House, Victoria Square. Telephone 7564 Central; telegraph, Circuit, Birmingham.

New London Office.—Messrs. Hans Renold, Ltd., have opened an office in Kingsway House, Kingsway, London, W.C., which will be managed by Mr. Charles E. Holliday, who has held a leading position with the firm in Manchester for many years. The London office will deal particularly with matters requiring personal attention, but ordinary enquiries and correspondence should be addressed to Manchester as hitherto.

Liquidations.—The Synchronised Clock Co., Ltd., is to be wound up voluntarily. A meeting of creditors will be held to-morrow at 11 Waterloo Place, Leamington Spa. Mr. C. H. Waterman is liquidator.

A meeting of creditors of Telegraph & Telephone Instruments, Ltd., will be held on Monday at Lennox House, Norfolk Street, Strand, London.

Bankruptcies.—The last day for receiving proofs in the bankruptcy of A. E. Felgate and W. Storey, electrical engineers, 10 Queen Victoria Street, Reading, is Monday. Mr. B. P. Allnatt, 2 Forbury, Reading, is liquidator.

Anchor Cable Athletic Club.—A very successful dance was held by this club on Saturday last at the Leigh Church Institute, when silver cups and medals were presented to the cricket section of the club. Mr. J. Bowyer, Works Manager, presided.

Railway Electrification.—It is stated that the Great Eastern Railway Co. have secured a site at Enfield for the purpose of erecting a power-house in connection with the contemplated conversion of some of their suburban lines to electric traction.

Telegraph Traffic.—By order of the Uruguayan Government, censorship has been established on telegrams to that country. Similar restrictions have been revoked by the Nicaraguan and Costa Rican Governments.—The cable between St. Louis and Teneriffe was out of action on 27th ult., and during this interruption telegrams are being sent via Brest-Dakar.—The El Arich route was down on the 28th ult. beyond Beyreuth, but was restored on the following day.—It is rumoured that the Western Union Telegraph Co. has had some ill-luck during the laying of the new cable across the Atlantic to Newfoundland. It is reported to have broken a few days after laying a considerable distance from the coast.

A Workmen's Compensation Case.—A further application was made last Wednesday in the Shoreditch County Court in the case in which an electrician named W. F. Sharpe sued the Mayor, Aldermen, and Councillors of Shoreditch under the Workmen's Compensation Act. The plaintiff appears to have received injury from a shock at the Shoreditch generating station in December, 1908. Until April 19th, 1910, half wages had been paid to him, but it was then suggested that he could return to work. This he tried to do, but, owing to the state of his nerves, ceased working. The matter then came before the Court, and eventually the man, who was stated to be suffering from traumatic neurasthenia, was sent to a convalescent home for a month. At the expiry of this period the Council again found work for him in connection with the substitution of electric light for gas for street lighting. This he again claimed to be unable to do, and the present case was brought. The defence submitted that the man could do the work, and the medical referee, Dr. Bate, concurred with this view. Finally, the judge said that he would not make any award which might retard an amicable settlement, but would adjourn this case, ordering the man to do whatever work he was offered consistent with reason.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Metalite.—The statutory meeting of this Company, which has been formed to acquire the business of the Bryant Trading Syndicate, was held on Friday. It was said that a site had been acquired at Derby for the erection of new works to cope with the Company's increasing business. The Chairman said that since August the new Company has been compelled to refuse orders for delivery during the present season for no less than 980,000 lamps. The new site at Derby already contains factory buildings, which cost approximately £14,000, but which have been acquired for £7,000. The factory will ultimately have a floor space of 200,000 square feet. Mr. J. Metcalfe, Managing Director, said that when the orders now in hand were completed there would be a net profit exceeding £160,000. He also said that a number of firms have indicated their intention of dealing only in Metalite lamps when the Company is in a position to supply them with their requirements. Many complaints have been received of the inability to obtain the Company's lamps, but he had no doubt whatever that in the early part of next year they would be able to multiply their output by five or six. He had no doubt that the shareholders would be more than delighted at the end of the coming year with the dividends they would receive.

Edison & Swan United Electric Light Co.—The result of the year's trading to June 30th is a loss of £3,184, which is deducted from the £10,027 brought forward. This result is attributed mainly to the high cost of production of metal filament lamps during the earlier part of the year. These costs, however, have been largely reduced, and a marked improvement is looked for during the current year. The report regrets the resignation of Sir Joseph Swan from the board in consequence of ill-health.

Wireless Telegraph Notes.—It is stated that while experiments were being made with the wireless telegraph apparatus on the new steamer *Drumcraig*, in Glasgow harbour last week, a message was picked up from the homeward bound Anchor liner *Caledonia*, whilst 850 miles at sea.

An interesting feature of the new Whiteley building in London, the foundation stone of which was laid last week, will be a wireless telegraph equipment.

Electrical Press v. Mountain.—This action, which is one by the proprietors of *Electrical Industries* against Mr. M. B. Mountain for alleged fraudulent misrepresentation, was to have been dealt with in the King's Bench Division on Friday. After a consultation in Court, however, the Judge allowed it to stand over for a fortnight, upon an intimation that he might not then be troubled with the case at all.

Steam Valve Explosion.—On Monday afternoon an explosion occurred at the Bow generating station of the Charing Cross, West End & City Electricity Supply Co., resulting in the deaths of two men and injury to two others. It appears that the men were working on a steam valve in a main steam pipe when the valve burst. On inquiry at the Company's offices, we understand that the supply was not interrupted on any part of the Company's system.

Defective Tramlines.—At the Clerkenwell County Court last week a jobmaster sued the London County Council for £4 2s. 6d., damage to his van through the wheel coming into contact with one of the rails of the electric tramways which projected some distance above the level of the ordinary roadway. The County Court judge decided that the rail constituted a danger to the ordinary road traffic, and gave judgment against the London County Council.

Students' Section of the Institution of Electrical Engineers.—The opening meeting of the session will be held at the Institution, Victoria Embankment, on Wednesday, November 16th, at 7.45 p.m., when Mr. C. H. Wordingham will deliver an address. At further meetings at the same place and hour, Papers will be read as follows:—Nov. 30th: J. C. Rennie, "Tramway Brakes and Brake-gear"; Dec. 14th: J. F. Shipley, "Progress in Arc-Lamps"; Jan. 19th: P. R. Coursey, "Wireless Telegraphy, with special reference to 'Short-spark' methods"; Feb. 1st: H. Clark, "Telephony"; Feb. 13th: H. C. Mary, "Dry-core Lead-covered Telephone Cables"; March 15th: R. C. Plowman, "Exhaust Steam Turbines"; April 12th: J. M. Bloomfield, "Overhead Lines for Transmission of High-tension Electrical Energy"; April 26th: J. B. Sparks, "Electric Traction on Main Line Railways"; May 3rd (annual general meeting): A. E. E. Cheal, "Some New Zealand Electric Plants."



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ELECTRICAL ENGINEERING

NO. 202 [VOL. VI., NO. 45] THURSDAY, NOVEMBER 10, 1910. [PRICE ONE PENNY.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.
Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

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SUMMARY

ALTHOUGH electric cars are almost unrepresented at the Olympia Exhibition, electricity is well to the fore in the accessory section, both in lighting apparatus and ignition appliances. Special lighting systems involving constant-voltage variable-speed dynamos are shown, and some improved designs of magnetos and dual ignition systems. (Page 707.)

SIR J. CLIFTON ROBINSON died suddenly last Sunday from heart disease in New York. (Page 708.)

THE re-trial of the action by Mr. C. A. Gould, of the American Gould Storage Co., against Mr. Lehwess, the promoter of the London Electrobus Co., for payment for batteries supplied in connection with that undertaking, is now proceeding before Mr. Justice Ridley and a special jury in the King's Bench Division. The batteries were supplied subject to certain tests being passed, and it is alleged that Dr. Lehwess intentionally prevented the tests being carried out. (Page 708.)

IN our monthly illustrated article on new supplies and accessories, a new pendant designed to withstand rough usage is described, and details are given of two new patterns of arc lamp. A design of convection heater in cast iron case is also illustrated. (Page 709.)

SOME figures of the actual cost of electric cooking are given. (Page 711.)

A DISCUSSION took place at a meeting of the Electrical Contractors' Association last week with regard to imposing a standard of work upon all members of the Association in an endeavour to improve the quality of wiring work generally. Complaints are being made at the action of certain electric supply companies undertaking wiring work. There is also a feeling among the members of the Association that the agreement with the Cable Makers' Association is not altogether in their best interests. (Page 711.)

MR. H. M. HOBART read a long Paper recently before the Arc Works Engineering Society, in which he dealt with the economic aspects of the electrical working of railways, and worked out estimated figures for a hypothetical case in some detail for both the continuous-current and single-phase systems to the disadvantage of the latter. Finally, he expressed the extreme view that in those cases where circumstances are such that, according to his basis of comparison, the single-phase system would show more economy than the continuous-current system, the retention of steam working would be more economical than either. (Page 713.)

THE annual report of the Postmaster-General records progress in the construction of the underground telegraph lines and other advances in the telegraph and telephone departments. Some criticisms of the telephone finance are answered. (Page 715.)

A LETTER from H. L. Webb criticises the finances of the Post Office telephone system. (Page 716.)

MR. C. FARADAY PROCTOR, in his inaugural address as Chairman of the Newcastle Section of the Institution of Electrical Engineers, attributed much of the success of foreign industrial competition to the unsuitability of our educational system. (Page 716.)

A WATER-POWER scheme of considerable size is under consideration in Tasmania. (Page 716.)

AMONG the specifications published by the Patent Office on Thursday was one by the Gesellschaft für Drahtlose Telegraphie for a relay for wireless telegraphy consisting of a light suspended armature attached to one electrode of a carbon microphone contact. The use of several such relays in series in combination with recording apparatus is described.—Mavor & Coulson, Ltd., patent an alternator for generating current at two different frequencies without alteration of the speed or of the rotor winding.—An automatic sign switch is described by the Reason Manufacturing Co.—Two patents by G. Bell and J. V. Pletts cover heating and cooking apparatus, in which the heat is stored up in an isolated body and conducted to the

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cooking utensils or to an oven by means of water circulating pipes.—A patent by J. H. Rosenthal for the combination of a superheater and a water-tube boiler with connecting pipes to both steam and water spaces of the drum, expires on Saturday after the full life of fourteen years. (Page 718.)

THE local gas company have objected to the Bray Council undertaking wiring, but the Council have replied that they do not wire premises.—It is stated that Edison storage-battery tramcars are to be run in Krugersdorp (S.A.).—The accounts of the West Ham Electricity Department show a loss of £93, but the rating of the undertaking has been increased to no less than £5,207.—In spite of the opposition of the local authorities, the tramway scheme between Brighton and Worthing is to be placed before Parliament.—A deputation from the Paris Municipal Council is at present in London inspecting the tramways. (Page 717.)

GENERATING machinery is required at Gloucester and Bispham. Extensions are contemplated at Barking, Beckenham, Queenstown (S.A.), Luton, and Wolverhampton. The Southampton Corporation require 2,000 radiator lamps; a 1,000-kw. mixed-pressure turbine is required at Walthamstow; and electric lighting plant by the Radford County Council. Electrical stores are required by the North Eastern Railway Co. and the Great North of Scotland Railway Co. (Page 717.)

THE capital of Robertson Electric Lamps, Ltd., is to be reduced from £100,000 to £35,000. The Cape Electric Tramways Co. show a profit of £9,047 for the year to June 30th. (Page 720.)

A 1½ KW. Balsillie wireless equipment, with a normal working radius of 400 miles, has been fitted on the Liverpool cargo boat *Drumcraig*. Time signals for ships are being sent out twice daily from Nordeich, in Germany, as well as from the Eiffel Tower. (Page 720.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, NOVEMBER 10TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. Presentation of scholarships and premiums, and inaugural address of the President, Mr. S. Z. de Ferranti.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science. Address on "Practical Electrical Measurements," by Mr. W. Tatlow.

TUESDAY, NOVEMBER 15TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At School of Technology. "Recent Electric Locomotive Practice and the H.T. D.C. Railway System," by A. Monkhouse.

WEDNESDAY, NOVEMBER 16TH.

Institution of Electrical Engineers: Yorkshire Section.

7.15 p.m. At Leeds University. Address by Chairman, Mr. T. Harding Churton.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At Victoria Embankment. Address by Mr. C. H. Wordingham.

SATURDAY, NOVEMBER 12TH.

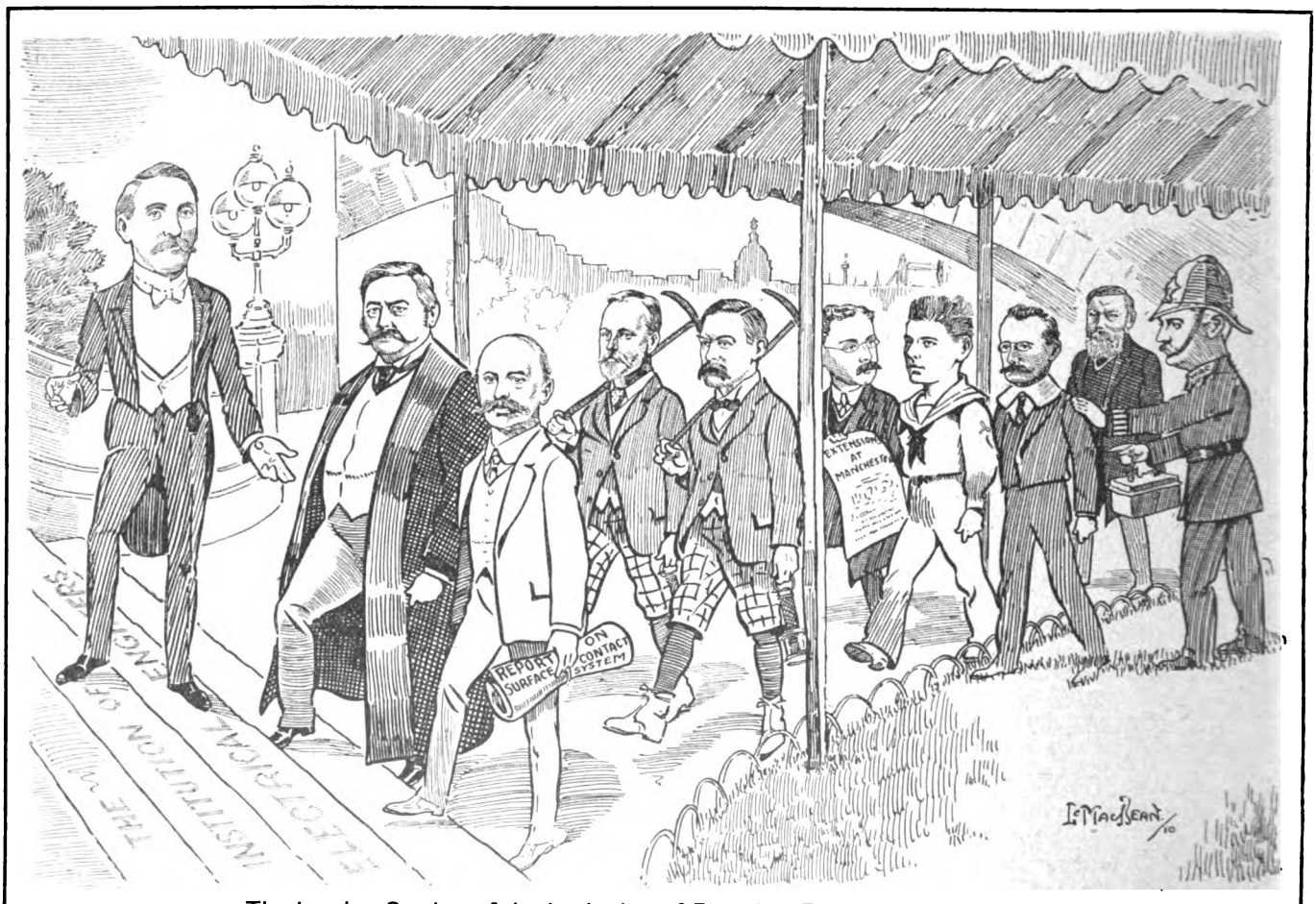
Birmingham and District Electric Club.

7 p.m. At Colonnade Hotel, New Street.

Institution of Junior Engineers.

7.30 p.m. At Royal United Service Institution. Presidential Address by Sir J. J. Thomson, F.R.S., on "The Influence of Pure Science on Engineering."

Telegraph Traffic.—The Direct Spanish Telegraph Co. has again suffered a reverse, the Marseilles-Barcelona section of cable having ceased working on 2nd inst., but a repair was effected on the 4th inst. Communication between Rome and Constantinople was down on 3rd inst., but was restored to working order on the 5th inst. The land lines between Saigon and Annam and Tonkin were interrupted on 4th inst. north of Khatrang Annam. The Indo-European Telegraph Co.'s land lines were down between Kertsch and Sonkhoum on the 4th, but were restored on the succeeding day. The C.S. *Faraday*, which began to lay down the new cable between England and Norway on October 22nd, at Newcastle, arrived on November 5th at Arendal, thus completing its work. The new cable has been tested, and proved very satisfactory.



The London Session of the Institution of Electrical Engineers opens to-day.

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ELECTRICITY AT THE OLYMPIA MOTOR CAR EXHIBITION

NOW that the pioneering days of the motor car are over, each of the annual exhibitions organised by the Society of Motor Manufacturers and Traders seems to contain less that may be described as novelty, for the principal changes are rather in the direction of increased perfection. This may be said to apply quite as much to electrical accessories, to which we wish to direct attention here, as to the magnificent collection of complete vehicles and chassis which are the products of modern automobile engineering.

It appears that in this country, at least, the electric private passenger car has not increased in popularity, for only one firm (The Electric Vehicle Co.) has shown anything of this nature. Two cars are on view on their stand, both in external appearance resembling petrol cars. One is a phaeton with collapsible rear seat, provided with a 195 ampere-hour 40-cell battery, said to be capable of 100 miles on one charge and a maximum speed of 30 miles per hour. The other is a smaller car, of a type which figured in the Show last year.

In the gallery there is more of electrical interest; a good deal of attention appears to have been paid to the electric lighting of cars, and an increased number of firms show sets with special dynamos for running off the engines after the manner of train lighting sets. Improved electric lamps are shown on a great number of stands; and, while we do not find any startling new developments, there are evidences of steady advance in the design of magneto and other forms of ignition gear.

Taking the car-lighting apparatus in more detail, we find a number of systems worked out in great completeness, and evidently well beyond the experimental stage. The latest form of the "C.A.V." system, of Messrs. C. A. Vandervell & Co. (Warple Way, Acton), employs a special dynamo giving a practically constant voltage over a considerable range of speed. The regulation is effected by the cross magnetising flux due to the current in the armature coils short-circuited by the brushes upon a pair of unwound auxiliary poles provided for the purpose. An important feature of the system is that no automatic switches are used, as the dynamo is not cut out when the engine speed drops too low, but is simply allowed to run at its own speed as a motor by a free-wheel arrangement. The details of the equipment are well worked out, and a special armoured cable is used for the wiring. The Blériot lighting outfit (Blériot, Ltd., 53-54 Long Acre) embodies a constant-voltage dynamo on a slightly different principle, with a centrifugal arrangement mounted on the end of the shaft working a cut-out switch when the speed falls. Needless to say, the firm show a large variety of the lamps, for which they are as famous as for the manufacture of aeroplanes. The well-known Leitner system of train lighting as applied to motor-cars, embodies another variety of constant-voltage variable-speed generator, in which the cut-out switch is electrically controlled, and is demonstrated by the Rotax Motor Accessories Co. (43 and 45 Great Eastern Street, E.C.). The Ducellier system, shown in action by A. A. Godin (1 Red Lion Square) is different in that the main field of the generator is provided by permanent magnets in conjunction with field coils for producing the adjustment according to the speed. The automatic cut-out switch in this system also is electrically controlled. Permanent field magnets are also used in the Mira "C.J.L. Magnetolite" system, shown on the stand of the High Tension Co., 1A Guildford Street, W.C., but the regulation is entirely due to armature reaction, and no auxiliary field coils or extra brushes are used.

The system exhibited by Messrs. Peto & Radford is somewhat different in principle, and employs a centrifugally-controlled slipping clutch to control the speed of the dynamo. The lighting dynamo shown by Longstreth's, Ltd. (190 Queen's Road, Battersea), is also provided with a centrifugal slipping clutch to limit its speed, but carries also on the other end of the shaft a centrifugal contact arrangement which only keeps the machine in circuit when the speed is above a certain value. These examples embody most of the main features of the leading systems, but several other exhibitors, including Messrs. Joseph Lucas, Ltd. (Birmingham), and Messrs. J. C. Fuller & Co. (Wick Lane, Bow), have also taken up the matter, and show variable-speed dynamos and complete lighting outfits, with the necessary cut-out switches. Nearly every accessory firm shows electric motor-car lamps of one sort or another, and among these attention may be drawn to the "R.V." lamp, shown by W. J. Harvey, Ltd. (415 Oxford Street), in which the parabolic reflecting surface is hermetically sealed, so that no cleaning is required, and the position of the lamp is adjustable to obtain either a concentrated or divergent beam as desired. The now well-known "Silverlyte" lamps, in which the reflector and lens simply consists of a solid conical block of Jena glass, with a convex front and without any silvering, and with the lamp inserted in a recess at the back, are shown on the stand of Hedley S. Hunt & Co. (9 Farringdon Road, E.C.).

There are a great number of exhibitors of ignition apparatus, and, with one very notable exception, practically all show high-tension magneto systems, combined usually with some form of battery and coil for starting and as a stand-by. Indeed, it may almost be said that the so-called dual ignition is now the standard in all up-to-date cars. The retention of the battery and coil is not due to any unreliability on the part of the magneto, but is provided more as a matter of convenience in starting, especially for being able to start "on the switch."

The one coil system that competes with success against the magneto is that originated by Sir Oliver Lodge, and shown in its latest form by Lodge Brothers & Co. (14 New Street, Birmingham). Various patterns of coil are shown, in which the working spark is really a secondary spark caused by the sudden overflow of a pair of condensers, and a novelty is exhibited in the Lodge "spark lamp," a spark-gap in a little partly exhausted bulb, which is fixed to the head of the plug, and can be put in series with it when required to act as a signal that the plug is working by showing a very visible glow.

The magnetos shown do not differ very widely from those we gave notes on last year (ELECTRICAL ENGINEERING, Vol. V., November 18th, 1909, page 983). Dual systems are now the rule, using the same high-tension distributor and plugs for the magneto and coil, with convenient change-over switching arrangements and push-buttons for obtaining a spark at starting. A typical and widely-used system on these lines is that of the Bosch Magneto Co. (40-42 Newman Street, W.). This firm have also a system for obtaining increased power at very high engine speeds, involving the use of two plugs in series in each cylinder. There is an imposing display of the Simms Magneto Co., Ltd. (Kimberley Road, Kilburn), who also show British-made high-tension magnetos of all sizes, self-starters, and a full dual system. The Hall magneto, formerly known as the E.I.C. Hall, but now known as the Hall E.O.A. dual system, is shown by the Electric and Ordnance Accessories Co., Ltd. (Cheston Road, Aston, Birmingham). It will be remembered that the distributor in this system is mounted horizontally, clear of the field magnets, and driven by a worm gear arranged to vary the timing by rocking its axis. It has several other constructional features of interest. Another magneto system well worthy of examination is that of Nilmelior, Ltd. (36 and 37 Alfred Place, Tottenham Court Road). A magneto somewhat different in construction from many is the "Mea" magneto, shown by United Motor Industries, 45-46 Poland Street, W. This is very small in size, and has the armature set lengthwise in the field of a bell-shaped magnet. The whole machine is arranged to turn to adjust the timing. It is, of course, impossible to mention all the numerous firms exhibiting ignition apparatus, but mention should not be omitted of the fine display of ignition and lighting accumulators made by Van Raden & Co. (Great Heath, Coventry).

Of more interest, perhaps, to engineers in general is the stand of Drummond Brothers (Churchill Works, near Guildford), who have a number of their well-known repairing lathes and drilling machines, and a special foot-driven universal grinding machine on view in the gallery. Attention should also be drawn to the exhibit of their special patterns of silent chains by Hans Renold, Ltd. (Progress Works, Brook Street, Manchester).

Advanced Lectures of Telegraphy and Telephony.—Professor J. A. Fleming,, F.R.S., will deliver a course of advanced lectures on "The Theory and Practice of Electrical Measurements, with Special Reference to Telegraphy and Telephony," at University College, on Wednesday afternoons at 5 p.m., beginning January 11th, 1911. The course is designed to meet the needs of post-graduate students, teachers, telegraph, telephone and electrical engineers generally possessing some knowledge of the subject of electrical measurement, but desiring to make a further study of the advanced theory and practice. As only a limited number of students can be admitted, early application should be made. Full particulars may be obtained from the Secretary of the College.

Accuracy in Fuel Calorimetry.—We have received a reprint of a paper by Mr. G. Nevill Huntly on the accuracy obtainable in fuel calorimetry, which was read recently before the Society of Chemical Industry. The subject is discussed in considerable detail, and the author finally arrives at conclusions which may be summarised as follows:—The limit of accuracy in the comparison of the heating values of fuels is from 0·1 per cent. to 0·3 per cent., and this can only be reached after a most careful study of the thermometer and calorimeter and the application of numerous corrections. If the small corrections are neglected the errors may amount to from 1 per cent. to 2 per cent. The heats of combustion of the standard substances used for the determination of the water equivalent are not certain within 0·5 per cent. The errors due to hand sampling cannot be reduced with certainty below 0·5 per cent., and may easily amount to 1·5 per cent. to 2·0 per cent. He points out that so far as coal is concerned, it is at present more important to devise means for reducing the errors of sampling than to increase the accuracy of the calorimetric determination.

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OBITUARY

SIR J. CLIFTON ROBINSON.

THE news of the sudden death on Sunday night at New York from heart disease of Sir J. Clifton Robinson has come as a shock to many. By a strange coincidence, it was in a tramcar that the great pioneer of tramway enterprise was seized with the attack that proved fatal, and he succumbed shortly after in a New York chemist's shop to which he had been taken. His decease removes a prominent figure in the tramway world, a pioneer who battled against great difficulties, and a man who probably did more towards the introduction of electric tramways to this country than any of his contemporaries.

His connection with tramway enterprise began at the early age of twelve, at Birkenhead, his native town, in his association with Mr. G. F. Train in the construction of the first real tramway in this country, from Birkenhead to Woodside Ferry, in 1860. He worked under Mr. Train on tramway construction in Staffordshire and elsewhere, and accompanied him to America in 1866. For about three years he was thus employed on tramway work in New York, but in 1871 he entered the contracting firm of Fisher and Parrish, and assisted in tramway construction in Liverpool, London, and Dublin. His subsequent positions included management of the Cork tramways, and he was in charge of the Bristol system from 1875 to 1882. These were, of course, all horse tramway systems. In 1882, however, he assumed the management of the Edinburgh tramways, and then began his connection with the cable system, which was continued in his work on the Highgate Hill line, on behalf of the Cable Tramways Corporation. This line was opened in 1884. About three years later Mr. Robinson went to America, and while equipping cable lines at Los Angeles, first began to see the possibilities of electric traction, and after acquiring experience with the construction of some of the electric lines then so rapidly spreading in the United States, Mexico, and Canada, he returned to England, to become managing director, in 1891, of the Imperial Tramways Co.

The list of British lines upon which he reported, and the conversion of which to electric traction was accomplished under his supervision, is too long to give here; it includes Dublin, Reading, and Bristol, but his most notable achievement was in the consolidation and remodelling of the West Metropolitan tramways, culminating in the present gigantic system of the London United Electric Tramways. In this work he had great difficulties to contend with, and was continually meeting with opposition from local authorities, &c., who placed very heavy burdens in the way of the development and extension of the system. He remained at the helm of the London United Tramways for sixteen years, and it was only this year that he resigned his position as managing director and engineer. "There are," he then declared, "fresh fields where I can develop the system of electric traction. Municipal tramways have snuffed out private enterprise, and the ground is now well covered in London. Abroad it is different. Further afield there are still ample opportunities, and more encouragement than this country affords." It is sad to think that his hopes could not be realised.

Sir Clifton Robinson was knighted in 1905, and it should be mentioned that he contributed a number of Papers on tramway subjects to Societies on both sides of the Atlantic. One of them, entitled, "The World's Tramways," earned him the silver medal of the Society of Arts. In addition to his connection with the London United Tramways, he was on the board of the Bristol Electric Tramways, the Metropolitan District Railway, and Underground Electric Railways Co. of London.

ELECTROBUS COMPANY AND ITS BATTERIES

BEFORE Mr. Justice Ridley and a special jury in the King's Bench Division on Monday the re-trial of the action by Mr. C. A. Gould, of the Gould Storage Battery Co. of America, against Dr. E. H. Lehwess in respect of a contract for the supply of batteries for the London Electrobus Co. was commenced. The previous action was reported in ELECTRICAL ENGINEERING, Vol. V., 1909, pages 488 and 1064, the new trial being ordered by the Court of Appeal on the ground that the damages awarded to Mr. C. A. Gould, who won the first action, had been assessed upon insufficient evidence. Mr. Gould claims £2,600 for the purchase of 16 sets of batteries of 42 cells each, which were sent to England under an agreement with Dr. Lehwess, who undertook to form an English Gould Storage Battery Co., with a cash capital of £25,000. A company called the Gould Storage Battery Co., Ltd., was duly registered in this country with a nominal capital of £25,000, and according to Mr. Atkin, K.C., who appeared for Mr. Gould, 21,000 shares were allotted to a company called the Asiatic Banking & Trading Corporation as fully paid up, in return for which the latter company was to do all in its power to bring the Gould storage battery before its friends and associated companies, and also to advertise the Gould Co. at its place of business. It was said that the Asiatic Corporation was registered in Jersey, and had a paid-up capital of only seven shares; that it had no connection with Asia, with banking or trading. Counsel further stated that the company had never done any business, had no directors, and was absolutely void of content altogether. It was, he said, a mere device by which Dr. Lehwess allotted to himself the whole of the issued capital, namely, 21,000 shares, leaving 4,000 shares unissued. Before sending the 16 batteries to England, Mr. Gould had cabled from America asking Dr. Lehwess the position with regard to the English Gould Co., and received the following cable: "All shares issued cash about £4,000 reserved." Mr. Gould read this—and during the proceedings, Mr. Justice Ridley suggested that at the moment it was the only way in which he thought the cable could be read—to mean that all the shares had been issued, and that £4,000 had been reserved as cash to carry on the company, putting the remaining £21,000 to a separate account as unnecessary for the then purposes of the company, and which would accumulate interest. As a matter of fact, said Mr. Atkin, no money whatever had been subscribed, and at no time did the Gould Company have more than £107 to its credit. Reading the cable in this way, Mr. Gould sent the batteries to England under certain conditions as to complying with specified tests, when they would be paid for. A part of the case for Mr. Gould now is that Dr. Lehwess intentionally prevented the necessary tests being carried out, and that the batteries were put into use upon 'buses mechanically unsound in other respects, with the result that full justice was not done to them.

With regard to the tests, Mr. Atkin, K.C., and subsequently Mr. C. A. Gould himself, in the witness box, stated that after many attempts to get the tests carried out officially, Dr. Lehwess, when in New York, and whilst the 'buses were running in London, agreed to send a cable authorising the tests to be carried out. The tests were not carried out, and as an explanation Mr. Atkin suggested, on the sworn affidavit of an employee of the London Electrobus Co., that Dr. Lehwess had sent another cable on the same day telling his representative here to hold back the cable authorising the tests to be made, such a cable having been seen in the offices of the London Electrobus Co. It is claimed by Mr. Gould that unofficial tests of the batteries were made by his representatives over here which gave better results than those called for in the contract, one being that the battery lasted for four hours fifteen minutes at a discharge rate of 80 amperes. Another point in the case is that the tests agreed upon between Dr. Lehwess and Mr. Gould were not the same as those upon which the London Electrobus Co. agreed to take over the batteries, but that Mr. Gould had never had any dealings with the 'bus company. Nevertheless, Dr. Lehwess had refused to pay because the 'bus company would not take over the batteries. In cross-examination, Mr. Duke, K.C., for Dr. Lehwess, brought in the statement that the Tudor batteries gave better results, and that for extensions the London Electrobus Co. would have preferred them. The Judge, however, suggested that this had nothing to do with paying for the first batteries supplied by Mr. Gould.

The action was still proceeding when we went to press.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to The Editor, ELECTRICAL ENGINEERING, *203-6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

SINGLE-PHASE.—We can recommend you Punga's book on "Single-phase Motors" (post free 4s. 9d.) for the general theory of the different types; and drawings and particulars of the design of some actual single-phase motors will be found in "Electric Motors," by H. M. Hobart (post free, 18s. 6d.).

C. A. MCKAY.—We think that you will find the information you desire in Prof. J. A. Fleming's "Elementary Manual of Radiotelegraphy and Radiotelephony for Students and Operators" (post free, 7s. 11d.), and "Radiotelegraphy," by C. C. F. Monkton (post free, 6s. 5d.). There is no journal devoted exclusively to wireless telegraphy, but as you are doubtless aware, we publish news and articles on this subject in our own columns from time to time.

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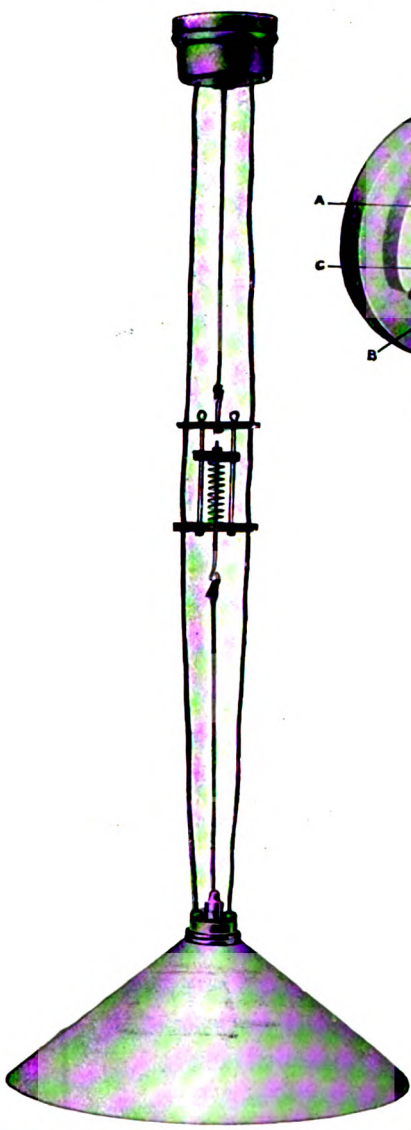
NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Pendant Fittings.

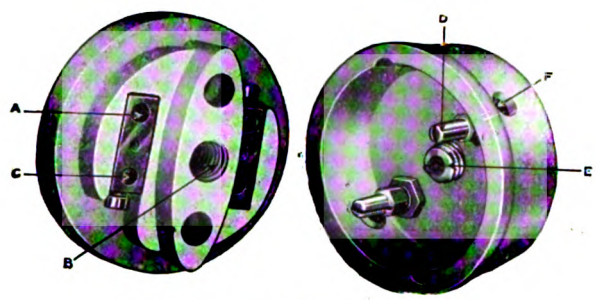
Simplex Conduits, Ltd. (Garrison Lane, Birmingham) have just put on the market, at a very moderate price, a novel form of pendant for office, shop, and factory installations, with a view to reducing the risk of fire due to flexible pendants. As is well known, pendants in shop windows and factories are subject to a deal of rough handling, and the two conductors being twisted together, there is a risk of short circuit should the insulation be damaged. The object of this new pendant is not only to keep the two poles apart, but to relieve at the same time all strain upon the flexible and the terminals of the holder and ceiling-rose. The wiring can be done wholly at the bench, the pendant simply being plugged into position when the base has been wired to the main circuit in the ordinary way.

In the accompanying illustration of the ceiling-rose portion of the pendant, *A* is one of the two sockets in the main circuit terminals into which are plugged the split pins *D* on the cover connected to the flexible leads. The weight of the pendant is carried by the screwed metal plug *E*, which holds the cover on to the base by being screwed into the hole *B*. *C* is the loop-in terminal for the circuit wires. If, when the ceiling rose and pendant is in position, it is necessary to make any adjustment to the length of the drop, this can easily be done without disconnecting the rose as the split pins to which the flexible is connected can be got at through holes provided in the cover of the rose marked *F*.

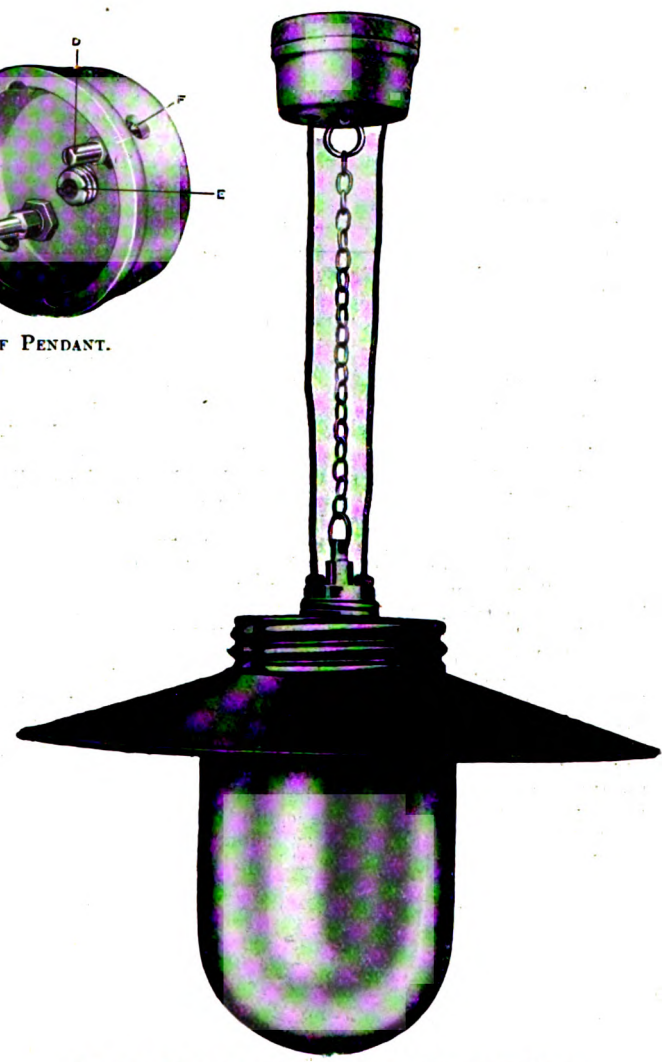
Two forms of pendants are put on the market, one for offices and shops, in which cord suspension is used, and another for factory work, where iron mill fittings are generally installed. In this case coppered steel chain is used to take the weight. A neat form of anti-vibrator is incorporated to complete the pendant, but the latter may be obtained without this device if necessary. This anti-vibrator is supplied with springs of three different tensions to suit varying weights of the fittings which may be used, the method of construction constituting by far the most efficient anti-vibrator yet introduced. Adjustment to the tension can easily be made by means of adjusting the small nuts on the spindle which carries the spring. This adjustment, combined with the range of springs, has been found necessary to meet the varying requirements of a 10 in. opal shade or a 9 in. iron shade, a three-light ball fitting, and a cast-iron mill fitting.



Simplex Office Pendant with Separate Leads and Spring Suspension.



Ceiling-rose Portion of Pendant.



Simplex Factory Pendant with Separate Leads.

Arc Lamps.

A new design of flame arc lamp for street lighting and the illumination of large open spaces has been introduced by the Globe Electric Co., Ltd. (11 Farringdon Avenue, London, E.C.), under the name of the "Multax" Century lamp. In general design this lamp follows the 36-hour pattern Globe "Multax" lamp, described and illustrated in Electrical Engineering, March 10th, 1910, p. 163, although it is constructed on somewhat different principles, which cannot be at present disclosed. The lamp has been particularly designed for the illumination of streets, railway stations, dockyards, harbour works, &c., and for this reason has been fitted with a projecting reflector consisting of an inverted truncated cone

C

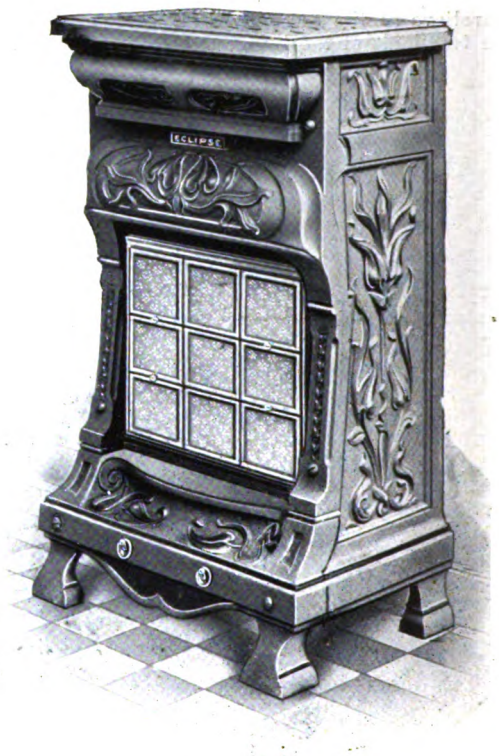
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in the lower portion of the globe. This reflector considerably increases the distribution of light in a horizontal direction, and is claimed to be an important improvement for lamps intended for street lighting. The lamp has a purely gravity feed, all clockwork being entirely dispensed with. A burning period of 100 hours on one trim is said to be obtained, and although two pairs of carbons are used, the lamp is entirely non-magazine, as the arc burns alternately from each pair in a similar way to which it travels from core to core in the case of the patent bridge core carbons of the ordinary "Multax" lamp.

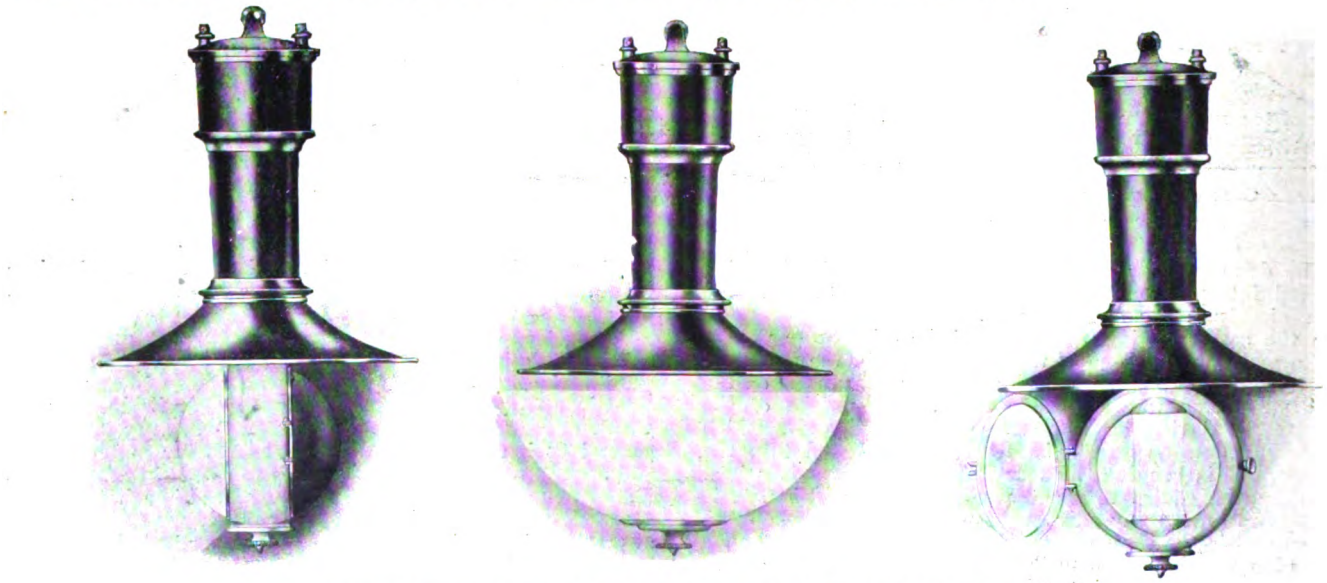
The Jandus Arc Lamp & Electric Co., Ltd. (Hartham Road, Holloway, London, N.), have introduced a small pattern of their well-known regenerative flame arc lamp, which is still the only truly enclosed flame arc lamp on the market. A description of the original pattern appeared in ELECTRICAL ENGINEERING, February 27th, 1908, Vol. III., p. 299. It will be remembered that the arc is enclosed in a narrow glass cylinder, which communicates at top and bottom with two metal tubes arranged one on either side of the outer globe. A circulation of the hot gases and chemical particles is thus produced down the metal tubes and up through the arc. By this means the chemical products giving the arc its light-producing and colour properties are used over and over again. This is an important feature of the lamp, as the slow-burning carbons would not liberate enough chemicals to keep the arc in proper condition if the gases and particles were carried away immediately, as in the case of the ordinary flame arc. The chemicals are made up in the form of a paste, which is pressed into the grooves of the lower carbon, which has a star-shaped section. A clutch-feeding mechanism with differential series and shunt-coil control, similar to that employed in the ordinary "Jandus" enclosed lamp is employed. The present small-pattern lamp takes only from 200 to 300 watts on direct-current circuits, and from 250 to 350 watts on alternate-current circuits. It is considerably shorter than the original pattern, being only 30 in. long, and is provided with a new design of outer globe as illustrated. In this design, the metal tubes are of oval section, and are made to form the frame for two translucent hemispherical globes. One is attached direct and the other is fitted like a hinged cover, so that the interior can be easily cleaned. This outer globe need not be opened or removed for trimming, however, which is done by removing the lower screw. The lamp takes 5 amperes at 50 to 55 volts, and has an average candle-power of 1,100. Using the standard "Jandus" regenerative carbons, it burns from 70 to 90 hours on one trim. It is claimed to be especially suitable for shop lighting and side-street lighting, and more economical than clusters of metal filament lamps for this purpose. For shop-front lighting one of the glass segments is replaced by an aluminium segment enamelled in the interior to act as a reflector, as illustrated. For interior illumination, a translucent bowl is fixed under the outer globe. This softens and diffuses the light, and the shadow thrown by the outer tubes is said to be hardly noticeable. If the lamp is not hung close to the ceiling, a metal reflector is fixed just above the globe, as shown. Remarkably low running costs are claimed for this pattern of lamp. It is claimed that for equal lighting effects, the total costs are only one-third those for ordinary enclosed arc lamps, and one-fifth those for metal filament lamps. A recent improvement to the "Jandus" lamps is the addition of an anti-vibration spring suspension device to the supporting pulley, which tends to steady the arc and produce more even feeding.

Heating and Cooking Apparatus.

A new list of "Eclipse" heaters has just been issued by the Electric and Ordnance Accessories Co., Ltd. (Aston, Birmingham). These are on the convection system, in which a current of air passes through the heater and flows out to mix with the air of the room at a temperature of about 300° F. The most usual size consumes 1½ kw., but smaller and larger heaters are also made. In addition to the great variety of designs in artistic sheet metal cases, the company have brought out some new patterns, of which one is illustrated here of enamelled cast-iron, with ruby glass panels, giving a cheerful glow.



CAST IRON E. & O. A. "ECLIPSE" HEATER.

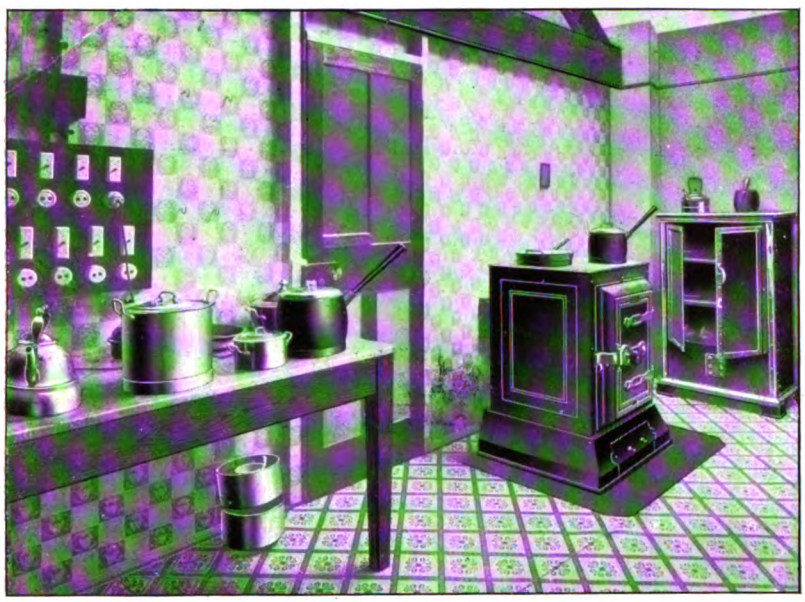


THREE FORMS OF THE JANDUS SMALL-PATTERN REGENERATIVE LAMP.

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AN ELECTRIC KITCHEN

THE British Prometheus Co. (Salop Street Works, Highgate, Birmingham), have a complete installation of their well known electric cooking apparatus in the kitchen of the staff dining club at their own works. The equipment is represented in the accompanying illustration, and the following particulars of the cost, both of the apparatus and of its working, will be of interest. The principal items of the

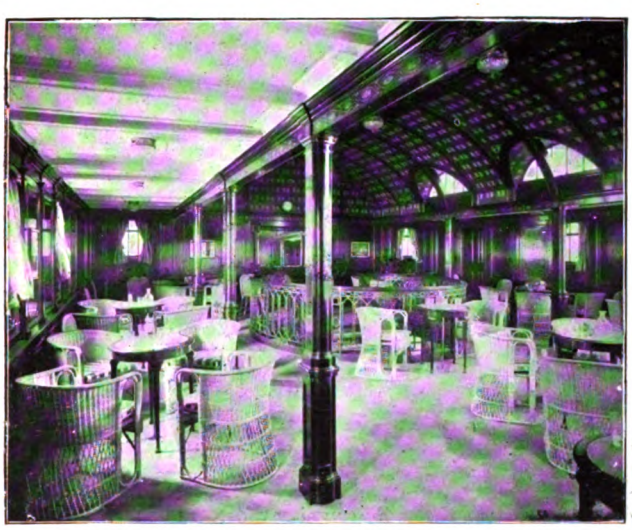


ELECTRIC KITCHEN AT PROMETHEUS STAFF DINING CLUB.

equipment are: one oven, two vegetable cookers, one plate warmer, and one kettle, the total catalogue price of which is £44. During the week ending October 29th, the aggregate number of dinners cooked was 54, and the total number of courses 162. For this the energy consumption was 44·6 units, costing, at 1d. per unit, 3s. 8½d., or about four-fifths per person per meal.

ELECTRIC LIGHTING ON BOARD THE "BALMORAL CASTLE"

THE accompanying illustration, which we have received from Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston), represents a portion of the smoking lounge of the s.s. *Balmoral Castle*, on



SMOKING LOUNGE ON S.S. "BALMORAL CASTLE."

which the Duke of Connaught made his journey to South Africa. This is a fine example of steamship lighting, and it is of interest to note that Tantalum lamps have been adopted throughout. Experience on the many ships that have now been equipped with them shows that the Tantalum lamp is specially suitable to ship-lighting conditions, owing to the ease with which it withstands the vibration and severe treatment to which lamps on board ship must always be subjected.

THE WIRING CONTRACTORS' POINT OF VIEW

THE Paper by Mr. G. F. Ratcliff, Chairman of the London Section of the Electrical Contractors' Association, containing suggestions for raising the status and efficiency of that body, was summarised and criticised in our issue for October 13th, and was further discussed at the November meeting of the Association held last week. From the discussion, or rather informal conversation—for there were only fifteen members and three pressmen present at the meeting—it seems that the real complaint is not that members of the Association are carrying out inferior work at cheap prices, but that foremen and workmen, at one time in the employ of members, are now working on their own account, or in conjunction with builders. They can do the work cheaply, as they have practically no establishment charges, and members of the Association consider their competition as serious.

On the question of standard of work, the discussion resolved itself into an endeavour to discover a means of "hall-marking" the work of members of the Association. Advertisements in non-technical papers and in builders' and architects' journals were favoured, urging the employment only of members of the Electrical Contractors' Association. That the Association should guarantee the work of its members was considered to be too ambitious a proposition, at any rate by the members of the Council, whilst the application of a monetary limit to any such guarantee would naturally suggest a half-hearted way of going to work. A statement put at the foot of the contractor's specification and tender to the effect that the tenderer is a member of the Association and that the work would be carried out in accordance with the rules of the Institution of Electrical Engineers will certainly carry some weight, and it is a question whether members can do more at present. Inspection of all work carried out by members was put on one side as impracticable, whilst another suggestion that cases of complaint only should be inspected did not meet with general approval, it being submitted that the Association would then be open to the charge of acting as a consulting engineer. In some preliminary remarks made by Mr. Ratcliff, he made an insinuation which central station engineers will rightly resent. He said:—"The central station engineer is at his wits' end to keep his load line as high as previously. . . . In Greater London there are thousands and thousands of lights added every year in the outlying districts. I venture to say that at least 50 per cent.—possibly 75 per cent.—of that work would not pass the rules of the fire insurance companies if they were applied, and certainly they would not pass the Institution of Electrical Engineers, and yet they are connected to the mains!"

Assuming that a standard of work is imposed, is it beyond doubt that it will be adhered to in every case by all members of the Association? The Central Board has no power to pledge its members to work to any definite standard. The Electrical Contractors' Association has some experience of the impossibility of forcing its members to a particular course of action when their own business is concerned in the case of the agreement with the Cable Makers' Association. It is notorious that many members of the Contractors' Association do not follow the injunction to buy only C.M.A. cable, because they can get cable which they consider sufficiently good for their purpose more cheaply. One member inadvertently let this out at the November meeting, and was firmly, but genially, castigated by Mr. W. R. Rawlings for his want of loyalty. Nevertheless, Mr. Ratcliff, who is Chairman of the London Section, admitted that there was a great difference of opinion upon this point.

Finally, a formal resolution was passed referring to the General Board the question of imposing a standard of work upon all members. Care must be taken that in endeavouring to arrive at a higher standard, the impression is not given to consulting engineers and architects that the effects of a "ring" will be the result. As a basis to work upon, Mr. W. R. Rawlings made a few suggestions, the most important of which were as follows:—

"The technical details of all specifications to be carried out in their entirety unless mutually agreed to be modified by all parties. All wires and cables to be supplied by a member of the C.M.A., whether specified or not, and in all cases the grade of wire specified will be supplied. In the absence of a specification the size of wire is to comply with the rules

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last published of the Institution of Electrical Engineers. The members of the Association will, as far as possible, confine themselves to the use of British-made goods. The Association will, at its own expense, examine into any complaints, and, if it is shown that the rules are not carried out, the Association will indemnify the consulting engineer, architect, or client against any expense they may incur in correcting such abuse."

Mr. Rawlings was, however, in doubt as to whether the time was ripe for the last of these rules.

The education of the consumers to a better standard of work would be an invaluable achievement, and some proposals were made with the view of attaining this. For instance, any case of a fire insurance company passing bad work is to be publicly exposed—presumably in the Association's journal. A similar fate is to befall any contractor or municipality putting in inferior installations—but these latter can only be judged in relation to the Association's own standard, which must necessarily be fixed first.

It was hinted that the Institution of Electrical Engineers' rules were too vague to adopt as a standard, but Mr. Rawlings, who is the Association's representative on the Wiring Rules Committee, said that the new rules which will be issued shortly will be more definite and will remove certain doubts. The use of slip socket, which it was thought was prohibited under the old rules, will be absolutely barred unless the joint has the same conductivity as the tube itself. Lighting cables are to be calculated on the basis of a drop of 2 per cent. *plus* one volt. For heating and power purposes, it is laid down that the drop in volts shall not exceed 10 per cent., and that the size shall be determined by the heating effect, viz., a rise not exceeding 21° F. above the surrounding atmosphere. Any suggestions sent to Mr. Rawlings will be placed before the committee. The idea of having a set of rules of their own as the Association's standard did not meet with approval.

Apropos of the suggested Municipal Wiring Bill, it is said that the Contractors' Association have a bigger war chest for the probable Parliamentary struggle than the municipalities, in addition to which the question of the legality of municipal funds being applied for such a purpose may be raised when the proper time comes.

Electrical contractors are not pleased with the action of certain large electric supply companies in opening showrooms and doing contracting work, and an eye is being kept upon them, as well as upon the municipalities in this connection.

The Municipal Bill.—Watford is in favour of that portion of the Bill which relates to standby supply and protection against unauthorised undertakers. Battersea is withholding its opinion until the Bill is actually drafted.

Stop-valve Explosion.—A Board of Trade Report has just been issued on a stop-valve explosion which occurred at the Hanley Electricity Works on July 25th. The cover of the valve was forced out of its screwed socket, and through the opening thus formed in the valve chest, steam, at a pressure of 130 lbs. per square inch, escaped until the receiver connections were closed. The cover was so slack a fit in the valve chest that it had only been, hitherto, held in position by the extreme edges of the screw thread, and these ultimately giving way, under ordinary working conditions, the cover was blown out by the pressure of steam in the receiver.

The Institution of Civil Engineers: Yarrow Educational Fund.—This Fund was established to afford assistance to young men who desire to become engineers, who have given proof of their capacity to profit by specialised education and training, but who lack sufficient means to obtain it. Grants varying between £50 and £100 per annum, for a period not exceeding three years, may be made at the discretion of the committee. Applicants for such grants must be of British birth, not more than 21 years of age, and must be prepared to qualify for attachment as Students of the Institution of Civil Engineers. Several vacancies for scholarships under the Fund will occur in March, 1911, and the Council of the Institution are prepared to receive and consider applications therefor. Applications should be addressed to the Secretary of the Institution of Civil Engineers, Great George Street, Westminster, S.W., from whom further particulars may be obtained.

RUBBER BELTING

ONE of the many applications of rubber and similar materials in which the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., specialise, is "Silvertown" Belting, both rubber and balata. They inform us that they have just fulfilled a large contract of this nature to the order of Messrs. Spencer & Co., Ltd., of Melksham, for the Hull & Barnsley Railway Co. Two large rubber belts (shown in the illustration ready for despatch) are to be used for loading vessels with coal at the Hull Docks by a new patent conveyor system which has already been successfully applied by the North-Eastern Railway Co. for the same purpose, and for which Messrs. Spencer & Co. have the sole rights of manufacture and supply. The plant will be electrically driven. The belts are 953 ft. and 929 ft. long, and weigh 12,071½ lbs. and 11,740¾ lbs. respectively.



RUBBER CONVEYOR BELTS FOR THE HULL AND BARNSLEY RAILWAY CO.

The Brennan Monorail.—On Saturday last Mr. L. Brennan, C.B., had the honour of showing a number of Cabinet Ministers the working of his monorail car in the Shepherd's Bush Exhibition grounds. Mr. Asquith, Mr. Lloyd George, Mr. Winston Churchill, and Mr. Augustine Birrell all took part in a ride in the car, and inspected the machinery. Mr. Winston Churchill in particular appeared to take great interest in the construction and working of the car, and assisted Mr. Brennan in his explanations to the other members of the Cabinet. Among others who were present were Mrs. Winston Churchill, Lady Gwendoline Churchill, Miss Violet Asquith, Mr. Raymond Asquith, Sir Ernest Cassel, Sir Edgar Speyer, Lord Basil Blackwood, Mr. George Cornwallis-West, and Mr. Guy Granet. A detailed description of the car appeared in our issue of November 18th, 1909.

New Single-Phase Railways.—The Austrian sections of the proposed "Mittenwaldbahn," which is partly in Bavaria and partly in Tyrol (Austria), are now under construction, and will be opened to service towards the end of 1912. The completed line will provide a shorter route between Munich and Innsbruck *via* Garmisch-Partenkirchen, and though the traffic will be at first of the nature of branch-line traffic, the line is being constructed with a view of ultimately making it a main line. A feature of the line is that for a length of 12 miles there is a continuous gradient of about 3.6 per cent. The trains will be of 100 tons and 200 tons weight, drawn by one and two locomotives respectively. These will be of the six-axle pattern with one large 800-h.p. single-phase motor coupled to four driving wheels through coupling-rods, as in the Dessau-Bitterfeld locomotives of the Prussian State Railways. Current will be supplied at 10,000 volts; the frequency will be either 15 or 25 cycles. A water-power station is being constructed to supply the electrical energy. This will contain two 4,000-h.p. sets supplying current at 50,000 volts to the sub-stations. The whole of the electrical equipment will be supplied by the A.E.G. Union Company of Vienna. The section of the line which is in Bavaria will run from Griesen to Scharnitz *via* Garmisch-Partenkirchen, and will also be worked electrically. The construction of this section has not yet been commenced, however.

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ELECTRIC RAILWAY ECONOMICS

Mr. Hobart's Defence of the Continuous-Current System.

A PAPER was read recently by Mr. H. M. Hobart, before the Arc Works Engineering Society, Chelmsford, on the economic aspect of railway electrification, which contained some interesting detailed comparative figures for the continuous-current and single-phase systems, on the relative advantages of which Mr. Hobart is known to have strong views.

The earlier part of the Paper treated generally of the conditions under which electric traction has advantages over steam traction. The main question is that of acceleration. As regards long-distance trains with infrequent stops, the steam locomotive is able to deal with the conditions usually obtaining, but for urban and suburban traffic, when the stops are at all frequent, the maximum accelerations commercially possible with steam locomotives result in a schedule speed so low that the tramcar and motor omnibus provide satisfactory alternatives. A 50-ton steam locomotive, giving a draw-bar pull of 3 tons, will only produce an acceleration of less than 0·2 m.p.h. per sec. on a 200-ton train, whereas with an electrical equipment, also constituting 20 per cent. of the total train weight, an acceleration of 1 m.p.h. per sec. is available, with frequent stops. The great importance of this was illustrated by curves showing that a steam train with an acceleration of 0·4 m.p.h. per sec. can only maintain a schedule speed of some 11 to 12 m.p.h., whereas an electric train with an acceleration of 1 m.p.h. per sec. can provide a schedule speed of some 18 m.p.h. If the distance between stops is one mile instead of half a mile, the schedule speed for the steam train will only be of the order of 17 m.p.h., while the electric train can provide a schedule speed of about 25 m.p.h. The development of steam railways to their present high stage of efficiency has entailed an enormous capital outlay, and this constitutes the chief stumbling-block in the way of the electrification of urban and suburban sections. The extra outlay for conversion to electrical working, taking interest at 4 per cent., has imposed an extra capital burden in various cases of electrification of sections of British railways, and works out as follows :—Tynemouth section of the N.E.R., 1·9d. per train mile; Southport section of the L. & Y.R., 2·0d. per train mile; Mersey Railway, 4·3d. per train mile; Victoria-London Bridge section of the L.B. & S.C.R., 6·4d. per train mile. With the increased train service introduced on the L.B. & S.C.R. on October 1st, the capital burden is reduced from the above figure to about 5·5d. per train mile, and the consummation of the programme now contemplated for this section of railway, will, if the present amount of rolling stock suffices for the intended future service, reduce the capital burden to 4·1d. per train mile. By the use of an appropriate system, the capital burden incurred in electrifying suitable suburban sections of main line railways probably need not exceed 2d. per train mile, but it is impossible to make any definite statement. The strong point of electrification is that, in respect to obtaining high speeds with frequent stops, the results cannot be approached by steam locomotive methods, and these attractive features ultimately produce an increase in traffic which, notwithstanding the large capital outlay and the by no means low operating costs, yields a larger profit in virtue of a greatly increased turnover.

The author then proceeded to work out a typical case in considerable detail, based on the latest results obtainable. The service assumed was for a schedule speed of 25 miles per hour with one stop per mile, which is intermediate between the cases of the Southport section of the L. & Y.R. and of the Victoria-London-Bridge section of the L.B. & S.C.R. The train-mile costs were worked out for two different electrical systems. In one, current is transmitted at high pressure three-phase to sub-stations in which it is converted, in rotating machinery, into continuous current at, say, 600 volts. At this pressure it is supplied to conductor rails. In the other system, single-phase transmission and distribution are employed with overhead contact lines.

The case was taken of ten miles of double track over which it is desired on week-days to operate a 12-minute service of three-coach trains from 6 a.m. until midnight, and to run half this service on Sundays. Ninety trains are despatched in each direction on week-days and 45 trains in each direction on Sundays. This aggregates 610,000 train miles per annum. Eleven trains are provided, each to run 55,500 productive miles per annum. The three-coach trains are 180 ft. in length, and provide 180 seats. The coach bodies weigh 18 tons each. The trucks weigh 6 tons each. Thus, exclusive of the electrical equipment, the weight of each train is 90 tons. For a schedule speed of 25 m.p.h., and with one 20-second stop per mile, the consumption of electricity on test runs will be about 90 watt hours per ton mile, or 2·25 kw. per ton weight of train. The efficiency of the electrical equipment will be about 70 per cent. Thus the average output from the motors will be 2·11 h.p. per ton weight of train.

Up to this point there has been no need to distinguish between systems. Continuous-current equipment yields an average output of about 10 h.p. per ton weight of equipment, while single-phase equipment yields an average output of 5·5 h.p. per ton weight of equipment. Consequently the weights of the equipment per ton weight of train will be 0·211 and 0·384 ton per ton weight of train respectively.

The weights and costs of the two trains are shown in the following table, assuming a cost of £80 per ton for bodies, £22 for trucks, and £125 for electrical equipment :—

	Continuous.		Single-phase.	
	Weight. Tons.	Cost. £.	Weight. Tons.	Cost. £.
Coach bodies	54	4,320	54	4,320
Trucks	36	790	36	790
Electrical equipment	24	3,000	56	7,000
Total weight	114	—	146	—
Cost of assembling and all further costs (at £5 per ton of total weight of train)		570	—	730
Total cost of train		8,680	—	12,840
Cost of train per ton of total weight		76.0	—	88.0
Cost of train per seat		48.1	—	71.4

The outlay for rolling stock is :—For the continuous system, £95,500, and for the single-phase system, £141,000. The cost of the contact conductors (third rail or overhead wire) will depend greatly on the line. It is taken as £2,000 per mile of single track for both systems, or £40,000.

The load factor of the sub-station output may be taken as 20 per cent. Before we can estimate the cost of the sub-station we must estimate the load. Taking the input in actual service as 30 per cent. greater than on test runs, then the input at the train per annum will be 8,150,000 kw. hours for the continuous system, and 10,420,000 kw. hours for the single-phase system, and the maximum loads on the sub-station will be (allowing 98 per cent. efficiency from sub-station to trains) 4,750 kw. and 6,080 kw. respectively. For the continuous system two sub-stations are provided for each for a peak load of 2,375 kw. each, with a rated capacity of 3,000 kw. of machinery. The cost of the two is taken as £30,000. The distributing cabins, which, in the single-phase system, replace the sub-stations, will cost about one-fourth as much per million kw. hours per annum as the sub-stations in the continuous system. On this basis, the capital outlay for the distributing cabins for the single-phase system amounts to £9,600.

The case is taken where electricity is purchased from a supply company, which delivers it to the railway's sub-stations. For the continuous system the railway will receive the electricity at the sub-stations in the three-phase form and at unity power factor. For the single-phase system the electricity will be received at the distributing cabins in the single-phase form and at an average power factor of 0·80. The single-phase electricity will cost the most on account of the greater cost and less efficiency of single-phase generators as compared with three-phase generators, the lower power factor, and the greater cost of the transmission line.

The price of the electricity will vary according to many circumstances. It is only the *relative* prices which will materially affect the results of this comparison. These may fairly be taken for the electricity as delivered to the sub-stations, as 0·62d. for the continuous electricity system, and 0·53d. for the single-phase system. The efficiency of the single-phase sub-stations may be taken as 100 per cent., as these will be merely distributing cabins. The efficiency of the continuous electricity sub-stations may be taken as 89 per cent. Consequently the amount of electricity to be paid for annually will be 9,350,000 kw. hours for the continuous electricity system, and 10,650,000 kw. hours for the single-phase system. At the above prices, the annual outlay for electricity is £24,500 and £30,200 respectively, or 9·7d. per train mile for continuous current, and 11·9d. for single-phase trains. For the annual outlay for repairs and renewals the following figures are taken :—Rolling stock, 8 per cent. for both systems: sub-stations, 6 per cent. for the continuous system; distributing cabins in the single-phase system, 4 per cent.

The repairs and renewals of the contact-conductors, insulators, bonding, feeders, &c., are taken as half as much again for the single-phase overhead system as for the con-

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tinuous "third-rail" equipment, or 5·0 and 7·5 per cent. respectively.

The annual cost for repairs and renewals thus work out as set forth in the following table:—

	Continuous System.	Single-phase System.
Rolling stock	£7,640	£11,300
Sub-stations	£1,800	
Distributing cabins	—	£380
Conductors, &c.:—		
(*a*) Cont. system	£2,000	—
(*b*) Single-ph. system ...	—	£3,000
Total	£11,440	£14,680
Do. per train mile	4·5d.	5·8d.

For wages of drivers and of sub-station attendants the following figures are appropriate:—

	Continuous	Single-phase.
Drivers' wages per train mile ...	1·0	1·0
Sub-station attendants, inspectors, &c.	0·8	0·4
	1·8	1·4

Summing up these items we have:—

	Continuous	Single-phase.
Outlay for electricity—per train mile	9·7d.	11·9d.
Repairs and renewals:—		
Of rolling stock, sub-stations, conductors, &c., per train mile	4·5d.	5·8d.
Wages of drivers and of sub-station attendants per train mile	1·8d.	1·4d.
Total	16·0d.	19·1d.

The capital outlays in these two cases are as follows:—

	Continuous.	Single-phase.
	£	£
Rolling stock	95,500	141,000
Sub-stations or distributing cabins ...	30,000	9,600
Contact conductors, &c.	40,000	40,000
Tools, buildings, and all further capital outlays incurred	10,000	10,000
Total capital outlay	£175,500	£200,600
Interest on above at 4 per cent. ...	£7,030	£8,050
Interest per train mile	2·76d.	3·16d.
Running and maintenance costs per train mile	16·0d.	19·1d.
Total costs per train mile depending on electric traction ...	18·8d.	22·3d.

Amount by which the single-phase system exceeds that of the continuous electric system ... ... 22·3d. − 18·8d. = 3·5d.

For the three-coach 180-seat train under consideration, the receipts per train mile are unlikely to exceed 36d. If comparisons, however, are worked for three cases, namely, receipts of 34d., 42d., and 50d. per train mile, the amounts which the lesser cost of the continuous system as compared with the single-phase system constitutes of the gross receipts per mile for a 180-ft. three-coach train, expressed as a percentage of the gross receipts, will be found to be 10·3, 8·4, and 7·0 per cent. respectively.

It will be noted, continues Mr. Hobart, that only in the improbable case that the receipts amount to as much as 50d. per train mile, does the difference between the train-mile costs of the two systems decrease to as low as 7·0 per cent. of the gross receipts. Consequently it follows that the use of the continuous-current system in preference to the single-phase system for a service of this sort, permits of the allocation of at least 7·0 per cent. more of the gross receipts to reserves, dividends, &c.

The only capital costs which have been worked out have related to the electrical equipment, including sub-stations, contact-line installation, and rolling stock and its equipment. These items aggregate only £176,000 and £201,000 for the two respective systems. But the chief capital outlays are in addition to these relatively small sums. These further capital outlays will vary widely, and may, for such a ten-mile urban or suburban route, be anywhere from £500,000 to £2,000,000, according to the locality and the type of road. A higher expenditure, such as for a subway or for a deep-level tunnel (which, for a ten-mile road, would run to from £4,000,000 to £7,000,000), could not be made to pay with so light a service as is represented by an average of only five trains per hour in each direction. Let us consider a case where the further (and chief) costs amount to £1,000,000 for a ten-mile road. The corresponding total costs are:—For the continuous system, £1,176,000; and for the single-phase system, £1,201,000. The aggregate gross receipts will be £86,000, £107,000, and £127,000 respectively, for 34d., 42d., and 50d. per train mile.

We have already seen that the items in the total costs which are affected by the type of electrical system employed amount to 18·8d. per train mile for the continuous system, and 22·3d. per train mile for the single-phase system. Taking the cases where the remaining costs are respectively 16d., 20d., and 24d. per train mile, as these values cover the range which would apply to such a road and with such conditions of traffic, the total costs per train mile are:—

	Continuous System.	Single-phase System.
Case A.—When remaining costs are 16d. per train mile	34·8d.	38·3d.
Case B.—When remaining costs are 20d. per train mile	38·8d.	42·3d.
Case C.—When remaining costs are 24d. per train mile	42·8d.	46·8d.

The corresponding total costs per annum are given in the following table:—

Total Costs per Annum.

	Continuous System.	Single-phase System.
Case A	£88,600	£97,500
Case B	£99,000	£107,700
Case C	£109,000	£118,000

The net profit, or net loss, of the capital outlay, is shown for all these cases in the following table:—

	Receipts per train mile.	Continuous System. Profit or Loss.	£.	per cent.	Single-phase System. Profit or Loss.	£.	per cent.
Case A.	34d.	Loss.	2,600	0·22	Loss.	11,000	0·92
	42d.	Profit	18,400	1·57	Profit	9,200	0·77
	50d.	Profit	38,400	3·27	Profit	29,500	2·46
Case B.	34d.	Loss.	13,000	1·10	Loss.	21,200	1·76
	42d.	Profit	8,000	0·68	Loss.	700	0·05
	50d.	Profit	28,000	2·38	Profit	19,300	1·60
Case C.	34d.	Loss.	23,000	1·96	Loss.	31,500	2·60
	42d.	Loss.	2,000	0·17	Loss.	11,300	0·94
	50d.	Profit	18,000	1·53	Profit	9,000	0·75

So long as electrified sections constitute only a small portion of the suburban mileage of a main-line railway, the effect of small variations in the profit or loss on the finances of the entire railway may be negligible, but with extensions of the electrified sections the effect of the use of the less-economical system will become much more manifest. It will be observed that in no instance is the return on the investment satisfactory. This draws our attention to another attribute of electric traction, namely, that an urban or suburban line involving large capital outlay, must be intensely utilised. In other words the train mileage per annum, per mile of line, must be high. Thus in the Underground and Tube Railways in London, which have cost well on toward £1,000,000 *per mile*, as against the £100,000 *per mile* of our example, and with a service, at certain times of the day, of 40 long trains per hour in each direction, there is an almost negligible margin between receipts and total costs. By doubling the frequency of the trains, that is, by operating a service with an average of 10 trains per hour in each direction (instead of only 5), then, assuming that double the number of passengers can be induced to travel (*i.e.*, assuming the same receipts *per train mile*) the profits will increase to much more attractive proportions. This will be particularly the case for the continuous electricity system, since the 100 per cent. increase in the rolling stock will, with the continuous electricity system, involve a smaller increase in the capital burden than is involved in a 100 per cent. increase in single-phase rolling stock.

The results in this Paper, concludes Mr. Hobart, only apply to the particular service selected for the example. The less frequent the trains, the lower the speed and the greater the distance between stops, the less unfavourable to the single-phase system will be the results of such a comparison, but the less also is then the desirability of employing electricity, and by the time the point is reached where the single-phase system, as at present developed, is more economical than the continuous-electricity system, the conditions are such that (except for very special cases) steam-locomotive operation constitutes at present the most economical system.

The Turin Exhibition.—Arrangements for the British section at the International Exhibition, to be held at Turin next year, are well in hand at the Exhibitions Branch of the Board of Trade. The site of the exhibition is at the end of the Corso Vittorio, Emanuele II., extending along both banks of the river and into the Valentini Park, quite close to the Porta Nuova central railway station.

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PROGRESS IN TELEGRAPHS AND TELEPHONES

The Postmaster-General's Annual Report.

THE annual report of the Postmaster-General for the year ended March 31st, 1910, devoted to telegraphs, records an increase of 2·4 per cent. in the total number of telegrams as compared with the previous year; 214 new post offices have been opened for telegraph business. Improved forms of apparatus are receiving attention. Modern keyboard perforators have greatly enhanced the utility of the Wheatstone automatic system, and the use of printing telegraph apparatus is receiving special attention. A satisfactory trial has been made of Undulator apparatus on the Bristol-Cork circuit, with a view to avoiding the use of repeaters on submarine cable circuits. The main underground line to the West has been completed, and the wires between London and the landing-places of the important cables starting from the West of England have now been diverted to the underground route. The northern underground line has been completed to Edinburgh; a section of underground work from Aylesbury to Coventry has been laid down, completing the second London-Birmingham underground cable; additional pipes and cables have been laid down between Manchester and Warrington, Manchester and Ashton, and Manchester and Stockport; and pipes have been laid between Leeds and Stockton, Chatham and Canterbury, and Berkeley and the City boundary of Gloucester. During the present financial year it is hoped to lay pipes from Gloucester to Worcester, from Leeds to Hull, and from Canterbury to St. Margaret's Bay, and Abbot's Cliff, the landing-places of Continental cables, and cables from Berkeley to Worcester and from Stockton to Leeds. The cable from Stockton to Leeds will complete the line from Warrington to Newcastle; and the pipe work from Gloucester to Worcester and the cable from Berkeley to Worcester will complete the underground connection between Bristol and Birmingham.

In connection with foreign telegraphs, it is mentioned that quadruplex working with the Baudot instrument has been experimented with successfully on two of the Anglo-Netherland wires. It is proposed to make the arrangement permanent after the completion of certain rearrangements now in progress at the Central Telegraph Office, by which the space allotted to the Continental wires will be increased. Arrangements have been made for the acquisition of the Anglo-Norwegian telegraph service by the two Governments from January 1st, 1911, a new cable, which will be the joint property of the two Governments, being laid between Newbiggin and Arendal.

With regard to wireless telegraphy, reference is made to the acquisition of the following coast stations from the Marconi Co. and Lloyd's:—Caister (Norfolk), North Foreland (Kent), Niton (Isle of Wight), Lizard (Cornwall), Seaforth (Liverpool), Rosslare (Wexford), Crookhaven (Kerry), Malin Head (Donegal). The sums paid to the Marconi Co. and to Lloyd's were £15,000 and £2,400 respectively. Steps are being taken with a view to establishing before long a ring of thoroughly equipped stations round the coast of the United Kingdom. The number of radiotelegrams dealt with during the year at the stations which are now in the hands of the Post Office was as follows:—Outward radiotelegrams to ships, 3,266, as compared with 1,817 in 1908-9; inward radiotelegrams from ships, 27,727, as compared with 22,732 in 1908-9.

Some interesting particulars are given of the trunk line telephone service. There are now 643 trunk exchanges and 2,666 trunk circuits. The Post Office are continuing their extensions in the less populous parts of the country, and arrangements have been made for the National Telephone Co. to proceed with extensions in the outlying parts of areas served by their system. Reference is made to the new Glasgow exchange (see ELECTRICAL ENGINEERING, August 18th, p. 531), and statistics are given of the London system, which now embraces 64,200 subscribers, originating about 70 million calls per annum.

The following paragraph concerning certain criticisms is worth quoting in full:—

"The finance of the Post Office telephone system has recently been the subject of some criticism, and in particular considerable publicity has been given to a statement, originally made at the annual meeting of the National Telephone Co., that the average cost of construction per telephone station was about £52 for the system of the Post Office as compared with about £30 for the National Telephone Co.'s system. In this calculation it appears to have been overlooked that the expenditure taken as the cost of the existing Post Office telephone stations included a sum of about £1,000,000 expended in providing plant for the use of the National Telephone Co. This sum should, therefore, have been added to the Company's expenditure, raising the average cost by about £2 per station. A corresponding deduction would reduce the Post Office expenditure by about £11 10s. per station. Expenditure on land and buildings seems to have been excluded from the Company's cost per station and included in the cost attributed to the Post Office system. Part of the Post Office expenditure has been for plant to replace the Company's overhead wires and cables, and some of their older exchanges, after the transfer of their system to the Post Office at the end of 1911. About 65 per cent. of the Post Office stations are in London, where a very costly underground system has been provided, and the average length of the lines in use is about double the length of the lines on the Company's general system. The Post Office has also provided all the underground junction wires for communication between the exchanges of the two systems in London."

CATALOGUES AND PAMPHLETS, &c., RECEIVED

WIRES AND CABLES.—The St. Helens Cable & Rubber Co., Ltd. (Warrington) are issuing an advance list of vulcanised rubber-covered wires and cables with revised prices. This contains particulars of "Association" and "non-Association" cables of all sizes. A complete new list will be issued in December.

ARC LAMPS.—The Abbey Electric Co. (17 Victoria Street, S.W.) have issued an attractive list of their latest forms of long-burning flame arc lamp, which range up to a size running for 40-45 hours, only 48 ins. in length over all, and without any magazine arrangement. This is a double carbon lamp with a ratchet feeding arrangement controlled by shunt and series coils. The mechanism was described in some detail in ELECTRICAL ENGINEERING, April 14th, page 245.

MACHINE TOOL DRIVING.—A large and most handsomely got up pamphlet, entitled "Machine Tool Driving," is being issued by the Electric Construction Co. (Dashwood House, 9 New Broad Street, E.C.). This contains illustrations typical of a number of patterns of motors made by the Company, most of which, we note, are now fitted with ball bearings. A series of photographs are also reproduced showing these motors applied to the individual driving of modern machine tools of large size and other forms of drive, such as group drive by belting of wood-working machinery. A list of some typical E.C.C. motor installations is also given.

THE I.C.S. STUDENT.—We have received from International Correspondence Schools, Ltd. (Kingsway), a copy of the first weekly issue of their magazine with the above title. This takes the form principally of a register of vacancies in prominent firms, and should prove useful to students who have completed their courses of instruction.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ACCUMULATOR ACCESSORIES.—A revised price-list from Messrs. Cookson & Co., 59-61 New Oxford Street, W.C., deals with accumulator plates, and such accessories as indiarubber corks, collars, &c., glass vents, and hydrometers, together with complete cells of small and moderate size. A list of electric motor-car and cycle lamps is also given.

FITTINGS.—Furthering their activities in the direction of electric lighting, the Welsbach Incandescent Gas Light Co., Ltd., have issued through their electric light section (344-354 Gray's Inn Road) a handsome and complete catalogue of electric fittings. This includes a long series of plain and ornamental brackets, table and floor standards, electroliers and chain pendants, the latter especially including some very attractive designs. There is also a considerable choice of dining room and dressing table counter-weight pendants, as well as ceiling fittings and ordinary flexible cord pendants, hall lanterns, &c. The above refer to house fittings, but water-tight and exterior fittings are dealt with in the latter part of the catalogue. A very complete selection of shades is included, and other articles dealt with include lamp holder switches, plugs, adaptors, &c., hall fittings, ceiling roses, and cut-outs. A few designs of radiators of the lamp pattern are included.

HEATING AND COOKING APPARATUS.—A new catalogue of their well-known "Quartzalite" heating and cooking apparatus (see ELECTRICAL ENGINEERING, Vol. V., page 631) is being issued by the Bastian Electric Heating Syndicate, Ltd. (91-93 Palmerston House, E.C.). This contains particulars of the construction of a number of forms of heaters for rooms, as well as ovens, toasters, water-heaters, irons, hot plates, and a new coffee percolator, in which the Bastian patent heating units, consisting of wire spirals embedded in quartz tubes, are used. An effective show-card calling attention to these heaters has also been prepared, and this and the catalogue can be obtained from any of the wholesale agents, among whom are Messrs. Drake & Gorham, Ltd. (66 Victoria Street, S.W.), Messrs. Johnson & Phillips, Ltd. (14 Union Court, Old Broad Street, E.C.), the British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), the Wardle Engineering Co., Ltd. (196 Deansgate, Manchester), the Electrical Co., Ltd. (121 Charing Cross Road, W.C.), and Electrical Installations, Ltd. (27 St. Martin's Lane, W.C.).

The Royal Society of Arts.—Among the forthcoming lectures are the following:—November 23rd, "Modern Methods of Detecting Firedamp in Mines," by Sir H. H. Cunynghame; November 21st and 28th, and December 5th and 12th, a course of Cantor lectures by Mr. C. R. Darling on "Industrial Pyrometry"; March 6th, 13th, 20th and 27th, a course of Cantor lectures on "Applications of Electric Heating," by Prof. J. A. Fleming, F.R.S.

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CORRESPONDENCE

POST OFFICE TELEGRAPH AND TELEPHONE FINANCE.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—That tardy annual, the Postmaster-General's Report on the Post Office for the year ending March 31st, has just made its appearance. A few years ago it was available in August, but it is gradually becoming a Christmas publication. In view of the approaching creation of an exclusive Post Office monopoly in the telephone, the financial results of the present telegraph and telephone work of the Post Office are of interest to business men and political economists. Summarised, they are as follows:—

Capital Expenditure.		
Telegraphs	£18,523,019	
Telephones	£10,138,128	
Total ...		£28,661,147
Gross Revenue.		
Telegraphs	£3,166,192	
Telephones	£1,391,377	
Total ...		£4,557,569
Working Expenses.		
Telegraphs	£3,568,203	
Telephones	£1,026,933	
Total ...		£4,595,136

The excess of expenditure over revenue for the year was therefore £37,567.

The working expenditure of the telegraphs was 113 per cent. of the gross revenue. The working expenditure of the telephones was 73·8 per cent. of the gross revenue. The working expenditure of the combined undertakings was just over 100 per cent. of the gross revenue. All capital charges on 28½ millions of capital have to be met from other sources than the earnings of the combined undertakings. Interest on the original capital of the telegraphs, £10,800,000, is paid out of the Consolidated Fund. On the capital added since the purchase capital account was closed, many years ago, no interest is paid. Interest and sinking fund on telephone capital is paid partly by net telephone revenue and partly by royalties from licencees; the royalties for the past year amounted to £320,590, or almost as much as the net revenue of the whole telephone business of the Post Office.

The actual net telephone revenue, arising from the trunk line system, the London system, and the provincial systems of the Post Office amounted to £364,444, or 3·55 per cent. on the total telephone capital of £10,138,128. The amount required for interest and sinking fund on telephone capital was £767,007, so the net telephone revenue failed to meet capital charges for the year by £402,563.

It is to a Department which produces from a technical industry financial results such as these that the political authorities now propose to entrust the entire telephone business of the country.

I am, Sir, yours faithfully,

HERBERT LAWS WEBB.

35 Old Queen Street. S.W.
November 4th, 1910.

PRACTICAL EDUCATION

MR. C. FARADAY PROCTOR gave the above title to his inaugural address as chairman of the Newcastle Section of the Institution of Electrical Engineers, which was devoted principally to a plea for improvement in the methods of education adopted in this country. As Sir G. Reid had said at the recent meeting of the British Association, modern students' knowledge was often too much of the nature of a gramophone record. The memory was cultivated at the expense of the intelligence. The present system tended to regard the successful passing of an examination as a proof of the scholar's knowledge. Mr. Proctor contended that it only proved his ability to pass examinations, and that the true proof of the efficiency of his education was his ability to earn a good living for himself, and a social position somewhat better than that which he would inherit from his parents. He deprecated the neglect in the teaching of drawing, and repeated Sir John Gorst's dictum that "book schools" should be replaced by "work schools."

He then passed on to show by one or two examples how little use the class of knowledge obtained by examination passing was without trained powers of observation. Ideas of manufacturing processes gleaned from text-books gave little help in battling with difficulties in practice due to variety of conditions. He thought that it was very striking how large a percentage of engineering college students adopted the teaching profession, and how few were at actual engineering work. He had been told that in Germany the clear understanding of a problem was regarded as of paramount importance. It was to the superior methods of technical education that he attributed much of passage of business in the electrical and other industries from this to other countries, and several examples were given of large orders which have been placed abroad, and industries which had practically left the country.

He asked why could not we only teach the bare essential principles of economic life to the masses, and give special assistance to those showing a real aptitude for study, and at the same time give more attention to the ability of the teacher to teach rather than his ability to learn, as shown by the passing of examinations in subjects they are never likely to require during their teaching duties.

Some people suggested other reforms than a more practical education, and, indeed, one large manufacturer who often advocated drastic reforms of at least as revolutionary a character), had proved that even the long-established Continental business of telephone making could be wrested from the foreigner (who had the advantage of good wood supplies), and conducted at a profit in England. He contended that the secret was simply a good combination of capital, labour, theory and practice, backed, of course, by good commercial ability.

Mr. Proctor then passed on to point out the absurdities of our systems of weights, measures, and coinage, and commended the action of the American Electrochemical and other societies in insisting that all papers containing English measures have the corresponding metric values given as well. He wished that their own Institution would follow this example.

WATER POWER IN TASMANIA

MR. F. A. M'CARTY, the well-known electrical engineer in Australia, has been in Hobart recently in the capacity of consulting engineer to the Complex Ores Co., and during that time he made a close examination of the Great Lake and the site upon which it is proposed to build the company's generating station. The following is an extract of his report:—

I visited the lake last Tuesday, and I inspected the proposed site of the dam or weir and found it to be a most suitable place for erecting a weir. It can eventually, if the company thinks fit, be raised, approximately, to a height of 16 ft., although I understand the company only contemplates erecting a dam 4 ft. high at the start. The area of the lake is, approximately, 26,000 acres, and from a rough calculation I found that a 6-in. rise on the lake, without counting on any supply coming in or making allowance for any evaporation, would run a plant generating 24,764 h.p. for 31 consecutive days. On this basis, with a dam 4 ft. high, built as the company proposes, enough water could be conserved to run the plant for eight months without any additional supply. For example, suppose there was an eight months' drought—an unprecedented thing in the lake district—enough water could be stored with that 4-ft. dam to run that huge plant for the period I mention. The evaporation and other losses which would take place would be compensated for by the ordinary supply coming in during this time. If the dam were raised to 8 ft., we could generate without any further expense, 50,000 horse-power, and with the diversion of the upper waters of the Ouse into the lake I calculate 100,000 horse-power could be generated without trouble. With suitable damming enough water can be stored at the lake to last out an eight months' drought. With the great lake harnessed, it will be possible to generate enough power to run the whole of the Government railways, even those in the remotest part of the State, and then have enough left over for the industries in the city and other places. With the low rates to be charged, it will be possible to build up industries here to supply the needs of other parts of Australia. Amongst the few industries which I hope to see established is the manufacture of iron and steel by electric furnace, the production of aluminium, nitrates, and calcium carbide.

In connection with this matter, gratifying progress is being made with the details of a scheme for utilising the water power for industrial purposes. The Complex Ores Co., of Melbourne, which have acquired the powers to instal a plant for the production of electricity, state that units of 5,000 h.p. will be installed as required. At the fall into the Ouse, where the power station will be located, metallurgical works are to be erected, and run by the company. This will gradually absorb one unit of 20,000 h.p. The plant to be installed will be of the latest type and design, and as much as possible will be made in the Commonwealth. It is estimated that a capital outlay of over £200,000 will be required to carry out and complete the first unit proposed to be installed, including headworks, power station, transmission lines, services, and metallurgical plant.

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LOCAL NOTES

Beckenham: *Proposed "Model" House.*—The Borough Electrical Engineer has been authorised to make a provisional arrangement with reference to the exhibition of electrical appliances in a "model" house which is to be provided by the owners of a local building estate.

Birmingham: *Additions to Showroom.*—A demonstration of electrically-driven machinery has been arranged in the Dale End showroom in order to show the manner in which electricity can be applied to the driving of machinery as apart from domestic applications. The Corporation, having introduced the supply of three-phase current for power purposes, have equipped the showroom with three-phase machinery, and among the apparatus on view is a welding plant, a rolling mill, shearing machine, &c. A number of small apparatus, including drills, polishing machines, grinders, &c., are driven by direct current motors. In all cases, the machinery has been loaned by manufacturers.

Bray: *Municipal Wiring.*—The Dublin & Alliance Gas Consumers' Co. have written to the Council stating that they are informed the Council are wiring premises for electric light, and pointing out that the Council do not possess any statutory powers in this connection. The letter was placed before the Council last week, when it was stated that the company have been misinformed.

Limerick: *Condition of Electricity Plant.*—Mr. Aubrey Clayton, of London, was recently called in by the Council to report generally upon the electricity undertaking. He states that the entire undertaking from beginning to end is in a most exceedingly neglected and dirty condition, and in many places in a bad state of repair. Moreover, there appeared to be an entire lack of system and discipline in all departments. The gas producers were working very inefficiently, the switchboard was in a most neglected and dirty condition, and the lids of the distribution boxes were loose and not watertight. In one case, the lid was missing altogether. Many other criticisms of a like character were made, including the statement that one of the brickwork chambers of a distribution box was found "half filled with clay, and crawling with worms and insects." The mains are said to be in good condition. Mr. Clayton suggests the installation of a battery. The result is that Mr. McNamara, the resident engineer, has been called upon to resign.

London: *London County Council: Invention by Official.*—Mr. W. E. Ireland, the Rolling Stock Superintendent of the L.C.C. tramways, has patented an improvement in tramway brake-gear.

Tramways.—A deputation of four members of the Paris Council is at present visiting London in order to study the tramway system of the County Council.

West Ham: *Electricity Accounts.*—The accounts of the Electrical Department for the year to March 31st, as we have already announced, show a debit balance of £93. The total number of units sold during the year, namely, 19,156,399, was increased by 3,634,322, 43 per cent. of which was due to power and heating. The total revenue from all sources increased from £72,114 to £79,454. The cost of maintenance increased by £1,617, due to expensive repairs and special overhauling, whilst the cost of coal increased by £2,249 in consequence of the increased output. The important factor which has told against the undertaking is rating, which shows an increase of no less than £5,207 for the year, but the under-valuation of the Electricity Department has been commented upon at Local Government Board inquiries from time to time. In a few remarks upon the Sales Department, Mr. Couzens states that the work has been very seriously handicapped, due to the many changes in the staff and the difficulty in obtaining assistance with previous experience, as departments on these lines are not common. He regards the function of a Sales Department not so much to show a profit, as to increase the sale of electricity, and benefit the undertaking as a whole.

Winchester: *Purchase of Supply Co.'s Undertaking.*—In connection with the arbitration proceedings for the purchase of the Winchester Electric Light & Power Co.'s undertaking, Mr. C. H. Merz has been retained by the Corporation as Consulting Engineer.

Worthing: *Tramways.*—In spite of the opposition of the Brighton Corporation, and of a large section of the Hove ratepayers, the promoters of the suggested tramways between Brighton and Worthing are said to intend to proceed with their application in Parliament for the necessary powers.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Ashford.—The East Kent Electric Supply Co., Ltd., have asked for the Council's consent to an application for an electric lighting Provisional Order.

Barking.—Extensions are to be carried out at the Electricity Works. A scheme for removing the Works to another site has not been approved. A loan of £11,000 is to be applied for.

Bispham.—Tenders are invited for gas engines, dynamos, switchboard, balancers, boosters, storage battery and mains. Particulars from Mr. J. W. Speight, Consulting Engineer, The Elms, St. Ann's-on-Sea.

Gloucester.—The Electrical Engineer recommends the installation of a 750 kw. turbo-alternator, condenser, switchgear, &c.; mechanical stokers for two boilers; steam feed pump; a 150-200 kw. motor-generator with switchgear, &c.; also feeders, distributing mains, and services, at a total estimated cost of £14,322.

Kildare.—An additional generating set is to be installed, and a loan of £500 applied for.

Llandudno.—Application has been made for a loan of £2,320 for electrical extensions.

London: *Hackney.*—Further extensions of mains are to be carried out in the Springfield district at an estimated cost of £100.

Luton.—Mains are to be extended at an estimated cost of £2,393.

Radnor.—It has been decided to install a small electric lighting set at the Talgarth Asylum.

Walthamstow.—Tenders are invited by November 25th for a 1,000-kw. mixed-pressure turbine with tandem generators of 500 kw. each, with surface condenser, pipe-work, &c. Particulars from Mr. G. R. Spurr, Electricity Works.

Wolverhampton.—An inquiry was held on Tuesday concerning a loan of £20,900 for electrical extensions. The loan is made up as follows:—Land, £1,400; generating plant, £10,845; additions to destructor, £4,200; new workshops and equipment, £1,850; services, £1,000; excess expenditure, £807; and contingencies, £807.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Conversion of Hanover Chapel, Peckham Road, to electric theatre.

Public Library in Woodland Street, Dalston.

Music Hall, 444/446, Fulham Road.

Alterations and extensions at Gospel Oak rink, Mansfield Road, Hampstead.

Surrey Vaudeville Theatre, Blackfriars Road.

New wing to Monastery in Khedive Road, Forest Gate.

Children's Home. The Guardians, Richmond.

PROVINCES.

Barnsley.—Extensions to York Street Public Baths.

Bradford.—Wool warehouse, Sunbridge Road. Architect, Mr. R. Calvert, Foster Square.

Bury.—Alterations and additions to St. Chad's Schools.

Canterbury.—Electric lighting of workhouse.

Doncaster.—Church in Hallgate.—New Sorting Office. H.M. Office of Works, London.

Glasgow.—Stores and offices at corner of Garscube Road and Firhill Road. Architect, Mr. Neil Duff.—High School for Girls in Kinggarth Street. Architects, Messrs. Thompson & Sandilands.—Alterations and additions to Messrs. Bell's works, 45 McFarlane Street.

Leeds.—Two hostels for men students at City of Leeds Training College. Architect, Mr. S. D. Kitson, Vicar Lane.

OSRAM·LAMPS

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published November 3rd, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

22,988/09. **Pendant Chain Suspension.** R. J. SIMPSON (Acock's Green, Worcestershire). Chains for suspending lamp fittings are constructed with hollow links split longitudinally and provided with means for fitting together. The leads to the fitting pass through alternate links and through openings in the ends of these. The links between the hollow ones may be integral with them, or may be simple solid links with holes at each end for the leads to pass through. Ten figures.

23,014/09. **Arc Lamp.** J. NEU (Nuremburg). In flame lamps of the type in which one electrode rests upon a fixed stop, this stop is pivoted, and provided with a counterweight so that it tips up when the pressure is released owing to the carbon being entirely consumed. This action is caused to cut the lamp out of the circuit or to insert a substitutional resistance. Six figures.

23,216/09. **Resistances.** A. W. MALEY (West Bromwich, Staffs). Resistance grids are stamped out of sheet steel, or consist of steel wire wound zig-zag. The grids are stamped or wound in a continuous series, and are then bent upon themselves so as to form a compact rheostat without intervening joints. Three figures.

23,818-9/09. **Heating and Cooking Apparatus.** G. G. BELL and J. V. PLETTS (London). These patents relate to cooking apparatus in which the heat is stored up in an isolated body of material, and conducted away when required. According to the first specification, water pipes are embedded in the heat-storing body, and form a closed circulating circuit with pipes placed in an oven either inside or adjacent to the body. The latter pipes are arranged helically to form one or more hot plates, on which the cooking utensils can be placed. The heating element is embedded in the heat-storing body, but an additional element may be placed in the oven. Four figures.—The second specification describes an electric oven with a vent pipe for allowing the products of ebullition to escape. Special utensils are employed, each having a pipe or vent in the lid communicating with this outlet. One figure.

23,980/09. **Street-Lantern Support for Metal Filament Lamps.** H. T. HARRISON (London). In an anti-vibration support for metal filament lamps in street and other lanterns, the lamp-holder is provided with a metal flange, and this is supported inside an insulating hood of inverted cup-shape by means of three or more spiral springs arranged radially and horizontally between the flange and the hood. Two or more such supports may be fixed together to form a group fitting. Six figures.

27,478/09. **Control of Polyphase Machinery for Marine Propulsion.** H. A. MAVOR and MAVOR & COULSON, LTD. (Glasgow). This specification describes an alternator designed to generate polyphase current at two different frequencies without any change in speed. The stator is provided with two windings, and the rotor has a special winding which produces a compound magnetic field equivalent to the resultant of two independent fields of different pole numbers. Current at any one frequency can be taken from the corresponding stator winding without altering the rotor connections. Eight figures.

30,000/09. **Sign Switch.** H. F. REASON and REASON MANUFACTURING CO., LTD. (Brighton). An automatic sign switch for heavy currents and with means for adjusting the time intervals consists of two solenoids connected in series, and arranged vertically one over the other. The circuit is completed through the two cores. When the circuit is closed, the cores rise together until the lower one reaches the top of the lower solenoid, when it falls, thus breaking the circuit. The upper core is retarded in its fall by being geared by means of a rack to a fly-train. When the upper core touches the lower one again, the circuit is closed, and the operation repeated. Three figures.

10,210/10. **Relay for Wireless Telegraphy.** W. P. THOMPSON (*Gesellschaft für Drahtlose Telegraphie, Berlin*). In order to be able to receive very weak signals, an oscillating relay is used in combination with a local telephone circuit. The relay consists of a light oscillating armature supported on two stretched wires, and having fixed to it one electrode of a sensitive carbon microphone contact. The armature is tuned to the periodicity of the received signals and resonates to them, the resultant parallel movement giving a good microphone action at the contact. Several such relays may be connected in series with their armatures tuned one to another. Magnetic control of the sensitiveness of the relay is provided. Several combinations in which a transformer and rectifier are used in the circuit of the last relay of a series for the purpose of operating a registering device are described. Sixteen figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: TAYLOR [A.-C. to D.-C. transformation and reverse] 20,867/09; SIEMENS BROS. & Co. and DIESELHORST [Cables] 1,194/10 and 3,818/10; WITZENMANN [Armouring of cables] 10,036/10; ST. HELENS CABLE & RUBBER CO., TAYLOR and BROOKING [Composite plates of hard rubber and metal] 11,664/10.

Dynamos, Motors, and Transformers: MIDGLEY and VANDERVELL [Machines] 16,447/09; MILCH [Control of induction motors] 16,559/09; SCOTT [D.-C. motors] 24,023/09; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Machines] 24,126/09; PARSONS and LAW [Regulation of A.-C. machines] 24,127/09; CARTER [Machines] 24,434/09; SIEMENS BROS. DYNAMO WORKS and KLOSS [Electrical marine propulsion] 25,734/09; A.-G. BROWN, BOVERI & CIE. [Single-phase motors on polyphase systems] 645/10; MEYNIER [Machines] 10,208/10; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Centrifugal compressors] 12,858/10; ALLGEMEINE ELEKTRICITÄTS-GES. [Windings] 14,862/10, and [Centrifugal compressors] 17,474/10; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckert werke Ges.*) [Commutators] 19,539/10.

Electric Ignition: ÉTABLISSEMENTS DE DION-BOUTON [H.-T. magnetos] 2,883/10; PARSONS [Driving of magnetos] 3,125/10; R. BOSCH [Magnetos] 6,653/10.

Electrometallurgy and Electrochemistry: PIESTRAK [Sterilising liquids by ozone] 1,117/10; KAISER [Production of oxygen nitrogen compounds] 20,325/10.

Instruments and Meters: STEWART [Magnetic speedometers] 1,915/10.

Switchgear, Fuses, and Fittings: MIDDLEDITCH [Prevention of corrosion of terminals] 29,773/09; R. BOSCH [Cable terminals] 11,600/10.

Telephony and Telegraphy: BRITISH RADIO TELEGRAPH & TELEPHONE Co. and BALSILLIE [Wireless telegraphy] 27,395/09.

Traction: IRELAND [Shields for axle-boxes] 24,617/09; FANNIN and NELLIS [Operating tramway points] 5,823/10; STROMEYER [Brake shoes] 17,276/10.

Miscellaneous: DE FERRANTI [Gyroscopic stability mechanism] 24,112/09; JEVONS [Electric welding] 24,958/09; KELVIN & JAMES WHITE, LTD., CLARK and CHETWYND [Compass] 25,718/09 and 27,181/09; TEXTILE APPLIANCES, LTD. and CARVER [Jacquards] 4,312/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: R. BOSCH [Magnetos] 18,095/10; UNTERBERG & HEMLE [Contact-breaker] 22,040/10.

Electrochemistry: RUMPLER [Treating aluminium before electro-deposition] 23,559/10; KÜTTNER [Forming insulating film on aluminium wire] 23,675/10.

Incandescent Lamps: WEBER [Mercury-carbon filament lamp] 9,250/10.

Miscellaneous: BERGER [Electric pendulum clock] 23,569/10.

Opposition to Grant of Patent

14,898/09. **Conduit Manhole Cover.** R. AMES. This patent has been allowed in spite of opposition. It relates to a manhole cover designed to prevent the disintegration of the asphalte or macadam paving at the edge.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

25,402 of Nov. 12th, 1896. **Steam Boilers.** J. H. ROSENTHAL (London). This patent covers the combination, with a water-tube boiler, of a superheater composed of doubled tubes placed in the combustion chamber and connected to cross tubes resting on the headers, and having separate pipe connections to the boiler steam space, and to the water space of the drum.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: H. LEITNER [Train-lighting system] 16,048/03; W. J. ROLLO [Ceiling fan motors] 16,072/02.

Electrometallurgy, &c.: J. HARGREAVES [Electrolytic apparatus] 17,161/97.

Traction: H. FROOD [Brake blocks] 16,222/04.

Miscellaneous: J. P. and G. M. STUBBS [Automatic-feed weighers] 14,477/01; BRITISH THOMSON-HOUSTON Co. (*C. G. Curtis*) [Steam turbines] 15,872/03 and 16,212-3/03; ELEKTRICITÄTS A.-G. VORM. W. LAHMEYER & Co. [Speed regulators and reversing gear for electric winding engines] 11,965/04; SOC. L. GAUMONT & CIE [Synchronous driving of cinematographs and phonographs] 15,708/04; T. WHITTLE [Automatic electric ship's progress indicator] 14,706/05.

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Maidstone.—Manual instruction room, &c., at Boys' Grammar School.—Alterations at Girls' Grammar School. Architects, Messrs. Ruck, 86 Week Street.

Paisley.—Additions and alterations at Dolter & Co.'s works, Hawkhead Road.

Rochdale.—Music Hall on site of Mason's Foundry.

Southend.—Drill Hall, instructor's quarters, &c., at Prittlewell.—Also additions to Drill Hall, York Road. Colonel F. F. Johnson, C.B., Bank Chambers, Chelmsford.

Staffordshire.—Roman Catholic Schools, George Street, Balsall Heath.

Stourbridge.—St. Thomas's Church is to be wired for electric lighting.

Todmorden.—New school at Castle Hill. Architects, Messrs. Sutcliffe & Sutcliffe.

Tonbridge.—New school. Kent Education Committee.

Tunbridge Wells.—Permanent County School for Girls.

Wakefield.—Alterations to Castleford Wesley Street School. Education Architect, County Hall.

Worcester.—Extensions to infirmary.

MISCELLANEOUS

Beckenham.—A Local Government Board inquiry was held last week concerning a loan of £11,000 for electrical extensions, of which £5,000 are for mains and services, £1,000 for meters, and £5,000 for free wiring. Mr. H. R. Hooper, the Inspector, made a number of inquiries with regard to the position of the capital account, and at one time threatened to suspend the inquiry until he obtained the required particulars. The Clerk complained that other inspectors wrote beforehand and intimated the particulars they would require, but Mr. Hooper had not done this, and he threatened to communicate with the Local Government Board as to whether Mr. Hooper was following the correct procedure in threatening to suspend the inquiry. With regard to some criticisms by the Inspector as to the high capital charges, namely, 2·5d. per unit, it was pointed out that this includes all the free wiring loans which are being repaid on a ten years' basis. The Inspector pointed out that the Council had already spent £27,000 on free wiring, and it was time to see whether the undertaking was a success. Eventually the inquiry was adjourned pending the receipt of the information asked for by the Inspector.

Brighton.—The Tramways Committee require 50 tons of British Standard No. 4 rails. Town Clerk.

Great North of Scotland Railway Co.—Tenders are invited for a six or twelve months' supply of stores, including electric lighting materials. Particulars from the Stores Superintendent, 80 Guild Street, Aberdeen.

London: *County Council.*—Tenders are invited for the overhead electrical equipment required in connection with the construction of the new tramways (approximately one mile in length) between Putney Bridge and Wandsworth High Street. Particulars from the Clerk, and tenders by December 6th, 1910. (See an advertisement on another page.)

Port of London Authority.—Tenders are invited by November 19th for stores, including electric lamps, &c. Particulars from General Manager, 109 Leadenhall Street, E.C.

Manchester.—Arrangements are being made for doubling the track in Fallowfield.

North-Eastern Railway Co.—Tenders are invited for a six or twelve months' supply of stores, including electric lamps, wires, and cables, electric light and fittings, &c. Particulars from Stores Superintendent, Gateshead, and tenders by November 24th.

Southampton.—The Electricity Department require 2,000 radiator lamps. Borough Electrical Engineer.

TENDERS RECEIVED AND ACCEPTED

Leeds.—The Tramways Committee recommend the Council to purchase four trolley omnibuses at £700 each.

London: *County Council.*—The London Electrical Engineering Co. have asked to be allowed to withdraw their tender for the electric lighting of Sherington Road school, Greenwich. In consequence, the tender of Messrs. E. Newbold & Co. has been accepted at £256. The Education Committee recommend that the London Electrical Engineering Co. shall not be allowed to tender for any work at the Council's schools for a period of one year.

Sheffield.—The Health Committee recommend the Council to rescind a resolution passed on October 2nd accepting the tender of the Electric Supply Department for certain electric lighting, and to accept the tender of Messrs. T. A. Ashton, Ltd., instead. The tender in question was for electric lighting and electric hoist at the Worthing Road depot, and electric lighting at the Park baths, for a total of £115 17s. 6d., the tender of Messrs. Ashton being 2s. 6d. less.

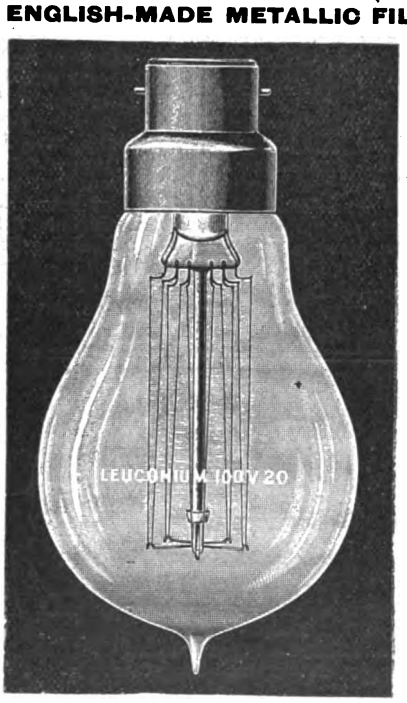
West Ham.—The tender of Messrs. Hurst, Nelson & Co., Ltd., has been accepted for 12 tramcar bodies and trucks at £488 10s. each, and that of Messrs. Dick, Kerr & Co., Ltd., for electrical equipments at £327 10s. each.

The Mirrlees Watson Co. have received the following orders:—Barometric jet condensing plants for Messrs. Henckell du Buisson & Co., Antigua Sugar Factory; the Natal Estates, Ltd., Mount Edgecombe, Natal; Sociedad Anonima Azucareza Argentina Lacarona Estate; South African Sugar Refinery; J. G. White & Co., Ltd., for Kalgoorlie Electric Light & Power Co.; and C. & W. Walker, Ltd., Donnington. Surface condensing plants for Messrs. Fraser & Chalmers, Ltd., for Erith Electricity Works; the Melbourne Electric Supply Co. Ltd., for Geelong; and the British Thomson-Houston Co., Ltd., for Dublin United Tramways. Low-level jet condensing plants for the Harland Engineering Co., North Blaina Collieries; the British Westinghouse Co., for St. Helens Corporation; and James Howden & Co., for Falkirk Corporation. Steam-driven Edward's air pump for Las Palmas del chaco Austral Sociedad Anonima.

Physical Society's Exhibition.—The date of the annual exhibition, held by the Physical Society of London, which was fixed some time ago for December 13th, has been altered to Tuesday, December 20th. The exhibition will be open in the afternoon as well as in the evening.

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APPOINTMENTS AND PERSONAL NOTES

The late Mr. Thomas Hurley, of Messrs. Gent & Hurley, Electrical Engineers and Contractors, of Leicester, left estate of the gross value of £8,533, with net personality of £6,635.

The following re-arrangement has been made in the staff at the York Electricity Works in consequence of Mr. Turnbull, the Works Superintendent, having been appointed Resident Engineer at the Stoke-on-Trent Electricity Works: Mr. Nichols, Mains Superintendent, to be Chief Assistant, at a salary of £150, rising to £175 per annum; Mr. Holmes, Charge Engineer, to be appointed Works Superintendent at a salary of £130, rising to £150 per annum.

The salary of Mr. E. T. Wheeler, collector of accounts in the Hackney Electricity Department, has been increased from £150 to £180 per annum.

In consequence of the resignation of Mr. P. J. Pringle, Electrical Engineer and Tramways Manager at Burton-on-Trent, it has been decided to appoint the Chief Assistant in the two departments to take charge on probation for six months. Mr. Slater will have charge of the Tramways Department, and Mr. Hall the Electricity Works.

Mr. W. Don has retired from the office of chairman of the Dundee Electricity Committee, having been re-appointed a magistrate. He is succeeded by Mr. J. M. Nairn, who also has had considerable experience on the Electricity Committee.

A capable man is required in a small generating station. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £60 to £60 5s. per ton (last week, £59 to £59 10s.)

Exhibition Awards.—Messrs. Crossley Brothers, Ltd., in addition to their award of a Grand Prix at the Brussels Exhibition, have received a similar honour at the Argentine Republic Industrial Exhibition, Buenos Aires.

Cable Prices.—Messrs. Siemens Bros. & Co. (Caxton House, Westminster), announce that owing to the fall in the market price of rubber, their interim price list of V.I.R. wires and cables, dated October, 1910, will be subject to the following discounts to the trade:—"Association" grade wires and cables and "C.M.A." flexibles, 20 per cent., 15 per cent., and 10 per cent. "Non-Association" class wires and cables, 20 per cent., 25 per cent., and 10 per cent.

Amalgamation.—Messrs. Hooper & Edman, Ltd., Spring Hill Foundry, Birmingham, have taken over the electrical business of the Rippingille Manufacturing Co., and solicit inquiries for water-tight or bulkhead fittings, wall hoists, winches, and other electrical specialities.

Board of Trade Intelligence Department.—A new edition of the handbook to the Commercial Intelligence Branch of the Board of Trade has been issued. It contains full information as to the organisation and objects of this Department of the Board of Trade. No. 73 Basinghall Street, London, where the Intelligence Branch is situated, is intended to be a centre at which information on all subjects of commercial interest shall be collected and focussed in a form convenient for reference, and at which, so far as the interests of the British trade permit, replies shall be given to inquiries by traders of commercial matters. The book is published at the price of 2d.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Western Telegraph Co.—Final dividend at the rate of 6 per cent. per annum, with bonus of 2s. per share.

Cape Electric Tramways.—There is a credit balance of £9,047 for the year to June 30th, all of which has been carried forward.

Cordova Light, Power & Traction Co.—Dividend of 3 per cent. for 1909–10, carrying forward £8,200. The *Financial Times* states that arrangements have been concluded for providing additional capital, which has become necessary owing to the rapid expansion of the company's undertaking.

West India & Panama Telegraph Co.—Dividend of 6s. per share on the first preference shares for June 30th.

Robertson Electric Lamps.—A petition confirming a resolution to reduce the capital from £100,000 to £35,000 will be heard before Mr. Justice Neville on Friday.

Eastern Telegraph Co.—The net profit for the June half-year amounted to £334,590, out of which £175,000 has been added to general reserve, £100,000 to meet two interim dividends of 1½ per cent. on the ordinary stock, and £59,590 carried forward.

Montreal Light, Heat & Power Co.—It is stated that proposals are under consideration for an amalgamation of this Company with the Canadian Light & Power Co. and the Montreal Street Railway Co.

Northern Light & Power Co. (Canada).—A report has been issued by this company, stating that the $1,750,000 new capital recently raised has been applied in the erection of a 8,500 h.p. plant near Dawson City, and the installation of a 44-mile transmission line from the power-station to Dawson.

WIRELESS TELEGRAPHY

THE British Radio-Telegraph & Telephone Co. has installed a wireless telegraph apparatus upon the Liverpool cargo steamer *Drumcraig*, which is the second British cargo boat to carry wireless telegraph apparatus. The previous boat, namely, the *Nonsuch*, was also equipped by the same company, and it is this installation which is to be the subject of an action for patent infringement by the Marconi Co. The *Drumcraig* apparatus takes 1½ kw., and has a normal range of some 400 miles. Besides these installations, the company have fitted two ships of the Spanish-African mail line, which has placed an order with them for four more sets. The Spanish Admiralty are also interested in these equipments.

According to the *Telephone Engineer*, further experiments have been made in New Haven and Toronto with De Forest wireless equipments on express trains. It has been found that, by using a comparatively short antenna wire stretched along the train parallel to the telegraph wires, excellent results are achieved, and it is presumed that the telegraph wires reduce the resistance to the transmission of the waves. Experiments with wireless telephone apparatus are shortly to be made on a line of the New York Central Railway.

Greenwich time is now transmitted twice daily, at midday and at midnight, to ships at sea by means of wireless signals from the German wireless station at Norddeich. A series of special Morse signals are sent out for five minutes before the hour, the last signal being transmitted exactly at 12 o'clock. An automatic transmitter is installed at Norddeich, and this is controlled electrically from the Imperial Observatory at Wilhelmshaven. Similar signals continue to be sent out from the Eiffel Tower, and Messrs. Ducretet & Roger, of Paris, have devised a simple receiving apparatus for use on ships not fitted with wireless installations for the sole purpose of receiving these time signals.

The Marconi Co. are fitting their latest type of wireless telegraph installation upon the Aberdeen Line steamers, *Miltiades*, *Marathon*, and *Moravian*.

THE NATIONAL TELEPHONE JOURNAL

A JOURNAL DEVOTED TO TELEPHONY.

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Papers: Their Writers and Audiences. By E. Hare.
Automatic versus Manual Switchboards. By J. J. Carty.
The Pupin System applied to Aerial Telephone Lines—(contd.).
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ELECTRICAL ENGINEERING

No. 203 [Vol. VI., No. 46] THURSDAY, NOVEMBER 17, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

Official Notices and Technical College Announcements are inserted at the rate of Ninepence per line (column width).

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Latest Time for Receiving
Letters for Insertion, *Tuesday first post.*
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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.
Telegrams: "*Circling, London.*" *Telephone No.:* 5509 *Holborn.*
Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

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SUMMARY

The London Session of the Institution of Electrical Engineers was inaugurated in the new building on Victoria Embankment on Thursday. Mr. S. Z. de Ferranti, the President, delivered an address, in which he described in some detail an ideal scheme for erecting 100 generating stations of 250,000 kw. capacity each, in which all the coal mined in the country would be utilised for producing electrical energy, which would be distributed for every industrial and domestic purpose at an average price of ½d. per unit. The scheme embraces the utilisation of bye-products for the purpose of intensifying the cultivation of land, and making the country independent of outside assistance for its food supply, and Mr. Ferranti considered that it is only a matter of time for the scheme to be carried out in its entirety. (Page 723.)

The new power station of the General Post Office supplies three-phase current at 6,600 volts to substations in the main Post Office buildings in the City, where it is transformed down for lighting and power, and for charging telephone batteries. (Page 724.)

An illustration is given of the lighting of a London Tube Railway Station. (Page 727.)

We publish a detailed description of the new electrical installation at the Institution of Electrical Engineers' building on Victoria Embankment, and illustrations of the principal fittings. The arrangement of the indirect lighting of the Lecture Theatre is fully explained, with a sketch to show the position of the lamps and reflectors. Special silent switches are employed for switching off the Lecture Theatre circuits. (Page 728.)

Works have been erected near London, on the mains of the North Metropolitan Electric Power Supply Co., for manufacturing stone from quarry débris. The method follows natural processes, and a reinforced stone for glazing-bars and floor slabs, as well as a reconstructed marble for switchboard panels, is also made. (Page 730.)

A letter from the Secretary of the Electric Supply Joint Publicity Committee in the *Financial Times* controverts statements in an article in the same paper on the relative activities of the business-getting departments of the gas and electric light companies. (Page 730.)

A paper by Mr. C. F. Smith, read before the Manchester section of the Institution of Electrical Engineers, described a long course of experiments on the irregularities in the rotating field of the polyphase induction motor. (Page 731.)

The Manager of the Bray Corporation Electric Supply Department writes to contradict the statement that the department is not wiring private premises, and gives reasons why they are compelled to do so. (Page 732.)

Mr. T. Harding Churton delivered his inaugural address as Chairman of the Yorkshire Section of the Institution of Electrical Engineers last night. (Page 733.)

Some notes are given on the Leblanc condenser with rotary air pump. (Page 733.)

Mr. M. J. Railling, in his address as chairman of the Birmingham Section of the Institution of Electrical Engineers, dealt with some of the causes of the present state of the electrical industry. (Page 733.)

Mr. S. Z. de Ferranti has patented a gyroscopic stability mechanism for aeroplanes, &c. Among the other specifications published on Thursday was one by A. H. Midgley and C. A. Vandervell for a special train-lighting dynamo. The British Thomson-Houston Co. describe a frequency changer or double-current alternator comprising a single armature with a double

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winding and a compound field, giving the effect of two field systems of different pole numbers. A patent for a block signalling system with electrically continuous rails is to be amended as the result of an application for revocation. A patent by H. J. Dowsing relating to luminous radiators, and another by Cowper-Coles for the electrolytic manufacture of reflectors expire next week after the full life of fourteen years. (Page 734.)

AN apparatus for estimating the percentage of dissolved matter in water by measuring the electrical conductivity consists of a U-tube with electrodes and a combined hand-generator and meter similar to a "Megger." (Page 735.)

FOUR vehicles have been ordered for the Railless Electric Traction scheme at Leeds. (Page 235.)

THE action by Mr. C. A. Gould against Dr. E. H. Lehwess in respect of the batteries for the London Electrobus Co. came to an end on Friday, when the jury stopped the case at the conclusion of the cross-examination of Dr. Lehwess. On Monday it was stated that Mr. Gould had been settled with. (Page 735.)

A LIBEL action is being heard in the King's Bench Division against Sir John Benn, it being alleged that certain speeches and articles of his have contained libellous statements concerning the G.B. surface-contact system. For the G.B. Co. it was stated that, as put down in the Mile End Road, the system was not the actual G.B. system, but one considerably modified by the officials of the London County Council, in the construction and laying down of which the G.B. Co. were refused any part. (Page 735.)

A REPORT has been prepared by the engineers representing the London Electric Lighting Companies, and Borough Councils owning electricity works, dealing with the linking up of the electricity works in London. (Page 735.)

A POLL of the Acton ratepayers is being taken on the question of whether the electricity undertaking should be transferred to the Metropolitan Electric Supply Co.—The Belfast Electricity Committee have refused to adopt certain rules which the Electrical Trade Union wish to be applied to jointers.—The differences between the Torquay Corporation and the Tramway Co. have now been adjusted.—West Hartlepool Corporation have definitely decided to purchase the local tramway company.—3,459 public lamps have now been converted from gas to electricity in Marylebone. (Page 737.)

ADDITIONAL generating machinery is to be installed at Birkenhead, Londonderry, Manchester, and Llandudno.—Expenditure on mains is contemplated at Hastings, and electric lighting schemes are under consideration by the Ballymoney and Enniskillen Councils.—Specifications are being prepared for a number of wireless telegraph stations in Australia.—The Sydney Corporation require a supply of arc lamp carbons. (Page 738.)

THE British Insulated & Helsby Cables, Ltd., are issuing £200,000 of 5 per cent. mortgage debenture stock. (Page 739.)

A CONFERENCE was held last Thursday between leading representatives of the I.M.E.A. and the E.C.A. with a view to seeing if a settlement could be arrived at of the disagreement of which the Municipal Wiring Bill is the outcome. We publish the names of the five delegates on each side. "Preliminaries" were discussed, and the Conference was adjourned until Dec. 8th. Meantime the E.C.A. are actively canvassing to raise an adequate "fighting fund," and £2,000 has already been guaranteed. (Page 739.)



[*In his Presidential Address to the Institution of Electrical Engineers last week, Mr. Ferranti said*:—"I think it will be possible to acquire knowledge which will enable us largely to control by electrical means the sunshine which reaches us, and, in a climate which usually has ample moisture in the atmosphere, to produce rainfall when and where we require it."]

CLERK OF THE WEATHER: The Crystal Palace? . . . Yes . . . I am very sorry, but you should have notified me of the Association Cup Final before. The Minister of Agriculture requisitioned tropical sunshine for the strawberry fields in North Kent, and you come on the fringe of that area. If it is of any use to you I can switch on a thunderstorm at half time.

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INAUGURATION OF THE LONDON SESSION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

Mr. Ferranti's Prophecies.

LAST Thursday the London Session of the Institution of Electrical Engineers opened the new headquarters of the Institution on Victoria Embankment. A large number of prominent members were present, the Council attended in force, and the new lecture hall, which seats over 400, was crowded to its utmost capacity. The outgoing President, Prof. Gisbert Kapp, welcomed the members to their new home, and then called upon Mr. Crompton to make a statement as to the work done at the unofficial meeting at Brussels of the International Electrotechnical Commission (reported in ELECTRICAL ENGINEERING of August 18th, 1910, p. 534). The premiums won last session (a list of which appeared in ELECTRICAL ENGINEERING of June 2nd, 1910, p. 353), were then presented by Prof. Kapp, and before he vacated the chair in favour of the new President, Mr. S. Z. de Ferranti, a cordial vote of thanks to him was proposed by Mr. Crompton, seconded by Mr. Mordey and carried with acclamation.

Mr. Ferranti then proceeded to give his Presidential address—an address of startling originality in itself, and rendered still more interesting by the fact that Mr. Ferranti spoke and did not read—and, in fact, hardly referred to his notes during the entire speech of about three-quarters of an hour's duration.

He commenced by pointing to the present wasteful methods of converting the energy of coal into useful work, which, taking all the uses of coal into consideration, involved a loss estimated at 90 per cent. In addition, we dissipate nearly the whole of the valuable bye-products, consisting principally of fixed nitrogen, which could be employed to increase the return of foodstuffs from the comparatively small acreage of land under cultivation, and Mr. Ferranti also referred incidentally to the ever-increasing exportation of coal to other countries which tended further towards the exhaustion of our coal supplies. He next pointed to the large expenditure of labour in raising, distributing, and burning coal, and also in clearing up the dirt produced by our present methods of using coal, and then outlined the ideal method of employing the coal resources of the country. This is to concentrate the whole transformation of coal into energy at a comparatively small number of great electricity-producing stations and to distribute electrical energy from them to supply the entire light, heat, power, and chemical energy required for the industrial and domestic needs of the country.

In order to supply electricity for all purposes in this manner, Mr. Ferranti estimates that it would be necessary, among other things, to have a conversion efficiency of not less than 25 per cent. Assuming this conversion efficiency, instead of the 10 per cent. already mentioned, the annual consumption of coal would be reduced from 150 million tons (a figure based on the Report of the Royal Commission on Coal) to 60 million tons. This would represent 131,400 million Board of Trade units of electricity. The only existing engine which is theoretically capable of returning 25 per cent. of the energy in the coal in the form of electricity is a gas-driven alternator, but the units are too small and the cost of the complete installation too high; the gas turbine is not yet available, nor is a method of generating electricity direct from coal. Mr. Ferranti favours an intermediate process, which will, he believes, give the necessary efficiency without undue complication or expense. "The steam-gas turbine," he said, "in which steam is used in the state of gas at a high temperature throughout the process of conversion into work, gives theoretically a high efficiency at workable temperatures, and I believe will, in course of time, supply the necessary means of conversion for effectively turning our coal into electricity."

The next consideration was that of capital cost, and to estimate this an assumption of a load factor is necessary. By employing heat storage in domestic heating, and adapting and modifying metallurgical processes so that they can take current intermittently and so fill up the load curve, Mr. Ferranti believes that a load factor of 60 per cent. would be obtained. To supply 131,400 million units annually at this load factor, 25 million kw. of plant would have to be installed. This would be supplied by 100 stations, each equipped with ten 25,000-kw. generators. Taking the cost of these at £7 per kw. and the cost of the distributing system at £13 per kw., a total expenditure of 500 millions sterling would be required for the scheme—only 100 millions greater than the 400 millions capital now estimated to be invested in electrical undertakings, of which 58 millions are invested in the electricity supply business. The units generated, however, would be 150 times as many as at present. The capital charges at 8½ per cent. work out to 0·0776d. per unit, and Mr. Ferranti takes the works costs at 0·036d., bringing the total costs, including capital charges, to 0·1145d., or 62 millions sterling per annum. In arriving at the works cost, the assumption has been made that the coal costs 10s. per ton, but the costs are credited with fixed nitrogen bye-products for agricultural purposes to the value of 8s. per ton of coal.

On this basis, representing an average selling price of ½d. per unit of electrical energy, electricity could be used with economy not only for lighting, heating, and traction, but even, Mr. Ferranti contends, for such purposes as the manufacture of pig iron, and, in fact, for every possible case in which coal, gas, or power are now employed.

The utilisation of the bye-products for the fertilisation of land and for the purpose of intensive culture was next considered, and it was estimated that it would be possible to provide in our own country all the grain which we should require for food, and also all the foodstuffs we should require for the raising of cattle. The other bye-products, tar and light oils, could be employed for road-making and motor-cars respectively—the latter when carburettors have been further developed. If the three million tons of sulphate of ammonia, the total amount of the bye-product, were not sufficient in itself for agricultural purposes, further supplies of fertiliser could be made economically at the low cost of generation by the oxidisation of atmospheric nitrogen, and this would also afford a means of improving still further the load factor. If this latter manufacture were carried on at such times as to fill up completely the gaps in the load curve, Mr. Ferranti concludes that, crediting the value of the additional sulphate of ammonia produced as a bye-product from the extra coal consumed, the cost of the corresponding 43,800 million additional units generated would only be $\frac{1}{10}$d. per unit.

This part of the address relating to the further generation of units at $\frac{1}{10}$d. was included in the printed Paper handed to the Press which will be published in the Institution *Journal*, but was not dealt with by Mr. Ferranti in his speech, nor was the suggestion that it should be possible to acquire knowledge which will enable us largely to control by electrical means the sunshine which reaches us, and, in a climate

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which usually has ample moisture in the atmosphere, to produce rainfall when and where we require it.

"It seems to me that it may be possible, when we know a great deal more about electricity than we do to-day, to set up an electrical defence along our coasts by which we could cause the moisture in the clouds to fall in the form of rain, and so prevent these clouds drifting over the country between ourselves and the sun which they now blot out. It also seems to me that it will be possible, when more water on the country is required, to cause the falling of rain from the clouds passing over the highest part of the country and so produce an abundance of water which, properly used, would greatly add to the fertility of the country."

In bringing his address to a conclusion, Mr. Ferranti said:

It may seem that these are only mad visions of the future, but I think we can hardly consider these results more improbable than anyone would have considered wireless telegraphy or flight in heavier-than-air machines fifty years ago. Of course there are many things which at present stand in the way of realising such a scheme as I have outlined. There are many technical details which nothing but an immense amount of work can solve satisfactorily. There are also political and legislative difficulties standing in the way, but these, when the time arrived, would have to be got rid of rather than allow them to handicap the advance of the country. The more, however, that I have considered these ideas in detail, the more certain am I of the fundamental soundness underlying them, and that it is only a matter of time before such a scheme is carried out in its entirety.

The applause which greeted the address was enthusiastic, and it was renewed after the formal vote of thanks had been proposed by Mr. R. K. Gray, and seconded by Dr. Glazebrook. A reception by the President and Council was then held in the Common Room, and members were also invited to inspect the building. As to its suitability for the Institution, there can be no two opinions. The imposing Entrance Hall, the fine Lecture Theatre, and, in fact, every one of the rooms combines tasteful elegance and intense practicability. There is seating accommodation for about 420 in the Lecture Theatre, about 30 per cent. more than in the Institution of Civil Engineers' theatre, which has hitherto been kindly lent to the Electrical Engineers for their meetings, and the acoustic properties are excellent; every speaker was heard at the back of the hall with absolute distinctness. The equipment of the Lecture Theatre is particularly praiseworthy. Frames for diagrams are arranged so that they can be raised or lowered by means of a winch; Lewis bolts are provided in the wall behind the lecture table, and there are holes in the ceiling for fixing or suspending machinery and apparatus; water and gas supply for experimental purposes is laid on under a floor trap in front of the table; the screen for the lantern can be raised or lowered from the lantern room; and the electrical arrangements, which are dealt with in another article in this issue, are all that can be desired.

An excellent idea is the "Common Room," which is intended as a "rendez-vous" for members, and in which smoking is permitted. In addition to the large Council Chamber, there are two smaller Committee Rooms, which will be lent to members for private meetings, and provincial members desiring the use of a room for interviewing candidates for appointments or similar purposes, may also have the use of one. The library is large, well arranged, and excellently lighted and ventilated, and the roomy offices give intense satisfaction to Mr. Rowell, the secretary, and his staff.

An article describing the electrical installation will be found on page 728.

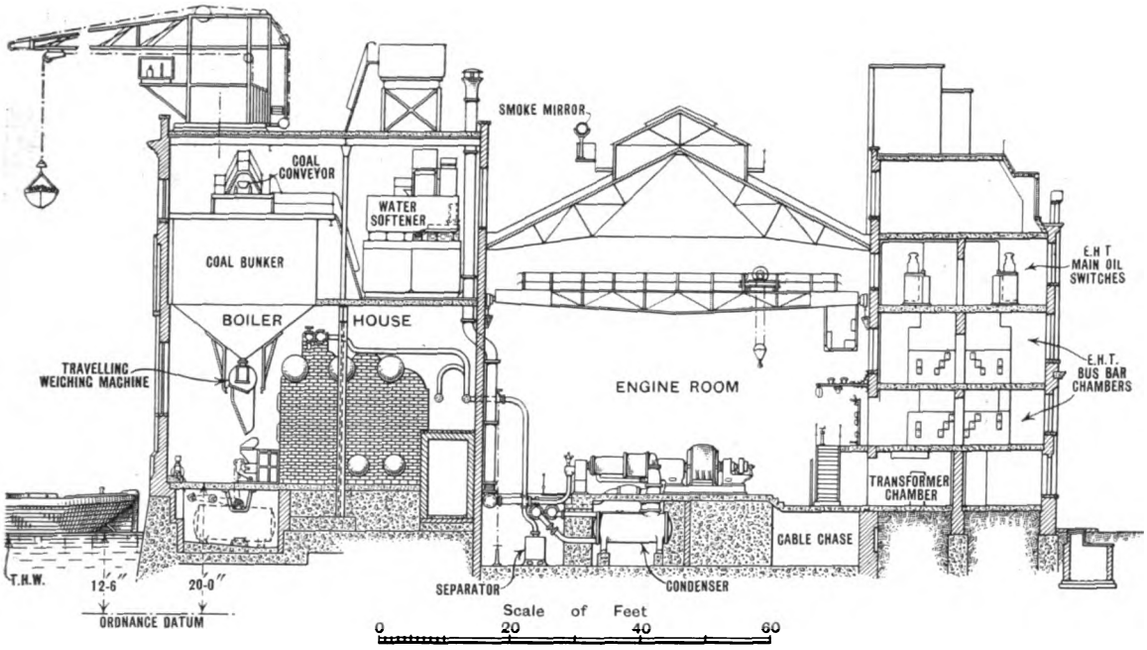
NEW POWER STATION OF THE GENERAL POST OFFICE

UP to the present, the lighting and power supply for the main Post Office buildings in London has been obtained from small generating stations situated in the basement of these buildings, while the extensive pneumatic service has been supplied from pumps steam-driven by beam engines, the first of which was installed in 1871. In order to meet the growing demand for power, an entirely new system has been designed, and is now completed. This includes a large generating station on the south side of the river near Blackfriars Bridge, which, at present, feeds three sub-stations situated in the basements at the new King Edward building, G.P.O. West and Carter Lane respectively. The load includes lighting, charging of telephone batteries, motors for various machines, fans, lifts, and conveyers, and electrically-driven air-pumps which will replace the beam-engine sets.

The power station has at present a normal full load capacity of 2,500 kw., and generates alternating-current at 6,600-volts, 50-cycle, three-phase, which is transformed down at the sub-stations to 110 volts for lighting and 440 volts A.C. and 220 volts D.C. for power. A plan and section of the station is given in Fig. 1. Coal is lifted out of the barges by an electric crane and grab on the roof, and delivered through an automatic weighing machine into an endless bucket conveyer, and distributed in the seven 100-ton sections of the overhead coal bunkers. The coal is fed to the stokers through travelling weighing machines, of which there are two, driven by small motors and supplied with current from trolley wires running along the entire boiler frontage. The conveyer returns along under the boiler-house floor to deal with the ashes in the usual way. Seven Stirling water-tube boilers are installed, and deliver steam at 200 lbs. per sq. in. pressure, superheated to 550° Fahr. They are fitted with Babcock & Wilcox chain-grate stokers, driven through chains and a shaft in the basement by an electric motor, or, alternatively, by a small steam engine. The mirror on the roof enables the switchboard attendant to detect any emission of black smoke. The feed-pump equipment includes an electrically-driven centrifugal pump, which will normally be used, a duplex steam pump, and an injector. Each is capable of delivering 3,000 gallons per hour against a pressure of 200 lbs. per sq. in. The feed water can either be passed through the Clay Cross economiser or direct to the boilers. Make-up water is drawn from the town supply, and is treated in a softening plant before use. Lea recorders are provided for measuring the condensed steam and the make-up water. The arrangement of the steam pipes can be seen from Fig. 1. The range is so sectionalised that any turbine or the small auxiliary set can be supplied from any boiler.

The main generating sets, a view of which is given in Fig. 2 consist of two 1,000-kw. and one 500-kw. standard Willans-Parsons turbines, coupled to Dick, Kerr 6,600-volt three-phase alternators running at 1,500 r.p.m. and 3,000 r.p.m. respectively. Each set has an overload capacity of 50 per cent. for two hours, and the steam consumption at full load is given as 17 lbs. per kw.-hr. with 27 in. vacuum. The radial clearance of the turbine blades measured cold varies between 22 mils at the H.P. end to 40 mils at the L.P. end between cylinder and moving blades, and from 32 mils to 50 mils between rotor and fixed blades. The axial clearance between moving and fixed blades is $\frac{1}{8}$ to $\frac{3}{16}$ in. Fig. 3 shows one of the turbines opened up. Bye-pass valves, through which high-pressure steam can be supplied to the intermediate sections in order to deal with heavy overloads, are provided. The surface-condensers for the 1,000-kw. turbines have each a total cooling surface of 2,200 sq. ft., and are fitted with vacuum augmenters.

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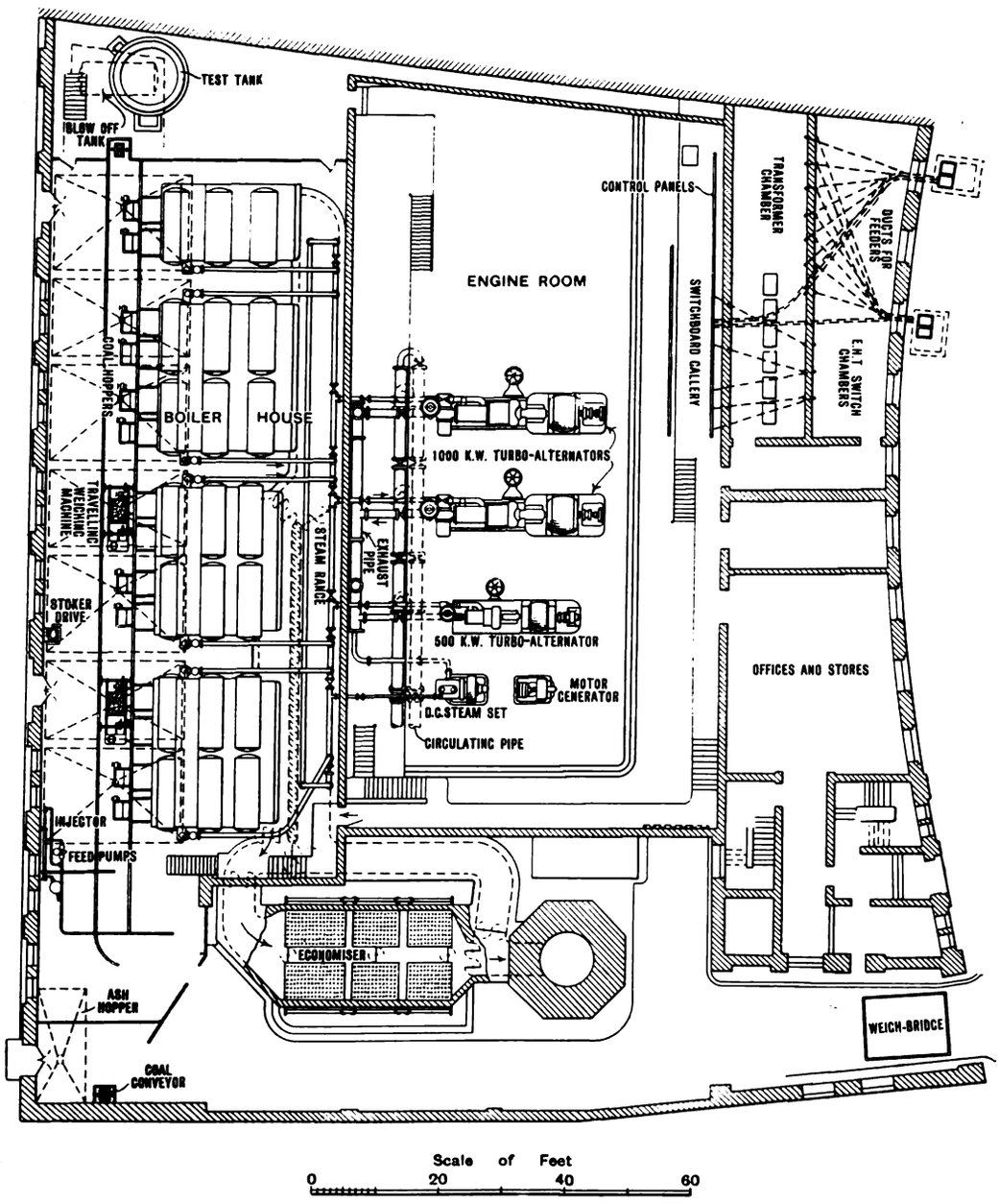


FIG. 1.—SECTION AND PLAN OF G.P.O. POWER STATION.

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For the circulating water, three 24 in. pipes have been laid in the river bed, and connected at a point 200 ft. out to a concrete apron containing pits protected by a grating. One pipe will be used for discharge, and one of the remaining two for suction, according to which is on the cool water side of the discharge, *i.e.*, according to the direction of the tide. Besides the usual strainers in the catch-pits, two electrically-driven mechanical strainers are installed. One of these is the well-known rotary Bailey-Jackson strainer. The other is of the Willans-Roberts type, consisting of three reciprocating plungers fitted with straining grids, and operated from a shaft with cranks set at 120°. At one end of the stroke of each plunger the corresponding grid is inserted in the suction, and at the other end it is inserted in the discharge. This strainer is on the river side of the pumps, and, therefore, protects them. Electrically-driven pumps of the Rees Roturbo vertical centrifugal pattern are employed, two having a capacity of 3,000 gallons per minute. For priming purposes and for ridding the pipes of air there are provided two steam-ejectors and an electrically-driven air-pump.

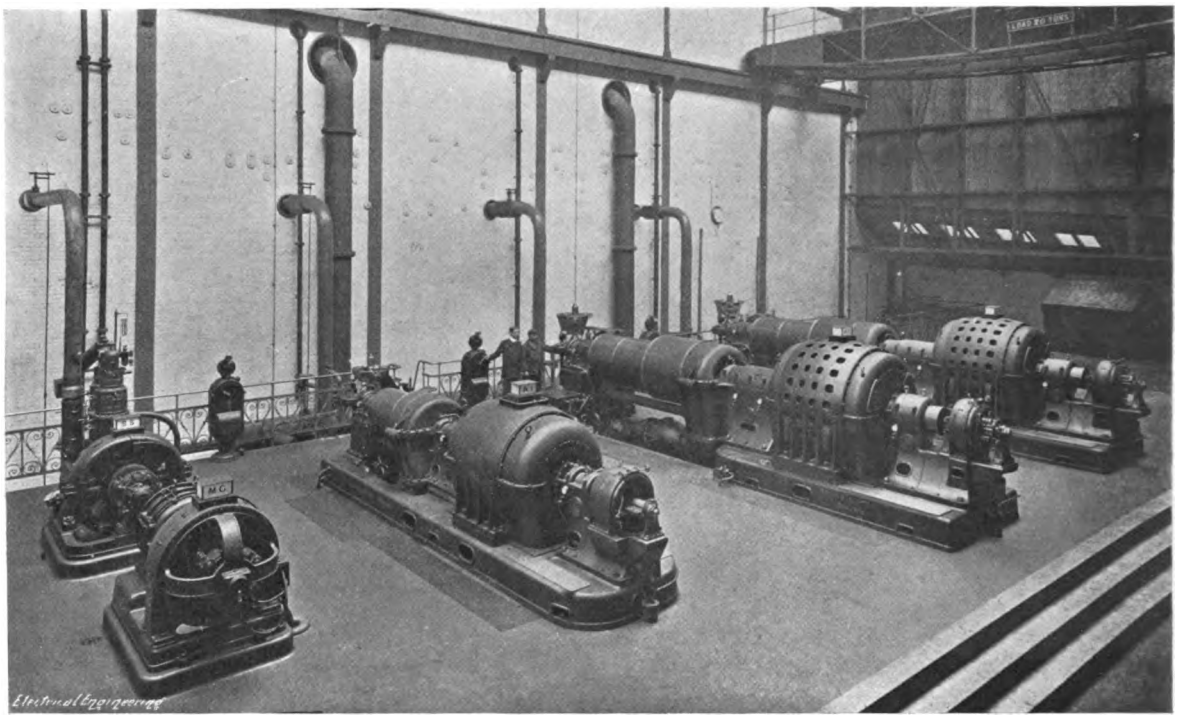


FIG. 2.—INTERIOR OF ENGINE ROOM OF G.P.O. GENERATING STATION.

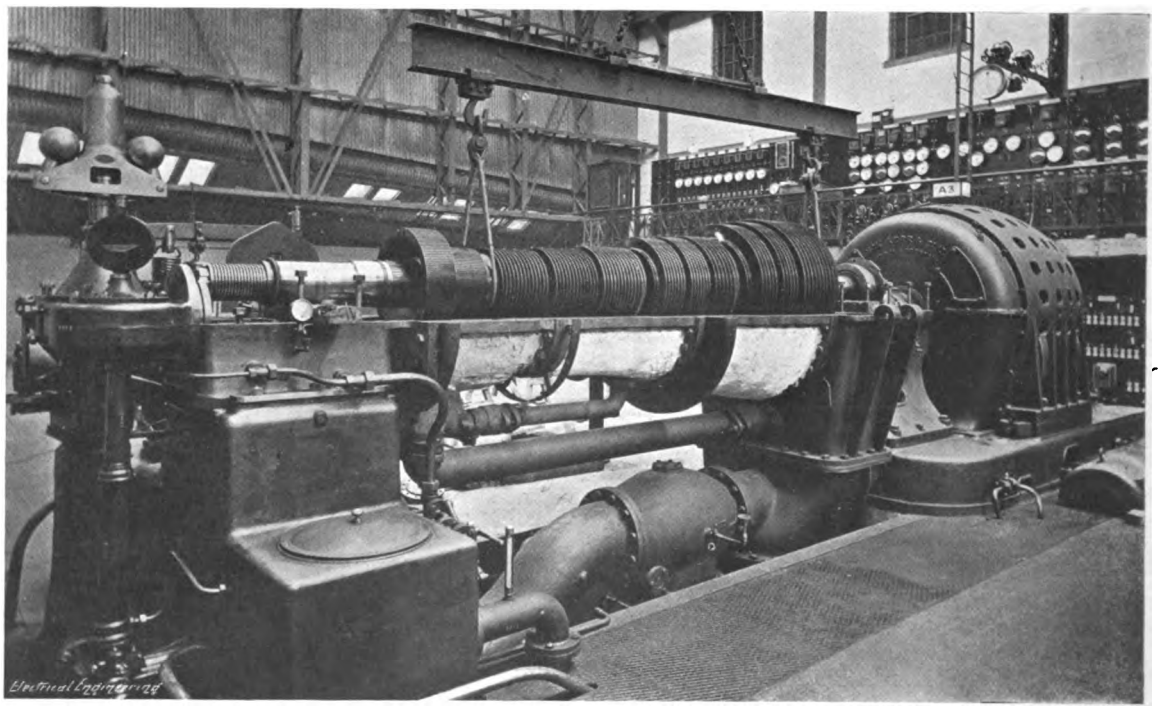


FIG. 3.—1,000 KW. WILLANS-PARSONS TURBINE WITH DICK, KERR ALTERNATOR.

In order to avoid any troubles arising out of the presence of triple-frequency currents, a switch is provided so that the neutral points of the star windings of the alternators can each be separately connected to earth. A resistance limits the current, in the event of an earth on the system, to the amount necessary to operate the overload relay on the feeder in question.

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The machines can thus be run in parallel with only one neutral earthed, but it is proposed to work the system normally with an unearthed neutral.

The auxiliary plant consists of two sets of three transformers with a capacity of 100 kw. per set, supplying current at 110 volts for power and lighting in the station; a 35-kw. 110-volt steam D.C. generating set for battery charging or lighting; an E.P.S. battery of 60 cells with a capacity of 700 ampere-hours on the one-hour rating, and, lastly, a 35-kw. B.T.-H. motor-generator, which forms a reversible link between the A.C. and D.C. 'bus-bars. The motors in the station include two 50-h.p. motors and one 25-h.p. motor for the circulating pumps, a 30-h.p. hoisting motor for the coaling crane, and twenty-four smaller motors for various purposes. The engine-room is lit by six flame arc lamps, and 124 incandescent lamps are employed. Paper-insulated lead-covered cable is used for power and lighting, run on wood cleats and protected by sheet-iron casing.

A water-resistance for loading the generators for testing purposes is provided. This consists of a vertical concrete barrel of 9 ft. diameter by 8 ft. deep, and contains three electrodes, which can be raised or lowered from outside the tank. By mixing river and town water and regulating the flow, a wide range of load can be obtained.

The arrangement of the switchgear, which was supplied by the British Westinghouse Electric & Manufacturing Co., is indicated in the elevation of Fig. 1. The high-tension gear is contained in cells of artificial stone, and is operated on the electrical remote control system, with signal lamps. The main 'bus-bars are in duplicate, and earthing switches are provided for use when cleaning either set. All connections from the control-board to the instrument transformers, operating solenoids, trip coils, &c., are run in steel conduit.

Current was first supplied from this station last August, and, since then, the load has been gradually transferred from the old stations. We had the pleasure of inspecting the station on Thursday last, when we also visited the sub-stations and the new King Edward building. A description of these and the distribution system will be given in our next issue. In conclusion, we would wish to express our thanks to Major W. A. J. O'Meara, Engineer-in-Chief to the Post Office, for permission to inspect and describe the station, and to Mr. H. C. Gunton, Engineer to the Power Department, for the loan of photographs and drawings, and permission to use information contained in a Paper read by him on Monday last before the Institution of Post Office Electrical Engineers in London.

The Andrew Carnegie Research Scholarship.—A Research Scholarship or Scholarships, of such value as may appear expedient to the Council of the Iron and Steel Institute from time to time, founded by Mr. Andrew Carnegie (Past-President), who has presented to the Iron and Steel Institute eighty-nine one-thousand dollar 5 per cent. debenture bonds for the purpose, will be awarded annually, irrespective of sex or nationality, on the recommendation of the Council of the Institute. Candidates, who must be under thirty-five years of age, must apply on a special form before the end of February to the Secretary of the Institute. The object of this scheme of Scholarships is not to facilitate ordinary collegiate studies, but to enable students, who have passed through a college curriculum, or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school, or works, provided it be properly equipped for the prosecution of metallurgical investigations. The appointment to a Scholarship shall be for one year, but the Council may at their discretion renew the Scholarship for a further period, instead of proceeding to a new election. The results of the research shall be communicated to the Iron and Steel Institute in the form of a Paper to be submitted to the Annual General Meeting of members, and if the Council consider the Paper to be of sufficient merit, the Andrew Carnegie Gold Medal shall be awarded to its author. Should the Paper in any year not be of sufficient merit, the medal will not be awarded in that year.

RAILWAY LIGHTING

BOTH the well-known Tantalum and One-watt lamps of Messrs. Siemens Bros. Dynamo Works, Ltd. (Tyssen Street, Dalston), have been adopted to a considerable extent in cases such as for railway work, where the toughness of their wire-drawn filaments offers particular advantages. The accompanying illustration shows a combined installation of these two types of lamp at a London tube railway station. A number of 100-c.p. lamps with suitable opal reflectors are fixed at regular intervals so that the light is directed upon the platform, whilst Tantalum lamps are installed in



TANTALUM AND ONE-WATT LAMPS AT A LONDON TUBE STATION.

weatherproof brackets on the wall, centrally, between them. Tantalum lamps have been also running successfully on the trains for some years, and some of them are reported to have given a life of over 6,000 hours. Tantalum lamps are still rapidly gaining ground for traction work, and at the present time three further tramway companies have decided in favour of installing them on their cars. The use of One-watt lamps is also extending rapidly, and several electric supply companies have arranged street lighting maintenance contracts with them.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

GAS AND OIL ENGINES.—A leaflet from Messrs. Fielding and Platt, Ltd. (73a Queen Victoria Street) gives some illustrations and particulars of their suction gas plants, which are made in sizes from 9 to 300 B.H.P.

FLAME ARC LAMPS.—A card from the A.E.G. Electric Co., Ltd. (Pembroke House, 133-135 Oxford Street), illustrates the latest form of A.E.G. flame arc lamp for long burning with low cost of carbons.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

OSRAM LAMPS.—The latest form in which the well-known Osram Lamp poster of the General Electric Co., Ltd. (67 Queen Victoria Street), has made its appearance is as a transparency about 12×10 in., which can be easily affixed to windows, etc., and when in position makes a very effective advertisement. The Company have also repeated this design on the cover of their new leaflet of prices and sizes of Osram Lamps, and this is so arranged that the name and address of any agent can be printed on it. All the ordinary sizes from 25 volts 10 c.p. to 200 volts 1,000 c.p. are included.

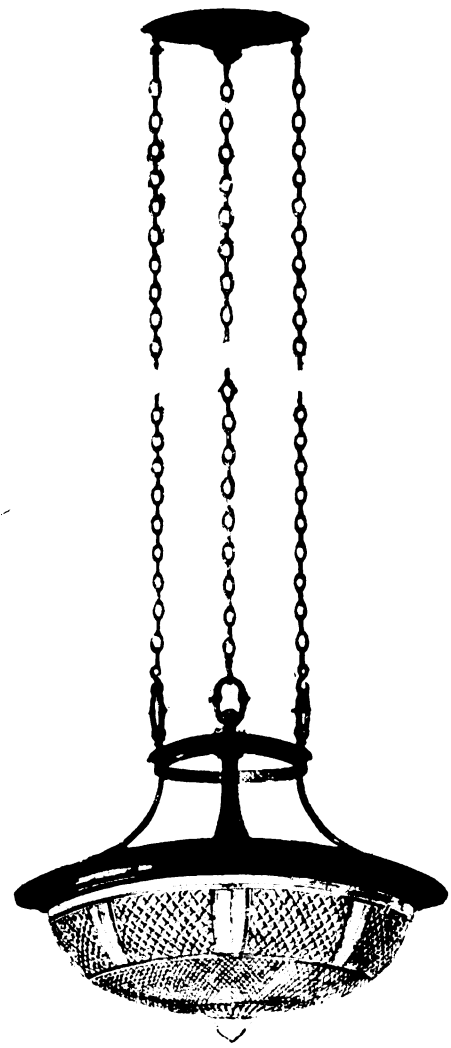
VACUUM CLEANERS.—A self-contained vacuum cleaner for domestic purposes, with electrically driven pump of a size that can be run from an ordinary lighting circuit, is described in a series of pamphlets from the Duntley Manufacturing Co. (Maconochie's Wharf, Millwall). In addition to being used in the ordinary way, the apparatus can be converted into a blower by fixing the hose to another nozzle, and used for blowing dust from articles which could not be cleaned by suction. Various massage vibrators and other toilet appliances can also be worked by its means.

METAL FILAMENT LAMPS.—A very effective card, embellished with a portrait of a Mephistophelian gentleman introducing a ring of lamps, is to hand from Fabius Henrion (Nancy), and calls attention to their "Osmine" lamp.

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THE ELECTRICAL INSTALLATION AT THE NEW BUILDING OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE electrical installations at the Institution of Electrical Engineers building on Victoria Embankment presents several points of unusual interest. As is well-known, the building is not actually a new one (having been purchased from the Royal Colleges of Physicians and Surgeons), but it has undergone so much transformation that the convenient name "new building" is hardly a misnomer. At the time it was taken over, the building was electrically lighted, but the work must have been carried out about 20 years ago, so that, as extensive alterations in the arrangements of the electric lighting were required, re-wiring

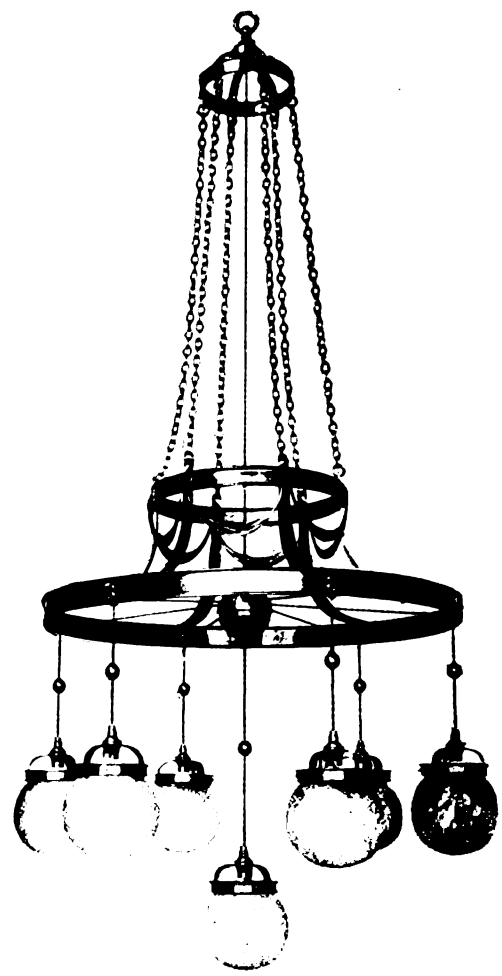


OSLER CUT GLASS DISH FITTING IN ENTRANCE HALL.
(One-Twelfth Full Size.)

was necessary. It was found, however, that the circuits to the parts of the building which the Colleges still occupy as tenants could remain as they were, and the Institution, as well as their tenants, continue to be supplied with current at 100 volts from the private plant of the adjacent Savoy Hotel as heretofore.

The Building Committee entrusted the specification and supervision of the work to Messrs. Handcock & Dykes, and tenders were advertised for. The tender of Messrs. Drake & Gorham, Ltd. (66 Victoria Street, Westminster), was accepted, and the installation has been carried out by this firm in a thoroughly workmanlike manner, as their reputation would naturally lead one to expect.

In order to select fittings, the Building Committee invited several firms to submit suitable designs, and two classes of fitting, by Messrs. Osler, Ltd. (100 Oxford Street, W.), and the Birmingham Guild, Ltd. (45 Gt. Charles Street, Birmingham), were selected. We illustrate the fitting supplied by Messrs. Osler for the Entrance Hall. This is a fine cut-glass dish about 2 ft. in diameter, with a suspension departing somewhat from the usual design, and is a fine example of the beautiful work always associated with the name of this firm. The glass is prismatically cut in such a way as to diffuse the light to the best advantage. It contains 10 lamps. In the library, fittings of a somewhat similar design, but with dishes of about 18 in. diameter, suspended more directly from chains, are employed, and Osler cut-glass fittings of a conical shape are used in the corridors and on the staircases. Our second illustration is the fitting made by the Birmingham Guild, Ltd., for the Council Room; it has an



SEVEN-LIGHT ELECTROLIER IN THE COUNCIL ROOM.
(Birmingham Guild, Ltd.)

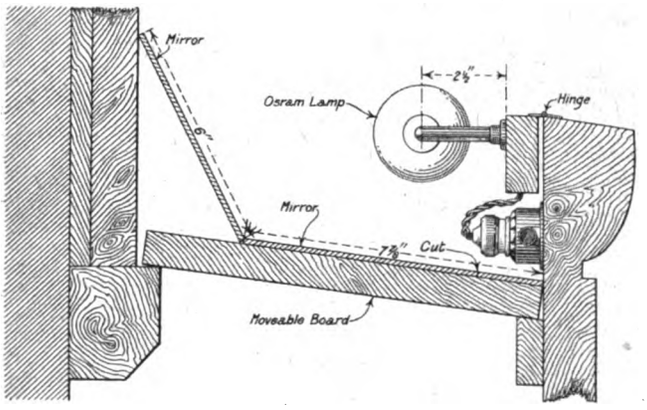
effective appearance, and smaller fittings and three-light fittings on precisely similar lines in the Committee Room and Common Room, although less imposing, are still more pleasing. In these fittings the flex—although of substantial size (70/40 C.M.A.)—is not relied upon to bear the weight of the lamp and globe in each case, but three fine steel wires are added for the purpose. This precaution— in our opinion unnecessary—certainly detracts from the appearance of the fitting when viewed at close quarters; we understand that it was added at the suggestion of the Committee, and

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certainly does not form a feature of the fitting as originally designed by the manufacturers.

Osram lamps are employed throughout.

Returning to the actual wiring. this has been carried out with Siemens C.M.A. 2,500-megohm cable, run in heavy solid-drawn enamelled steel conduit for the power circuits and main cables (except in those cases where the existing 19/12 jute-insulated lead-covered cable has been utilised), and in "Kalkos" conduit for the sub-circuits. The latter system has lent itself admirably to the concealed work, and was adopted by the contractors, who were given the option of employing this or steel barrel. The use of draw-in boxes has been



SKETCH SHOWING ARRANGEMENT OF LAMPS AND MIRRORS FOR REFLECTED LIGHTING IN THE LECTURE HALL.

avoided, and the drawing-in of the wire has been done from the switch and point boxes. These boxes, with their adjustable rings, forming, as it were, a false bottom for the base of the switch, have facilitated the adjustment of the cover-plates of the switches flush with the surface of the walls, and, although the cover-plates themselves might with advantage have been of a more elegant pattern and finish, the whole is a sound and admirable piece of work. In the case of the switches and switch-runs in the marble-faced walls, the tubing is run between the brick wall and the marble slabs, and the latter were bored accurately to take the switch-boxes so that the cover-plate over the switch entirely hides the hole, and no making-good round it was required.

The distribution boards are in iron cases, and on the main distributing boards a useful carrier type of fuse is employed, in which the fuse wire is run through an asbestos-lined black fibre sleeve with wide flanges. In the projector lantern circuits, a low resistance is placed in circuit at the distributing board in the basement in each case (a one-ohm resistance capable of carrying 50 amperes, and a 2½-ohm resistance for 25 amperes, respectively), to prevent any evil effects from short circuits. A special heating circuit is run to a room in the basement allotted to the boiling of tea and coffee. This terminates in a six-way D.P. distribution board containing switches for each circuit, and there is a red pilot lamp above each way which glows when the circuit is on. Six plug points are fed from this board, and General Electric Co. boilers are employed, each with 1 kw. for the first heat and 350 watts after. One of the boilers is adjustable, further, to 200 watts.

A room in the basement has been allotted for a special motor-generator (not yet erected), which will supply current for experimental purposes in the Lecture Theatre when the 100-volt supply is not suitable for demonstration purposes. A fuse-board with six 50-ampere ways has been fitted in this room, and is connected to a similar board in the Lecture Theatre. In the Common Room there are also three pairs of 25-ampere terminals controlled by two-way switches, but these are connected to the 100-volt supply only. A special terminal is employed on these boards in the Motor-generator Room, the Common Room, and Lecture Theatre, which enables any size of cable to be connected up rapidly. To facilitate the demonstrations in the Lecture Theatre, a telephone line connects this to the Motor-generator Room. From the terminal board in the Lecture Room, which is on the wall behind the Council table, a 3 in. earthenware tube is led under the floor to the space in front of the table so that the wires may be conveniently connected to the apparatus without being trailed across the floor.

The lighting of the Lecture Theatre is "indirect." Around the cornice 220 30-watt Osram lamps are fixed above corrugated mirrors in the manner sketched opposite, and their light is reflected upwards on to the curved portion of the cornice or frieze, which reflects it downwards and diffuses it. The battens upon which the lamps are fixed are each 10 ft. long, and are on hinges, so that the batten may be turned back for lamp renewals, cleaning, &c. Each batten has eleven lamps fixed on it in a horizontal position, and wired with "Stannos" cable, and the lamps are divided into ten groups (two battens each), connected to plugs. The relative position of the plugs and lamps is indicated in the sketch. The plugs are connected on two circuits, and are wired alternately so that the lighting remains symmetrical if one circuit is off. This reflected lighting is supplemented by the light of four 4-ampere Westinghouse Silica lamps suspended about 6 ft. 6 ins. above the "lay-light" or glass ceiling in the centre of the theatre. The combined effect of the blue light from these lamps and the reflected light gives a soft illumination of a similar colour to daylight, and to all intents and purposes as well diffused, and the illumination is sufficient to enable small print to be read with ease. The light, however, is a cheerless one, probably because it resembles daylight too closely in character, while the illumination must necessarily be less than that of daylight. We recommend the addition of a large electrolier in the centre of the hall itself. A use of the Silica lights that must be mentioned is that, owing to the difference in colour, they do not affect the lantern, and in consequence they can be left on when pictures are shown, so that members can refer to their papers and take notes, although the other lamps are extinguished.

A small Lantern Room is built in the wall of the Lecture Theatre, facing the lecture table. In the room are three switches controlling the two circuits of the cornice lights, and the Silica lamps in the roof. These are two-way, as the circuits are wired so that they can be switched off from the floor of the Lecture Theatre or from the Lantern Room. It was deemed necessary that they should work with absolute silence, and they have been specially designed for this purpose. They are of the quick break laminated pattern, in which an auxiliary contact arm takes the spark, and this flies back against a rubber buffer, which separates the main from the auxiliary contact arm. Terminals and an ammeter are provided for the lantern, and a fireproof flexible cable is employed for the connection. The Lantern Room is fireproof; the wall to the Lecture Theatre is lined with uralite, and the opposite wall and side walls are the solid brick walls of the theatre.

The rooms are provided with 15 "Magneta" clocks, which were presented by the Magneta Time Co., Ltd. (Chatham House Works, Turnham Green). The master clock is in the Committee Room. The circuits of these, as well as of the bells and internal telephones, are wired with "Stannos" wire, using the outer sheathing as a return.

Our thanks are due to Messrs. Handcock & Dykes, and Drake & Gorham (and Mr. C. Smith and Mr. P. H. Wigg respectively of their staffs) for giving us particulars for this article, and to Mr. P. F. Rowell, the Secretary of the Institution, for permitting us to make a minute inspection of the installation in the building.

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MANUFACTURE OF STONE FROM QUARRY DEBRIS

WE recently had the opportunity of visiting the works at Ponders End, Middlesex, of the British Stone & Marble Co., Ltd., in which the manufacture of reconstructed stone from quarry débris by the Thom process is being carried on. The works are large, and cover an area of some three to four acres; electric power is employed exclusively.

The process consists of a series of mechanical and chemical operations, following closely the natural process of the formation of sedimentary rocks. The chemical composition, physical texture, and characteristic features of the natural stone are accurately reproduced, while the defects of bedding-planes and non-uniformity are eliminated. The density is greater than that of the natural product, and tests have shown that the reconstructed stone is actually superior in strength, hardness, and durability. Débris or waste chippings of any suitable building stone are brought straight from the quarries to the works, where they are disintegrated in a special machine which preserves the form of the orginal component egg-shaped grains of the Oolitic stone, but separates them from the carbonate matrix. The resulting grit is mixed with about 10 per cent. of lime made from dolomite calcined in closed retorts, and the mixture thoroughly slaked. Water is added until the consistence is that of cream, and the mixture is then poured into steel moulds and put under hydraulic pressure to remove the water and consolidate the mass. On leaving the moulds, the blocks are of the consistence of soft chalk, but are perfectly uniform throughout. After being exposed to the action of the atmosphere for a week or so, they can be sawn, shaped, and carved with ease, the carving by skilled men taking only about one-third the time necessary when working on hard stone. The finished blocks are dried at a temperature of 100° to 120° Fahr., and then placed in closed steel tanks. The air is exhausted, and the carbonic acid gas extracted from the dolomite in the production of the lime is admitted under a pressure of 100 lbs. per sq. in. This gas permeates the blocks, and the whole of the hydrate of lime holding the stone particles together is chemically converted into the carbonate, thus actually reconstructing the original natural stone. Any kind of sedimentary rock can be reconstructed in this way, but Oolitic limestones, such as the Bath, Portland, and Ketton stones, are the most suitable. A very durable stone for paving and building purposes and having the appearance of Kentish Rag, is made with crushed blast-furnace slag as the basis.

Power is supplied to the works at 10,000 volts, three-phase, 50 cycles, from a ring main of the North Metropolitan Electric Power Supply Co., who have erected a transformer sub-station in the works. This contains two 100-kw. three-phase transformers, which transform down from the supply pressure to 415 volts, three-phase, four-wire, for distribution in the works. The lighting is at 240 volts between any one phase and the neutral.

Taking the plant in the order of the process, the stone débris is first broken into pieces of the size of the fist in a rotary stone-crusher, and it is then passed into a Carter's disintegrator, in which it is reduced to grit. From this it is raised by a vertical bucket-conveyer to hoppers above. After sifting, it is carried to further hoppers over rotary mixing machines, each stone hopper having a lime hopper adjacent to it. The two materials fall into automatic weighers, and quantities are dropped into the mixers in the ratio of 8 to 10 parts of stone to one of lime. After mixing dry, a small quantity of water is added to effect the slaking. The product is then transferred in the form of a damp powder to storage hoppers, where it is left for two or more days. There are two large mixing and slaking machines at work, and two more are now being installed. The crusher, disintegrator, and slakers are all belt-driven from shafting driven by two 75-h.p. motors. These two motors are controlled by a single oil switch with overload release, and in order that they may be stopped instantly in cases of emergency, provision is made for tripping the switch from push-button switches placed adjacent to the machines. To ensure that these local circuits are in working order, the machines are shut down by this means two or three times a week.

There are four hydraulic presses: a 1,800-ton press giving 4 tons per sq. in. and taking blocks of $9' \times 2' \times 2'$; a 2,000-ton press, giving 2 tons per sq. in., and taking blocks $4' \times 2'\ 6'' \times 9''$; a 1,000-ton press giving 4 tons per sq. in. and taking blocks $3' \times 3' \times 3'$; and a 540-ton experimental press. All four presses are supplied from a large 80-ton hydraulic accumulator, which is fed by means of a 60-h.p. three-throw pump, controlled automatically by electrical gear supplied by the British Westinghouse Co. The operation of this gear was fully described in an article on the electrical equipment of Yarrows' shipbuilding works (ELECTRICAL ENGINEERING, October 7th, 1909, Vol. V., p. 871), where similar plant is installed. Projections on the side of the accumulator operate a tappet switch when the accumulator reaches certain positions, thus starting a small auxiliary motor, which causes the main motor to be started up or stopped, according to the position of the accumulator.

After being shaped and carved, the blocks are dried in chambers heated by hot air obtained from an economiser in connection with the lime kiln. There are nine large steel tanks for treating the stone, and three CO_2 storage tanks. Besides the above-mentioned motors, there is a 35-h.p. motor driving a compressor for the CO_2 plant, and two smaller motors for other work. An electric travelling crane carries the blocks from the presses to the drying chambers and workshops. This has three motors of 7, 7, and 2 h.p., for hoisting and longitudinal and cross-traversing respectively. Most of the wiring consists of braided vulcanised rubber cable supported in porcelain cleats, but there is a certain amount of steel conduit wiring in the extension. The main lighting is by flame lamps run two or four in parallel off auto-transformers.

Reconstructed stone is from 15 to 25 per cent. cheaper than natural stone, according to the amount of shaping and carving, the saving due to working on the stone when soft being very considerable.

An important product of the Company is a form of reinforced glazing-bar, made by embedding a ½ in. square section steel rod in grooved bars of stone for roofs, window mullions, &c. These bars can be of smaller section than is usual with stone glazing-bars, and are very much stronger. Thin reinforced slabs suitable for the floors of switchboard galleries and similar purposes are also manufactured. In these cases, the steel bars are fixed in the mould before pouring in the mixture. Slabs manufactured in this way are far superior to reinforced concrete, as the material is of a much higher density and is pressed close on to the bars. The company also manufactures reconstructed marble suitable for switch panels, and we understand that samples which have been tested have shown high dielectric strength and insulation resistance. It occurs to us that, if this reconstructed marble is otherwise suitable, it should have one great advantage over natural marble or slate for switchboards, as the slabs could be drilled and accurately shaped while still in the soft state, and delivered to the switchboard manufacturer ready for assembling.

In conclusion, we should like to acknowledge our indebtedness to Mr. G. L. Anderson, Manager of the works, for kindly showing us over the plant and explaining the process, and to Mr. H. W. Child for some particulars of the electrical installation.

ELECTRIC SUPPLY ADVERTISING

AN article appeared in the *Financial Times* last week under the title of "Electric Lighting Progress," the general trend of which was to show that the electric supply authorities were not doing all that they might in pushing business, and, in order to make a point, the writer instanced a comparison between the Joint Electrical Publicity Committee and the gas companies, and claimed that the former did not work upon such a well-organised plan as the gas companies. We are pleased to see that these statements were not allowed to go unchallenged, for Mr. H. B. Renwick, Secretary of the Electrical Supply Publicity Committee, wrote immediately to the same paper on behalf of the Electric Supply Publicity Committee, and pointed out that the gas companies had not as yet any combined systematic organisation, although a project was in the air to form such a combination. On the other hand, he showed the wide extent to which advertising and publicity had been carried by the electric supply authorities of London through their joint scheme.

Variable-speed Three-phase Motors.—Mr. J. J. Elink Schuurman writes us that his attention has been drawn by Dr. A. Scherbius to an error in his recent Paper before the Iron and Steel Institute. The Paper was published in abstract in ELECTRICAL ENGINEERING, Oct. 6th, 1910. p. 633, and Fig. 1 of the abstract, represented as the Scherbius system, is now described by him as a general diagram applicable to both the Kramer and Scherbius systems. Another diagram (not given in our abstract) was attributed by Mr. Schuurman to Dr. Scherbius, but is really due to Mr. C. Krämer, whose most important system was illustrated in Fig. 2 of our abstract.

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THE FIELD OF THE INDUCTION MOTOR

A PAPER, entitled "The Irregularities in the Rotating Field of the Polyphase Induction Motor," was read by Mr. C. F. Smith at the Manchester Section of the Institution of Electrical Engineers on Tuesday, November 8th. He classified the causes of want of uniformity in the field of the polyphase induction motor as follows :—Non-sinusoidal waveform of the supply voltage; disposition of the stator winding in a limited number of slots; variation of the air-gap reluctance due to the varying position of the teeth and slots of the rotor in relation to those of the stator; want of uniformity of the air-gap due to the rotor being out of centre; the effect of want of proportionality between magnetising current and flux was also mentioned, although of less importance. He then proceeded to describe a number of experiments to determine the extent of this irregularity by measurements of the electromotive forces induced in special search coils wound on the stators of two induction motors, so as to embrace portions of the air-gap flux of the motors. These search coils were disposed in various positions round the stator, and were wound so as to embrace different numbers of stator teeth.

In the first investigation, the voltages induced in the search coils with the rotor stationary and the normal voltage applied to the stator were measured, and these were found to agree almost exactly with the theoretical values calculated on the assumption of a sinusoidal distribution of flux, except for differences due to the lack of uniformity of the air-gap round its circumference, caused by wear of the bearings. Curves of the search-coil voltages, taken when the rotor was supplied with current through the slip-rings, agreed with these observations except for differences due to the cause mentioned above. Alterations in the grouping of the search coils produced consistent results.

The effect of the rotor being allowed to rotate was then investigated. The curve is slightly different in shape from the one taken with the rotor at rest owing to the addition of higher harmonics of voltage, which vary in amplitude for the several coils.

The effects of load on the motor and of driving the motor with open-circuited rotor by means of a separate machine were also tried. No alteration in the induced voltages was to be observed, except for a very slight change caused by the variation in the harmonics, which depend upon the speed of the motor. The coil voltages were also found to be unaffected by a reversal of the direction of rotation of the rotor.

By connecting the rotor slip-rings to the supply and short-circuiting the stator winding, the functions of the two motor windings were inverted, and the search-coils, being regarded as situated on the rotor, instead of on the stator, of an induction motor were employed to examine the voltages induced in a rotor under working conditions. The voltages were lower than when the rotor was stationary, but higher than would be produced by a uniformly rotating field cut with the speed of slip. Another striking peculiarity of the curves was the great difference between the voltages induced in successive coils, which gave them a "saw-tooth" appearance. The two characteristics of the rotor flux indicated by these results are due to want of uniformity of the main rotating field due to the disposition of the stator winding in a limited number of slots, and even more to pulsations produced by the rotation of the teeth of the rotor core. Further experiments were made with a motor driven at its synchronous speed.

Having considered the voltages developed in the individual coils, the next step was to investigate the effect of connecting a number of coils in series to form a complete winding. This was done by joining together several search-coils in series and observing the voltage of the combination. With the supply on the stator, the voltage of the grouped coils was almost identical with that previously observed with the rotor stationary, the higher harmonics of voltage being too small in amplitude to have any appreciable effect.

When the motor was run at synchronous speed with the supply on the rotor, it was evident that the resultant voltage induced by field irregularities in several windings connected in series bears very little relation to the voltages of the individual windings, and is in general much smaller. This effect can be shown to be due to the fact that there are always voltages induced in some coils which are in direct opposition to those being simultaneously generated in others.

The results just arrived at, remarks Mr. Smith, are not without practical importance, since they have a direct bearing on the question of wound rotors *versus* squirrel-cage rotors for short-circuited induction motors. For example, in one case a pulsation voltage of 9·5 volts was induced in the coil wound in a pair of slots having a pitch equal to that of the poles of the motor. This corresponds to nearly 1 volt per turn at the normal voltage. If such a coil were directly short-circuited on itself, as would virtually be the case in a squirrel-cage motor, we should probably obtain a considerable current of high frequency which would not contribute to the torque of the motor. By connecting in series the conductors in several slots, the resultant voltage due to irregularities of the field is much decreased, while at the same time the impedance of the circuit in which this voltage acts is largely increased. The pulsating currents and the heating due to them may thus be reduced to a relatively small value in a wound rotor. On short-circuiting the rotor winding of the induction motor under consideration, while driven at synchronous speed, the slip-ring current was found to have a value of just less than 1 ampere, although the open circuit slip-ring voltage was over 4 volts.

It will be seen from the results that the damping out of high-frequency voltages in the rotor winding depends less on the number of slots per phase than on the relation existing between the spans of the several coils. The same consideration will govern the extent to which the effects of "cogging" will make themselves felt, when full speed has been obtained. In most motors the magnitude of the voltages which are induced in the separate rotor coils is masked by the differential action between the coils, which makes it impossible to measure them. It is, however, evident that the slip-ring voltage at synchronism gives very little information as to the actual amplitude of these pulsations.

Oscillograph records were also taken of the search-coil voltages. An examination of the curves shows that they all consist of a combination of three principal harmonics, and that the differences between them are due to the variety in relative amplitude possessed by these harmonics. These three harmonics are :—A fundamental, or first harmonic, having the frequency of the supply, showing the extent of the change in strength of the flux per pole of the motor; a sixth harmonic, due to the variation in the field produced by the excited winding, not caused by flux pulsation, but showing the influence of the changes of maximum induction and speed of the field, and a twenty-fourth harmonic due to flux pulsation, and dependent for its period on the number of teeth acting upon the winding.

A few remarks are included near the end of the paper on the effects of uneven air-gap, which causes the different coils in the winding to share the flux unequally, and it is noted that the following disadvantages are apt to arise from this cause :—Magnetic drag on the rotor in the direction of the strongest field, concentration of the applied voltage in certain coils of the winding, producing unequal dielectric stresses, increased hysteresis and eddy-current loss in the teeth subjected to high induction, and unequal voltages in the phases of the rotor resulting in an unsymmetrical distribution of currents, varying with the frequency of rotation.

Discussion.

Mr. W. Cramp (Manchester Municipal School of Technology) commented on one or two matters of detail, and thought that account should be taken of pulsations due to slight eccentricity in the mounting of the rotor on the shaft. He thought also that a component of the pulsating voltage might be due to the number of times per second there was a correspondence between the rotor and the stator teeth. This depended on the G.C.F. of the number of slots, and it did not follow that the change would correspond with the flux moved per tooth. The main conclusion to be drawn from the Paper was that pulsation voltages were of importance only in very high pressure machines, and the average induction motor as at present constructed was, on the whole, wonderfully free from effects due to irregularities in its field.

Prof. E. W. Marchant (Liverpool University) referred to some similar experiments made in his laboratory by Mr. Lawson, who had found considerable increase in the losses due to pulsations in the teeth as the load rose; in fact, at full load the magnetic pulsations were sometimes more than double their value at no load. The currents due to these irregularities were small owing to impedance offered on account of their very high frequency. He thought that the most important effect of unevenness of air gap was the inequality of voltage produced in the different phases.

Mr. G. W. Worrall traced from several points of view the

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agreement between the author's results and those of his own experiments on alternators, and spoke of the greater importance of the effects in the stator teeth than those in the rotor teeth.

Dr. ROSENBERG (British Westinghouse Co.) spoke of the equalising currents which might be set up in the rotor if it were not central, but did not think that these would be of any great value, although every equalising current reduced the fields which set up this voltage.

Mr. J. FRITH suggested that the effect of unequal induction due to uneven air gap could be lessened by connecting coils on the opposite side of the motor in parallel and not in series.

Mr. F. C. ALDOUS said that this was often done, but was impracticable in high-tension motors.

Mr. C. F. SMITH, in reply, said that he did not think the G.C.F. of the slots would affect the flux variation as much as Mr. Cramp had suggested. Losses that might be expected from inequality of the field were not confined to the stator teeth; they would be found in both the rotor teeth also, and in copper losses due to equalising currents set up in the rotor winding. The amount of the latter had not been investigated.

CORRESPONDENCE

MUNICIPAL WIRING.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Referring to your note headed "Bray" in your issue of 10th inst., the statement that my Council contradicted the allegation of the Dublin & Alliance Gas Consumers' Co. that this Council is wiring private premises is incorrect. The circumstances are as follows :—

Bray is a small town thirteen miles distant from Dublin. As there is no local wiring contractor, and as the Dublin contractors naturally charge fairly heavily for sending men out here every time there is a small job going, it became apparent to me that we could do no real good unless, when canvassing for consumers, we were at the same time able to give an estimate for the work and afterwards carry it out if successful in our solicitations. Therefore we have for some years been doing wiring work, and with very successful results. Had we not adopted this course I feel sure that we should have secured practically no fresh consumers during the past few years, and that at a time when they were so urgently wanted, owing to the decreased consumption of existing consumers due to metal filament lamps.

In a town such as this the majority of new consumers do not require more than 10 to 15 lamps per house, and it is unlikely that the contractors from a large city will come here to canvass for these small jobs when there are bigger fry waiting to be captured much nearer home.

Personally I consider that in towns where there are plenty of contractors in competition it is better that contracting work be left to them and that the supply authorities should give the contractors every assistance and encouragement. I believe, however, every municipal undertaking should have full powers to do such work if necessary. Surely it is absurd that it should be legal for certain towns which have obtained a special Act to do installation work and illegal for the smaller towns (where the necessity is more apparent) which are debarred owing to the cost of obtaining a special Act.—Yours, &c.,

WM. J. U. SOWTER,
Engineer and Manager.

Electric Lighting Station, Bray,
November 11th, 1910.

Testing Stations.—We understand that on Friday a Conference of Local Authorities owning electricity undertakings was held at the Islington Town Hall for the purpose of considering the question of taking joint action with regard to the requirements of the London County Council *re* testing stations and the removal of service boxes from the operation of Section 45 of the London Building Act of 1894.

Rating of Tramways.—The Tottenham District Council summoned the Metropolitan Electric Tramways, Ltd., last week for the non-payment of £371 14s. 4d., claimed to be due as balance of the general district rate for the September half-year. The company are fighting the case on the claim that the tramways in respect of which the rate is due, namely, one running from Bruce Grove to Wood Green, was a light railway, and as such should be assessed as a railway at one-quarter the net annual value. The local magistrates decided against the company, being guided in their decision by the result of the Swansea case some years ago. In that case the Swansea Tramway Co. appealed to a Divisional Court, when the decision of the Swansea magistrates was upheld, but the case was taken no further. In the present instance, it is the intention of the Metropolitan Electric Tramways, Ltd., to appeal to a Divisional Court, and, should they lose there, as they anticipate they will, the case will then be taken to the Appeal Court.

ARRANGEMENTS FOR THE WEEK

MONDAY, NOVEMBER 21ST.

Junior Institution of Engineers.
7.30 p.m. At Caxton Hall, Westminster. Fourth Lecture on "The Law Relating to Engineering," by L. W. J. Costello.

Electro Harmonic Society.
8 p.m. Concert (Ladies' Night) at Holborn Restaurant.

Society of Arts.
8 p.m. Cantor Lecture I. on "Industrial Pyrometry," by C. R. Darling.

Institution of Electrical Engineers: Newcastle Section.
8 p.m. At Armstrong College. "Electric Winders," by J. G. Wilson.

TUESDAY, NOVEMBER 22ND.

Institution of Electrical Engineers: Manchester Section.
7.30 p.m. At University. "Street Lighting by Modern Electric Lamps," by Haydn T. Harrison.

THURSDAY, NOVEMBER 24TH.

Institution of Electrical Engineers.
8 p.m. At Victoria Embankment. "Street Lighting by Modern Electric Lamps," by Haydn T. Harrison.

Engineering Exhibition, 1912.—The announcement is made that an Engineering and Machinery Exhibition, promoted by the *Engineering Review*, will be held at Olympia from October 4th to October 26th, 1912. Applications for spaces are already invited.

Lighting of Factories.—At the meeting of the Illuminating Engineering Society last week, it was announced that many Government delegates at the Congress of Hygiene, which was held in Brussels this year, agreed to recommend their Governments to take in hand the question of the illumination of factories, especially as regards the lighting of dangerous machinery. In this connection it was announced that the Home Office have appointed one of their inspectors of factories as its representative in the Society.

Glasgow Local Section of the Institution of Electrical Engineers.—The opening meeting of the session was held on Tuesday of last week, when the chairman, Mr. Sam Mavor, delivered his inaugural address, which dealt with "The Power Equipment of Collieries." An abstract of this will appear in our next supplement on Electrical Engineering in Mines. The secretary (Mr. James E. Sayers) read a communication received from Lord Pentland acknowledging receipt of the Section's expression of condolence on the death of his late Majesty King Edward. It was agreed to contribute £20 towards the proposed Kelvin memorial, which it is suggested to erect at Glasgow University. Mr. W. W. Lackie, in proposing a vote of thanks to the chairman, referred to his intimate knowledge and experience in colliery practice, both at home and abroad. Mr. Mavor had casually mentioned to him earlier in the evening that he had been in Moscow the previous week, where extensive coal-mining operations were in process.

New Method of Producing High-Tension Discharges.—A recent Paper before the Physical Society, by Prof. Ernest Wilson and Mr. W. H. Wilson, described a method of producing high-tension discharges in which energy is taken from an alternating or continuous current source, stored in a magnetic field by an inductance; and then permitted to surge into a condenser which forms with the inductance a *low* frequency oscillating circuit. When the energy is stored in the condenser the latter is mechanically bridged across the primary winding of a spark coil, with which it forms a *high* frequency oscillatory circuit. The energy is then transmitted by the secondary winding of the spark-coil to the work circuit in well known manner. A special contact-making device is used, consisting of a cylinder of insulating material driven by a small motor, carrying suitable contacts upon which brushes bear. The coil of the inductance is connected in series with the primary winding of the spark-coil, and forms one circuit. In parallel with this circuit is placed the condenser. One pole of the supply source is connected to a brush on the contact-maker. The other pole of supply is connected to a tapping point on the inductance suitable for the voltage of supply. The junction of the inductance and the condenser, and the junction of the inductance and the primary winding of the spark-coil are connected to the other brushes on the contact-maker. At the epoch of "make" the current rises in the winding of the inductance and builds up the magnetic field. The condenser also becomes charged and its charging current passes through the primary winding of the spark-coil. At the period of "break" the energy stored in the condenser is added to that in the inductance, and the condenser begins to be charged in the reverse direction. Ultimately the whole energy in the system is stored in the condenser. At this moment the inductance is short-circuited, and the condenser discharges with great rapidity through the primary winding of the spark-coil, and the energy oscillates to and fro. The electromotive force induced in the secondary winding may be of an oscillatory or uni-directional character, according to the nature of the work circuit.

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MR. CHURTON'S ADDRESS TO THE YORKSHIRE SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

MR. T. HARDING CHURTON touched on a number of matters in his inaugural address last night as chairman of the Yorkshire section of the Institution of Electrical Engineers. He spoke of the usefulness of the committee on electric driving of textile factories and other fields of activity of the Institution, and passed on to some remarks on the manufacturing side of the industry. He believed that the present unsatisfactory state was due to the productive capacity of our factories exceeding the demand of the market that is open to us, more than to anything else. He outlined some of the directions in which modern designs of machinery were tending, and emphasised the value of standardisation within the factory, although he was not so much in favour of attempts to bring about universal uniformity of details. There was, however, he said, good and sufficient reason for an endeavour to establish agreement as to the definitions of terms used and for the adoption, by general consent, of certain standard specifications respecting the performance of electrical machinery, qualities of materials, and other such matters. He did not consider the attempts of the Engineering Standards Committee in this direction altogether satisfactory. He did not agree with the six-hour run as a test for continuous rating, nor the one-hour run for intermittent rating on account of the very different time constants of different-sized motors. Nor were the standard speeds suggested for each horse-power of much use. The standardisation of voltages and frequencies was, however, of great importance.

A few remarks on technical education followed, and the necessity for a due mingling of the practical and the theoretical was pointed out.

In conclusion, the question of coal conservation was taken up, and the speaker urged the great economies obtainable by the establishment of generating stations on a large scale with large units in connection with collieries, steel works, &c., with high-tension electric transmission. 40,000 to 50,000 volts would be, he thought, quite practicable in this country.

WESTINGHOUSE-LEBLANC CONDENSING PLANT

OUR attention has been drawn to the special advantages of the Westinghouse-Leblanc condensing plant for steam turbine installations, where a very high vacuum is essential for economical working. The principle and construction of the Leblanc condenser and rotary dry-air pump were fully described with illustrations in ELECTRICAL ENGINEERING of May 19th, 1910. p. 323, in connection with the Bahia Blanca power-station, where five sets are installed. The pump may be regarded as a reversed Pelton wheel in conjunction with an ejector, the water being thrown out through the discharge pipe in the form of a rapid succession of films, between which the air is entrapped. There are no reciprocating parts, valves, or waste clearance spaces, and the efficiency is high. The British Westinghouse Electric & Manufacturing Co. (Trafford Park, Manchester) supply these pumps in conjunction with practically any type of condensing plant. A new leaflet issued by the company describes this system as applied to a simple jet-ejector type condenser, a multiple-jet condenser (an improved low-level jet plant, in which there is no liability to backflood the engine or turbine), a barometric-jet condensing plant, and a surface condensing plant. The Leblanc pump compresses the air passing through it, and delivers the vapours at the temperature of the sealing water. This permits the circulating water to be reduced so that the temperature of the hot-well discharge may be within 2° Fahrenheit of the temperature corresponding to the vacuum, and in some cases equal to it. The actual volume dealt with by the pump increases with the vacuum; with reciprocating pumps, however, the reverse takes place, which necessitates disproportionately large pumps. The Leblanc condensing apparatus was introduced on the Continent about five years ago, but it was not until three years later that the apparatus was introduced to the British market. Over 100 sets have already been installed in this country in conjunction with all types of engines, including colliery winding engines, rolling-mill engines, and turbines, and the results are said to have been entirely satisfactory.

The Turin Exhibition.—The Exhibitions Branch of the Board of Trade inform us that a large number of applications for space in the British Industrial Court at the Turin Exhibition have been received. There is also great activity in the direction of securing a representative exhibit of the chemical industries in connection with which a strong committee has been formed. The Association of Chambers of Commerce is also urging the participation of British firms in the exhibition.

THE BRITISH ELECTRICAL INDUSTRY

MR. M. J. RAILING devoted his inaugural address as Chairman of the Birmingham Local Section of the Institution of Electrical Engineers to general questions connecting the welfare of the electrical industry in this country. Want of suitable and profitable employment, or absence of satisfactory returns for the labour or capital spent had made itself felt in the electrical industry for a number of years. Many reasons were brought forward to explain this. There were men who sought the root of the evil in the different way in which engineers were educated in this country compared with other countries. There were others who attributed the more prosperous conditions of rival countries to our present fiscal policy, which was in opposition to the one adopted by the rest of the manufacturing nations, while others again blamed those at the head of the great concerns engaged in financing engineering undertakings, or engineering industries, for want of enterprise. Mr. Railing then proceeded to call attention to the principal changes in circumstances which had taken place in the relations between England and other countries. With the improvement of communication and the more settled state and increasing industrial importance of European countries, many of the conditions which had led to make England the trading country of the world in the past had gone, and but little of the advantages of longer experience remained. Neither were there reasons depending on supplies of raw material or of power why we could manufacture better or cheaper in this country. Taking the two principal materials required in the electrical industry, it was remarked that England had ceased to be the principal iron and steel country of the world, and had to depend almost entirely on foreign supplies for copper. With regard to labour conditions, we were at a disadvantage, and we could, he said, only endeavour to make up the want of balance by the more efficient organisation of our factories and the labour employed in them, by means of careful supervision of the minutest details. He emphasised the necessity for large outputs and a constant flow of work for perfect organisation. If we want to keep our position or "move up," he continued, we must get bigger outputs and larger markets. Other countries do not possess advantages over us in the supply of raw material or power. We possess as good men of science, designers, and engineers, and as capable, if not more capable, workpeople. It is output which we want to give us the lead again, and men who can give us that output; men who know best where to obtain the most satisfactory supplies and what markets are most suited for the disposal of our products. The man he spoke of must know as intimately as possible everything about manufacturing and our manufactures, and at the same time be thoroughly conversant with the language and conditions of the country to which it was desired to sell. More attention should be paid, he claimed, to the training of this special class of commercial engineer. Other countries had stolen a march on us, not so much in the production of engineers nor yet in the production of purely commercial men, but in the development of a type of man who combined the qualities of both. In Birmingham a move in the right direction had been made by the establishment of a commercial faculty at the University; but it was not sufficient to establish such a faculty for training commercial men. A free interchange between the engineering and commercial faculties was needed, so that those whose training was designed primarily to equip them as engineers should study also commerce and commercial subjects. The young electrical engineer abroad was encouraged to study, in addition to his own science, the technology of allied trades, and to train himself as well in languages, in commercial law, in natural economy, and in commercial routine generally. He pleaded that such a course might some day be adopted in this country as well. The commercial side of engineering should, he thought, also be more considered in the system of apprenticeship.

The L.C.C. Tramway Subway.—At the meeting of the Institution of Civil Engineers, Mr. G. W. Humphreys read a paper on "The London County Council Holborn to Strand Improvement and Tramway Subway." The author dealt with the construction of the Kingsway and Aldwych thoroughfares with their pipe and cable subways, and of the tramway subway from Holborn to the Strand, which links up the north and south sections of the L.C.C. tramways. For a description of the last portion of this subway to be opened reference may be made to ELECTRICAL ENGINEERING, Vol. III., page 343, March 5th, 1908, where drawings of the special form of conduit used will be found.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published November 10th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

16,447/09. **Train-lighting Dynamo.** A. H. MIDGLEY and C. A. VANDERVELL. (London.) A reversible self-regulating dynamo has the brushes in the normal position relatively to the main poles which are not excited. Auxiliary wound poles are provided in the commutating zone, and induce heavy currents in the short-circuited coils. These local currents set up a cross-magnetising flux which distorts the inducing flux into the main poles, and thus causes an E.M.F. to be generated in the working part of the armature winding. The distortion will be in one direction or the other, according to the direction of rotation, and consequently the current taken from the brushes will always be in the same direction. As the reaction of the working current is exactly opposed to the inducing poles, the output of the dynamo will remain practically constant at all speeds. Three figures.

20,867/09. **A.C. to D.C. Transformation.** A. M. TAYLOR. This specification describes a transforming apparatus consisting of specially wound transformers working in conjunction with a rotary switch or commutator driven by a synchronous motor. The transformer has two secondary coils wound in opposite directions and connected in series direct with the D.C. circuit. The switch short-circuits the coils alternately while they are giving an E.M.F. in the wrong direction. Methods of increasing the period during which the E.M.F. is nearly zero, and of eliminating the pulsations from such a rectifying system, are described. Thirteen figures.

24,112/09. **Gyroscopic Stability Mechanism.** S. Z. DE FERRANTI. A pair of gyroscopic units are interconnected in such a manner as to impart stability to a body such as a monorail car, ship, aeroplane, or submarine, equally in all directions. Means for allowing inclinations in certain directions and not in others are provided. The invention is described in relation to the steadying and control of an aeroplane driven by two motors of the Gnome pattern arranged with their axes vertical, and driving the propeller through bevel gearing. Each motor constitutes a gyroscopic unit, and is mounted so that it can swing in any direction. To ascend or descend, the gyroscopic system is locked, so that it loses its controlling effect in the longitudinal vertical plane. A method of accelerating the precession of the gyroscopes in order to render an initially unstable body stable (see ELECTRICAL ENGINEERING, Nov. 18th, 1909, Vol. V. p. 977) is also described. Thirteen figures.

24,126/09. **Frequency Changer.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). A synchronous double-current alternator or frequency changer comprises a machine with a single armature and field system. The armature has coils forming two windings of different pole numbers, and the field system has two component magneto-motive forces corresponding in pole numbers to the two pole numbers of the armature. The voltages of the two currents generated may be varied independently. When running as a frequency changer with a constant voltage on the motor side, the voltage on the generator side may be varied. Three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: HIRST and ANGOLD, 29,069/09; BLACKWELL, 2,263/10; REGINA-BOGENLAMPENFABRIK GES. [Alloy for supports for carbons] 6,523/10; W. C. HERAEUS GES. [Starting means for mercury vapour lamps] 8.125/10; HEIMANN and SCHAFFER [Working arc lamps in series with metal filament lamps] 11,581/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: LILIENTHAL and LAUER [Treatment of mica] 4,980/10.

Dynamos, Motors and Transformers: SMITH and GOOD [Machines] 25.144/09; LECOCHE [D.C. motors] 25.230/09; ALLGEMEINE ELEKTRICITÄTS GES. [Machines] 15,753/10.

Electrometallurgy and Electrochemistry: EYCKEN, LE ROY and MORITZ [Electrolytic production of oxygen and hydrogen] 24,716/09; SCHOTT and GEN [Electrolytic apparatus with liquid anode] 6,597/10; DURA ELEMENTBAU GES. and LESSING [Primary cells] 8.810/10; KAISER [Electrical manufacture of nitrates] 12,229/10.

Heating and Cooking: BERRY [Heating apparatus] 24,813/09; TREPREAU [Heating apparatus] 24,829/09; REGINA BOGENLAMPENFABRIK GES. [Alloy for withstanding heat of arc in soldering and other tools] 6,523/10.

Incandescent Lamps: ALLGEMEINE ELECTRICITÄTS GES. [Exhausting apparatus] 15,754/10.

Instruments and Meters: ROEKE [Thermostats] 25,254/09; GEISSINGER [Thermostats] 25,819/09.

Storage Batteries: SCHNEIDER [Manufacture of positive plates] 3,631/10.

Switchgear, Fuses and Fittings: SHEWARD [Lamp-holders] 23,634/09; BLOCH [Connectors for alarm circuits] 24,076/09; MILNE [Wiring conduit and accessories] 24,561/09; SCHEIBE [Control gear for vapour devices] 1,483/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Electro-magnetically controlled switches] 7,465/10; DEY [Switches] 12,489/10 and 12,490/10.

Telephony and Telegraphy: MONTAGNA [Telegraphic transmission of pictures] 15,734/10.

Traction: A.-G. BROWN, BOVERI & CIE [Electric drive for railway vehicles] 24,843/09; WINTERS [Combined trolley-wire hanger and circuit-breaker] 3,383/10; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Signalling] 3,982/10; DUDGEON [Trolley-wire insulators] 4,716/10.

Miscellaneous: EVERSHED, KILROY, and EVERSHED & VIGNOLES, LTD. [Motor-driven apparatus for the production of sound for signalling] 16,895/09; DIEMEL [Pocket igniter] 21.130/09; DIXON [Capstans] 24,249/09; ANDERSON and HOLMES [Fire-damp detector and indicator] 24,371/09; FAIRBURN-HART (*Electric Renovator Manufacturing Co.*) [Vacuum cleaning apparatus] 24,766/09; BLOCH [Burglar alarm] 2,824/10; DOBSON [Electrically-operated locks] 6,915/10; SIEMENS & HALSKE A.-G. [X-ray apparatus] 13,765/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution Systems, &c.: PETERSON [Manufacture of insulating material] 23,671/10.

Electrochemistry: BILLON-DAGUERRE [Sterilisation of liquids by ultra-violet rays] 24,025/10.

Instruments, &c.: BLONDEL [Photographic records of oscillographs, &c.] 22,576/10.

Miscellaneous: VIETTE [Bell call indicating apparatus] 18,678/10; FELTEN & GUILLEAUME-LAHMEYERWERKE A.-G. [Winches] 21,833/10; SANCHEZ [High-frequency apparatus] 24,143/10.

The following amended Specification can now be obtained.

JOHNSON AND PHILIPS and BROCKIE [Arc lamps] 15,287/09.

Application for Revocation

15,798/09. **Electric Block Signalling System.** J. D. TAYLOR. As a result of the application for the revocation of this patent (*see* ELECTRICAL ENGINEERING, February 10th, 1910, p. 100), the Comptroller has ordered an amendment to the specification. The patent is for an automatic block signalling system, in which electrically continuous rails are used.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

26,191 of November 19th, 1896. **Peat Fuel.** E. T. ZOHRAB. This specification describes a machine for pulping and moulding peat, and a process of drying and carbonising the blocks produced.

26,249 of November 20th, 1896. **Heating Apparatus.** H. J. DOWSING. This patent covers the combination of a glow-lamp with a special form of conical or angular reflector to throw the heat rays outwards. Arrangements of one or more such reflectors in heating or cooking apparatus are described.

26,251-3 of November 20th, 1896. **Electric Firing Device for Ordnance.** VICKERS, SONS & Co., A. T. DAWSON, and G. T. BUCKHAM. The first of these two patents relates to a combined electric and friction firing gear with safety devices; the second covers a construction for an electric primer.

26,616 of November 24th, 1896. **Reflectors.** S. O. COWPER-COLES and REFLECTOR SYNDICATE, LTD. Reflectors are manufactured by depositing electrolytically a backing of base metal upon a coating of silver applied to a mould of suitable form. A protective coating of palladium may be added. Certain details in the process, including the strengthening of the silver film before the electrolytic treatment, and a method of detaching the finished reflector from the mould, are also covered by the patent.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: O. WILHELMI [Protection of underground cables] 15,149/01.

Dynamos, &c.: A. RAKY [Electric winding-engines and pit-head gear] 16.416-8/04.

Incandescent Lamps: G. WEISSMANN [Capless lamps for glass-bead festoons] 16,391/02.

Instruments, &c.: W. HAMILTON and FERRANTI, LTD. [Meter counting trains] 15,498/05.

Telephony, &c.: G. E. SCHMIDMER [Telegraph wire coupling] 16,762/04.

Miscellaneous: A. BARR and W. STROUD [Electric signalling dial apparatus] 17,434/97; C. W. BLUEMEL and P. R. SELL [Electrically-controlled pneumatic and belt dispatch systems] 16,650/04; A. HEIN [Vacuum cleaner] 26,357/05.

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ELECTRICAL TESTING OF WATER

AN electrical apparatus, designed by Messrs. Digby and Biggs, for the testing of water has been introduced by Evershed and Vignoles, Ltd. (Acton Lane Works, Chiswick, London). It is founded on the principle (explained in an original communication to the Institution of Electrical Engineers by Mr. W. Pollard-Digby and abstracted in ELECTRICAL ENGINEERING of July 21st, 1910, p. 478) that the conductivity of water is a good indication of the degree of hardness.

The apparatus consists of a glass U-tube, the bend of which is connected with a drain-pipe of rubber closed by a pinch-cock, and to a third vertical tube ending in a funnel for filling. An electrode consisting of a ring of platinum strip is fixed at the top of each arm of the U-tube. The tube, after being washed out, is filled with the water to be tested, and the electrodes are connected by a twin-flexible and plug to a sealed box containing a direct-reading conductivity meter and a D.C. hand-driven generator. The latter combination is similar in many respects to the well-known Evershed "Megger" for insulating testing; the dynamo generates at 100 volts, when the speed of turning is such that the clutch is felt to slip, and the meter then reads direct in conductivity units (the reciprocal of megohms). By giving the electrodes a large surface and using a long tube, variations in conductivity due to gas bubbles on the electrodes has been practically eliminated. The back E.M.F. of polarisation (about 2 volts) is allowed for in making the scale. As the conductivity varies with the temperature, this is measured, and the reading corrected by means of a table. A chemical analysis is necessary in the first case to determine the nature of the impurities in the water, as this apparatus does not discriminate between the different dissolved substances. It indicates and measures as a percentage any change in hardness, however, showing what alterations are required in the softening process. The actual degree of hardness in grains per gallon may be deduced at any time from a curve which is plotted at the time the chemical analysis is made. Various uses of the apparatus were described in the article referred to above. One important application is for the testing of surface condensers. As any leakage of the cooling water (which generally contains dissolved matter) into the condenser increases the conductivity of the hot-well water, a test on the latter will indicate the slightest leak. Taking the conductivity of distilled water at 2, the addition of 1 per cent. of London tap water will raise it to 7, while 1 per cent. of sea water will raise it to 620. Boiler priming is detected in a similar manner. We understand that Messrs. Evershed and Vignoles will send to any of our readers on application an illustrated booklet describing this apparatus and its use.

THE ELECTROBUS COMPANY AND ITS BATTERIES

THE action by Mr. C. A. Gould, of the Gould Storage Battery Company of America, against Dr. E. H. Lehwess in respect of a contract for the supply of batteries for the London Electrobus Co., was continued before Mr. Justice Ridley and a special jury in the King's Bench Division on Wednesday, Thursday, and Friday last week. In our last issue we dealt with the case for Mr. Gould. On Wednesday further evidence was given to show that whilst the Electrobus Co. officials refused to allow the official tests of the batteries, as provided for in the agreement between Mr. Gould and Dr. Lehwess, to be carried out, what were termed secret tests were made by the representative of Mr. Gould in this country, with the result that one battery lasted for four hours 15 minutes, at a discharge rate of 80 amperes, which was better than the test provided for in the agreement. Evidence was also called to show that the batteries had been sold for old metal, and that the London Electrobus Co. had received a cheque for about £100 in this connection.

Mr. Duke, K.C., addressed the Court on behalf of Dr. Lehwess, arguing that there had been no fraud on his part, as the whole question turned upon the construction of the agreement, which Dr. Lehwess had read differently from Mr. Gould. He urged that Dr. Lehwess had not made a penny out of the transaction, and, indeed, had lost two years' work upon the scheme, and had been put to considerable expense. With regard to the point that a cash capital of £25,000 was to be provided, Mr. Duke remarked that this could hardly have been in Mr. Gould's mind, as he himself was to receive £13,750 in fully-paid shares, and it could not be said that Dr. Lehwess was going to pay this amount of cash into the Gould Storage Battery Co. after he had already refused to buy the Gould English patents for £10,000. He argued that there was no evidence that Dr. Lehwess had prevented the tests from being carried out, but that, in fact, the batteries were never in a condition to pass the tests prescribed in the agreement.

Dr. Lehwess gave evidence to the same effect, and stated his impression that in America the term "cash" capital meant "nominal" capital. He admitted that the Asiatic Banking Corporation, to which he had allotted 21,000 shares, was a sham company altogether, but that he had used it as a nominee in order to transfer the 13,750 shares to Mr. Gould.

At the end of Dr. Lehwess's cross-examination the jury handed up a note to the judge intimating that they had heard sufficient of Dr. Lehwess's case in defence, and as a result the parties conferred and came to an agreement by which Mr. Gould was paid.

RAILLESS ELECTRIC TRACTION AT LEEDS

WE understand that considerable progress has been made in the scheme for running trolley-omnibuses in Leeds, in accordance with the powers recently acquired by the Corporation. The route over which powers have been obtained is about four miles in length. On about a mile of that a tramway is already in operation, and the railless vehicles will use the ordinary trolley wires for the positive current, and additional wires, one on each side, will be put up for the negative return. This part of the overhead equipment is by side poles and bracket arms, and the same method will be continued along the new part of the route. The number of vehicles with which a start will be made is four, and contracts for the complete vehicles have been placed with the Railless Electric Traction Co., 56 Moorgate Street, E.C. The body will have a single deck with 28 seats on cross benches. As the route is very thinly populated, and the traffic will be light, it is anticipated that it will not be necessary to employ a conductor, and therefore the entrance and exit is alongside the motorman. We are unable to give, at this stage, any particulars of the electrical equipment of the cars, other than they will be driven by two motors, and will embody several improvements on the earlier designs of the company.

LINKING UP THE LONDON ELECTRICITY WORKS

GOOD progress is being made by the Joint Committee of London Borough Councils and Companies, which was formed immediately after the passing of the London Electric Supply Act of 1908, to prepare some proposals for linking up the whole of the electricity works in London. The Committee of Investigation which was appointed presented a preliminary report, in which recommendations were made that there should be uniformity in the systems of linking up; that a pressure of 10,000 volts, three-phase, 50 periods, should be employed for the ring mains: and that there should be an agreed unit of converting plant, namely 500 kilowatts, which could be used singly or two or more in parallel, as circumstances might demand. The result of this preliminary report was the appointment of a consultative committee of twelve members, six representing borough councils, and six companies. We now understand that a report has been drawn up by the engineers on both sides, which has been under consideration by the Consultative Committee, and that the latter will shortly issue a report upon the whole question.

THE G.B. SYSTEM IN THE MILE END ROAD

AN action was commenced in the King's Bench Division on Tuesday, before Mr. Justice Ridley and a special jury, in which Mr. William Griffiths, as owner of the G.B. surface-contact traction patents, sued Sir John Benn for libel in respect of certain statements made by him relating to the G.B. surface-contact system.

Mr. F. E. Smith, K.C., M.P., said that the action was for libel, slander, and disparaging statements, the defence being that they were made on privileged occasions, that they were statements of fact, true, and in so far as they were expressions of opinion, they were fair comment made *bona fide* without malice. But the plea of justification was not made. Counsel's opening statement on behalf of Mr. Griffiths dealt in great detail with the circumstances of the experiment by the London County Council with the G.B. surface-contact system in the Mile End Road. Owing to the fact that the London County Council insisted upon the contract with the G.B. Surface-Contact Co. being in terms of a licence to use the system on payment of a royalty, the G.B. Company had taken no part in the laying down of the system, nor its working. He alleged that the officials of the London County

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Council who were responsible for this had no knowledge of the system, and that they were the cause of its complete failure, for which the G.B. Company had had to suffer. The libels complained of were contained in letters and articles in the Press and public speeches, all bearing directly upon the experiments with the G.B. system in the Mile End Road. Among the statements complained of were "stud tramway fiasco"; "the system is described as the G.B. system, but its label should be really 'Moderate'"; "jerry-built tramways"; "live stud system"; "let us have an efficient system"; "company considerations prevailed"; "start ripping up this mischievous and impossible system"; "a system which all competent experts have declared entirely unsuited to London." All these and a number of other extracts from further speeches and articles by Sir John Benn were alleged to be highly damaging to the prospects of the G.B. Surface-Contact Co., and that, in fact, the company had been absolutely ruined as a result. No corporation now, said Mr. Smith, would think of looking at the system, and negotiations with regard to putting it down in Paris, Oxford, Folkestone, and elsewhere had fallen through. Indeed, the company had not thought it worth while to keep up the foreign patents. The complaint was that the system which was condemned by the London County Council was not the G.B. system at all, inasmuch as the company were refused all along any share in its construction or maintenance; and had Sir John Benn stated that the system, as modified by the London County Council's officials and put down in the Mile End Road, was inefficient, there would not have been so much cause for complaint, but throughout all his statements he was specifically referring to the G.B. system, and cared not whether he ruined the owners of the patents or not, as long as he was able to score a point off his political opponents.

After having mentioned that the system has been working with perfect success at Lincoln for five years, and that the Board of Trade have granted the first permanent certificate for it there, Mr. Smith dealt in detail with the manner in which the system had been modified by Mr. Maurice Fitzmaurice, the County Council's chief engineer, and Mr. Fell, the chief officer of the tramways, in spite of continual protests by the inventors that a failure would inevitably result. The equipment of the cars was carried out by the Tramways Department of the London County Council, and the fact that the London County Council reduced the amount of the royalty payable from £800 to £500 per mile, on the ground that their staff would not require any technical assistance from the company, was an endeavour to get something for nothing. The access boxes were so designed that gas, water, and mud found their way into them, and explosions resulted, as well as short-circuits. Instead of, as at Lincoln, having a water-tight system, as much as a bucket of water a month was taken out of the sump-pits; instead of having a closed conduit system for carrying the conductor, connections were made between the underground conduit and the sewers, which allowed more gas to accumulate; the Roots blower for ventilation in use at Lincoln was dispensed with, and as a substitute, on the day of the first trial, the tramway staff appeared on the scene with a vacuum cleaner. Similarly, Mr. Fitzmaurice had re-designed the stud, and Mr. Fell the car equipment. The correspondence showed that from the very beginning the G.B. Surface-Contact Co. were dissatisfied with both the road equipment and the car equipment, and were repeatedly calling the attention of the County Council to the matter. Another detail mentioned was that insulators were placed near pieces of special track work where fractures were unavoidable, and in positions against which the County Council officials had been warned. Unsatisfactory working was the inevitable result, and as a consequence the company had offered to put the whole thing in order at their own expense. Sir John Benn, continued Mr. Smith, had made the statement that the system had been condemned by all experts at a time when he knew the contents of Mr. Mordey's report that the system could be made easily workable by a few minor alterations. As a matter of fact, he said, Sir John Benn, though criticising the system in the manner he had, knew no more about it than he did of the mineral resources of Timbuctoo. Mr. Smith described Sir John Benn's statements as "absolute falsehoods," "flagrantly unfair," and "unworthy sneers," all made in the venomous and bitter atmosphere of political party criticism. Mr. Smith occupied the whole of Tuesday and a portion of Wednesday in his opening speech.

LOCAL NOTES

Acton: *Electricity Works Transferred.*—In connection with the proposal to transfer the electricity works to the Metropolitan Electric Supply Co., it was decided by 11 votes to 10 at a special meeting of the Council last week to take a referendum of the ratepayers in question, as there seems great difference of opinion on this matter.

Belfast: *Wiremen and Jointers.*—The Electrical Trade Union have sent the City Electrical Engineer a list of rules which they wish applied to jointers as well as wiremen. As these do not conform with the requirements of the Electrical Department, the Committee have decided not to adopt them. The difficulty is chiefly in connection with wages, and this matter the Committee deal with at no other time than January or February each year.

Bognor: *Electric Lighting.*—The Council have decided to apply for an electric lighting provisional order.

Bournemouth: *Tramways.*—The Board of Trade have approved the plans of the proposed change of tramways from the conduit to the overhead system.

Burnley: *Tramway Speed.*—The Board of Trade have refused to increase the speed of the tramcars in Brierfield from 12 to 16 miles per hour.

Canada: *Toronto: Overhead Mains.*—The Toronto Electric Light Co. have applied for an injunction to restrain the engineers of the City Electric Light Co. from placing their electric power mains and poles in dangerous proximitiy to those of the Company.

Dunfermline: *Electric Lighting.*—An agreement transferring the Council's Provisional Order to the Fife Electric Power Co. has been completed. It provides for the re-transfer of the Order to the Council at the end of thirty years.

Friern Barnet: *Electric Lighting.*—The Council have consented to the Finchley Council applying for an order under the Electric Lighting Act, 1909, to supply electricity in Friern Barnet.

Golborne: *Electric Lighting.*—A Sub-Committee of the Council is at present negotiating with the Lancashire Electric Power Co. with regard to electric supply.

Kendal: *Overhead Wires.*—An application has been made to the Board of Trade by the Corporation for consent to erect a number of overhead wires for transmitting electrical energy at a pressure of 440 volts.

Lisbon: *Tramway Strike.*—The electric tramways in Lisbon have ceased running owing to a strike of the power-house staff.

Liverpool: *Damages for Tramway Accident.*—At the Liverpool Assizes last week damages to the amount of £400 were awarded against the Liverpool Corporation in respect of an accident to a Miss Marshall, who was injured through colliding with one of the Corporation tramcars whilst she was riding a bicycle. The evidence showed that the driver of the car was travelling at an excessive speed.

Llanelly: *Electric Lighting and Tramways.*—The Llanelly & District Electric Traction Co. expect to have the streets lighted by December 14th or 15th, and the tramways running by April.

London: *Kensington: Tramways.*—The Council have decided to consent to the proposed tramway by the London County Council through the northern part of the borough, linking up the lines in Wood Lane and Harrow Road.

Marylebone: Street Lighting.—The Lighting Committee report that a further 89 additional street lamps have been converted from gas to electricity, making a total of 3,459 public street lamps now lit by electricity.

Manchester: *Charges for Power Supply.*—At a Local Government Board inquiry last week concerning a loan of £30,000 for a new turbo-alternator at the Stuart Street power house, the Manchester Ratepayers Association opposed the loan in order to ventilate a grievance they think they have against the policy of the Electricity Committee in regard to its charges for power supply. They also complained that the Tramways Committee should be charged more than cost price for their electricity, and that larger sums should be placed to depreciation and reserve. The suggestion was also made that the Electricity Department was "slowly murdering" the Gas Department, as the Gas Department paid more in relief of rates each year than the Electricity Department. Mr. S. L. Pearce, the City Electrical Engineer, refused to disclose prices charged to certain large consumers, for the reason that it would be to the disadvantage of the Department to do so. He denied that there was any loss upon these contracts, and said there was a slight profit directly, in indirect profit, in the abatement of the smoke nuisance.

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Dealing with the contentions of the Ratepayers Association, the Town Clerk pointed out that the Electricity Department had never drawn one penny from the rates, but, on the other hand, £86,480 had been paid in relief of rates.

Portrush: *Electric Lighting.*—Having considered the report of Messrs. Miller, Wilson & Pegg with regard to electric lighting, the Council have decided to apply for a Provisional Order.

St. Anne's-on-Sea: *Electricity Accounts.*—The accounts of the electricity undertaking for the year to March 31st shows a net surplus of £1,243, of which £1,000 has been transferred to relief of rates, and the balance placed to reserve.

Stanley: *Electric Lighting Order Revoked.*—The Board of Trade have revoked the electric lighting order granted to the Council in 1902.

Torquay: *Tramways.*—A conference took place in London last week between the representatives of the Council and the Tramways Company to discuss various points of difference in relation to the conversion of the tramways to the overhead system, and according to a statement given out afterwards, an amicable settlement has been arrived at. It is also understood that the Tramway Company have agreed to pay the greater portion of the arbitration costs.

West Hartlepool: *Tramway Purchase.*—The Council have at last definitely decided to purchase the local tramway company. The company had made a proposal that their powers should be extended for a further term of 42 years, and the notice to purchase withdrawn by the Corporation. These terms, however, were not accepted.

Worcester: *Municipal Wiring.*—The Electricity Committee have received a further deputation from electrical contractors in the city, and have discussed the proposed Sales Department of the electricity undertaking. The contractors distinctly refuse to recognise any form of trading whatsoever by the Electricity Committee, and the Committee discussed at their last meeting a proposal that the Department should pass on to local contractors or to manufacturers of heating and cooking apparatus and motors any orders they may obtain. It was also decided upon that the Department is not to undertake the sale of fittings or lamps or the wiring of houses, and that the Council are not to be liable for the price of goods sold. When a resolution to this effect was put, it was carried by the casting vote of the Chairman.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Barnes.—The Electrical Engineer recommends the installation of an additional 750-kw. generating set.

Baroda.—A scheme is on foot for the conversion of the Baroda horse tramways to electric traction.

Birkenhead.—An inquiry was held last week concerning a loan of £2,000 for a turbo-generating set. The inquiry was adjourned for certain particulars to be furnished to the inspector.

Dunoon.—The proposals of a company to construct tramways in the town are being received favourably by the Council, who are inclined to erect a power station for supplying the necessary electrical energy.

Hastings.—Application is to be made for a loan of £2,083 for mains.

Ireland.—A scheme for the electric lighting of Dromore has been prepared by Messrs. Miller, Wilson & Pegg.

Messrs. Wilkins & Burden, Consulting Engineers, of Dublin, propose to erect a generating station and to use overhead wires in Ballymoney.

The same firm of consulting engineers have placed a similar proposal before the Enniskillen Council.

Llandudno.—A Local Government Board inquiry was held last week concerning a loan of £2,322 for mains and services. On the suggestion of the Inspector, Mr. H. R. Hooper, it was decided to purchase services out of revenue and to reduce the loan by £256.

Londonderry.—Extensions of the generating station to the extent of £9,000 are contemplated.

Manchester.—A Local Government Board inquiry was held last week concerning a loan of £30,000 for a turbo-alternator at the Stuart Street works.

Netherlands.—A Commission has been formed, says the *Board of Trade Journal*, under the presidency of Mr. J. E. Schalten, with the object of constructing a central electric generating station for the provinces of Groningen, Drente, and Overijssel.

Russia.—From a Parisian source the *Board of Trade Journal* states that the municipality of Tiflis will shortly invite tenders for the erection of a power house.

South Africa.—The Queenstown (Cape Province) Municipality are proposing to instal electrical plant.

Venezuela.—An electric power house is to be erected in connection with a Custom House at Ciudad, Bolivar, and the *Board of Trade Journal* announces that the name and address of the main contractor for the harbour works is on file at 73 Basinghall Street, London.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Cinematograph Hall, Coldharbour Lane, Brixton.

Proposed Oriental Theatre, 226 Commercial Road, E.

Empire Picture Palace, 225 Streatham High Road.

New drill hall in Old Deer Park, Richmond. Territorial Force Association.

Extension of Queen Alexandra wing at British Home for Incurables, Crown Lane, Streatham.

New building for nurses at the Infirmary, Southwark.

Concert hall at 133 Commercial Road, E.

Music-hall in Euston Road, N.W.

Cinematograph theatre, 17 Highgate Hill, N.

PROVINCES.

Aberdeen.—Children's hospital.

Accrington.—Extension of Messrs. Higham's mill. Architect, H. Ross, 15 Cannon Street, Accrington.

Airdrie.—New Town Hall.

Altrincham.—Twelve houses. The Council.

Bath.—Electric theatre in Southgate Street.

Blackpool.—Additions to Grand, South Shore, and Victoria Hotels.

Extensive reconstruction of Winter Gardens and H.M. Opera House.

Blyth.—New secondary school. Clerk to Governors, Bridge Street.

Bolton.—New Church Schools.

Bournemouth.—Rebuilding of Victoria Hotel. Architect, Mr. H. Hawker, St. Peter's Chambers.

Bridlington.—Purchase of People's Palace for conversion to Town Hall.

Chislehurst.—Cinematograph theatre.

Christchurch.—Infirmary. Builders, Messrs. Jones & Seward.

Clydebank.—Offices, &c., at Messrs. John Brown & Co.'s works.

Coventry.—New municipal buildings and Town Hall.

Dalkeith.—Drill Hall. Midlothian Territorial Force Association.

Darlington.—Extensions to Infectious Diseases Hospital.

Proposed sanatorium for consumptives.

Deal.—New Salvation Army hall.

Dundee.—Warehouse in Don's Road.—Alterations to Hawkhill School.—Installation of electric lighting at King's Cross Hospital.

Dunfermline.—Aerated water factory in Townhill Road.

Edinburgh.—Building in Northfield Avenue for J. MacFarlane & Co. Architect, J. I. Adams, 34 St. Andrew's Square.

Falmouth.—Pavilion in Gyllyndune Gardens. Town Clerk.

Ilkeston.—New Secondary School.

Keighley.—Extensions to Nurses' Home.—Also alterations at Workhouse Infirmary.

Kettering.—All Saints' Church.

Kilmarnock.—Extension to Messrs. Glenfield & Kennedy's Works. Alterations at factory of Saxone Shoe Co.

Lanark.—School in Wishaw Road.

Lancashire.—Proposed mill at Great Harwood. Mutual Mill Building Co., Windsor Road.

Leeds.—Rebuilding of Corporation gas premises, Meadow Lane.

Lincoln.—Extension of Monk's Road School.

OSRAM·LAMPS

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Llanelly.—Proposed theatre.
Londonderry.—Rebuilding of Guild Hall.
Manchester.—Sanatorium for consumptives. South Manchester Guardians.
Middlesbrough.—Alterations and extensions to Linthorpe School.
Morley.—Offices and workshops at Messrs. Ackroyd & Best's works.
Neath.—Proposed school on the Eagle's Bush Estate.
Newport (Mon.).—Proposed Primitive Methodist Church.
Newton Abbot.—Drill Hall for St. John Ambulance Corps.
Oswestry.—New Welsh Church.
Plymouth.—Barracks at Millbay for Territorial Force Association. Architect, F. A. Clark, 83 Old Town Street.
Poole.—New school in South Road.
Reading.—New police station, sessions house, &c.
Rochester.—Two shops and dwelling-houses in High Street. Trustee of Richard Watt's Charity.
Scarborough.—Extensions to sanatorium.
Stafford.—Council school at New Chapel.
Stirling.—New municipal buildings.
Stockport.—New church at Great Moor.
Stockton.—School in Yarm Road.
Truro.—New mill at Malpas Road. Architect, Mr. A. J. Cornelius.
Woking.—Proposed workmen's home.
Wolverhampton.—Extensions and alterations to Royal Orphanage. Architect, F. T. Beck, Wulfrun Chambers, Darlington Street.

MISCELLANEOUS

Australia: The *Board of Trade Journal* states that tenders are invited by the Deputy Postmaster General at Melbourne on December 6th for cable-testing instruments and 6,000 jacks. Tenders are also invited by the Deputy Postmaster General at Adelaide until December 29th for the supply of line material, telephone and telegraph instruments, also telephone cable. The Deputy Postmaster General at Sydney invited tenders by January 4th for three multiple magneto switchboards. Copies of Specifications, &c., may be had at 72 Victoria Street, London, S.W., or 73 Basinghall Street, London, E.C.

Calcutta.—The Calcutta Electric Supply Corporation require tenders to their London office by December 1st for overhead electric and hand cranes.

Chili.—The Chamber of Deputies, according to a Reuter message, has requested the Minister of Public Works to give preferential treatment to the Bill for converting the railway between Santiago and Valparaiso and of the Andes branch to electric traction.

Japan.—Large extensions of the telegraph and telephone systems in Korea are contemplated. A new submarine cable is also to be laid at an estimated cost of £65,000.

The Japanese Railway Board, says the *Board of Trade Journal*, have decided to lay down a narrow-gauge electric railway alongside the railway track from Yokohama to Tokio.

South Bank.—The Cleveland & Durham Electric Power Co. have asked for the Council's sanction to carry out street lighting by means of overhead wires.

Sand Fire-extinguishing Equipment.—A sand fire-extinguishing equipment has recently been supplied by Messrs. Merryweather & Sons, of Greenwich, to a prominent London electric light company for the protection of their power station. It comprises a three-wheeled galvanised sheet steel sand-truck, and holding about 6 cwt. The sand can be taken from the top, hinged covers being provided to open from either end, or it can be shovelled into a bucket from the side, in which a sliding-panel is fitted. When the sliding-panel is raised, a peg is inserted in a hole in the side of the truck to prevent the panel from dropping down. A fibre bucket is carried on a bracket at the back, and two strong wooden spades are supported on suitable iron brackets at the side. In another form, the sand-bin is of larger capacity (holding about 8 cwt. of sand), and mounted on legs instead of wheels. It is equipped with two fibre buckets and two spades, and has a hinged cover at the top and a sliding-panel at the side.



TENDERS RECEIVED AND ACCEPTED

Australia: *Sydney.*—The tender of the British Insulated & Helsby Cables, Ltd., at £10,610, has been accepted for the supply and laying of low-tension cables. The tender of the Standard Waygood Co. for alterations to lifts in the Town Hall and Queen Victoria markets has also been accepted. Two additional D.-C. feeder panels are to be ordered from the Australian General Electric Co., Ltd., at £816, erection costing an additional £78.

Blackburn.—The Board of Guardians have accepted the tender of Mr. H. Garstang, of Darwen Street, for an installation of private telephones.

Crompton.—Messrs. Edmundson's Electricity Corporation have received the contract for the electrical equipment of the sewage works.

London: *County Council.*—The tender of the British Westinghouse Co. for the supply and erection of standard-type controllers, electrical interlocking gear, and additional cables for a hundred double-deck cars, is recommended for acceptance at £6,490. The tender of Messrs. Matthews & Yates for the supply of cooling fans and filter frames for the fitting two turbo-generators at the Greenwich power house has been accepted at £374.

South Africa.—The tender of Messrs. Reunert & Lenz for £5,608 for additional machinery at the Randfontein Municipal Power Station has been accepted.

Wigan.—The following tenders have been received for the supply of two electrically-driven centrifugal pumps at the Boar's Head pumping station:—Worthington Pump Co., £439; Tangyes, Ltd., £414; Drysdale & Co., Ltd., £[illegible]; Holden & Brooke, Ltd., £468; G. Mills & Co., Ltd., £[illegible]; E. Scott & Mountain, Ltd., £425; Rees Roturbo Co., Ltd. (accepted), £389; Johnson Bros., £405 and 461; Tickle Bros., £417, £455, £437, and £462; Pulsometer Engineering Co., £377; Corlett Electrical Engineering Co., £377; and I. Stott & Sons, Ltd., £530.

The D.P. Battery Co. (Bakewell) have, during the [illegible] month, shipped two batteries to the Transvaal and one [illegible] to India, Siam, Queensland, Newfoundland, and Canada. They have also recently completed the replating of an [illegible] make of battery at the Charlotte Street sub-station of the Chelsea Electric Supply Co.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night was £59 15s. to £60 per ton (last week £60 to £60 5s.).

Motor Converters.—We referred briefly in our issue of October 20th (page 673) to a large order for motor converters for the Calcutta Electric Supply Corporation, which has been placed with Messrs. Bruce Peebles & Co. The order is for 16 Peebles motor converters (La Cour patents), each of 475 kw., running at 500 r.p.m., to convert from 6,000 to 6,600 volts, 3 phase, 50 cycles, to 450/550 volts continuous, or *vice versâ*, and they will supply a three-wire network. The tenders were originally invited for induction and synchronous motor generators, with permission to quote for rotary converters or motor converters as alternatives. The order was finally placed for motor converters at £25,000, a price little less than some of the offers for motor generators and rotary converters, on the advice of the Consulting Engineers, Messrs. Kennedy & Jenkin.

The I.E.E. Premiums.—We are informed that all the instruments presented as premiums at the Institution of Electrical Engineers on Thursday were made by Mr. R. W. Paul, Newton Avenue Works, New Southgate, London.

Plant for Sale.—The Edmonton Board of Guardians have for sale two 30-kw. generating sets, a 15-kw. D.C. dynamo, switchboard and instruments, 4 tons of battery plates and 100 cells, counter shafting, bells, arc lamps, 18-inch fans, &c. Particulars from Messrs. May & Hawes, Caxton House, Westminster, London. (See an advertisement on another page.)

Moncrieff, P. Ford & Co.—This firm has opened offices at 57 Colmore Row, Birmingham. In addition to handling their own specialities in engineers' small tools and hardening furnaces, they will specialise in gauges, micrometers, and temperature measuring apparatus. Mr. Ford was recently sales manager to Mr. S. N. Brayshaw (Manchester), and was at one time managing director of the Brooke Tool Manufacturing Co. (Birmingham).

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APPOINTMENTS AND PERSONAL NOTES

Mr. J. P. Simpson has been elected secretary of the Newcastle branch of the Association of Mining Electrical Engineers, in place of Mr. H. J. Fisher, who has resigned.

Sir Charles Petrie has been re-appointed Chairman of the Liverpool Tramways & Electric Power Committee.

At a smoking concert of the Faraday House Old Students' Association next Friday, a presentation will be made to Mr. H. Foulds, late hon. sec. of the Association.

The Municipal Wiring Bill.—A Conference was held last Thursday between representatives of the Incorporated Municipal Electrical Association and the Electrical Contractors' Association (Incorporated). This Conference was held at the suggestion of the latter Association, with a view to seeing if a settlement could be arrived at of the disagreement of which the Municipal Wiring Bill is the outcome. The I.M.E.A. were represented by Mr. J. Christie (President), Mr. H. Faraday Proctor (Honorary Secretary), Alderman Pearson (Bristol) (Honorary Solicitor), Mr. A. H. Seabrook, and Mr. A. C. Cramb. The Electrical Contractors' Association were represented by Mr. Harland Bowden (President), Mr. Leonard G. Tate (Secretary), Mr. R. Tweedy Smith (Honorary Solicitor), Mr. J. McDermott (Past President) of Manchester, and Mr. Thomas Wright (Past President) of Glasgow. We are informed that the preliminaries were considered satisfactory to both sides, and the Conference was adjourned until December 8th.—In the meantime meetings are being held at various centres, at some of which the President and Secretary of the Electrical Contractors' Association attend, with the purpose of increasing the "fighting fund." We understand that guarantees amounting to nearly £2,000 have already been received. So far, about two-thirds of the country has been covered in this way, but Yorkshire and Newcastle have yet to be dealt with.

"The Central."—The October number of the magazine of the Old Students' Association of the City and Guilds of London Central Technical College opens with an article on Steel-making, by Professor H. C. Armstrong. Other miscellaneous subjects treated are rainfall, boiler management, and bird's-nest photography; an account is also given of the proceedings of the Engineering Section of the meeting of the British Association at Sheffield. Notes on the doings of old students of the College are also given, and reviews of a number of technical books are included. An excellent portrait of Professor W. J. Pope, F.R.S., forms the frontispiece.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Anglo-Portuguese Telephone Co.—Interim dividend at the rate of 3 per cent. per annum on ordinary shares.

British Insulated & Helsby Cables.—Subscriptions have been invited during the week for an issue of £200,000 of 5 per cent. mortgage debenture stock at par. The new stock is part of an authorised total of £500,000, and will be redeemable in 1925 at par, but the right is reserved to pay off the issue at any time after 1915 at a premium of 2½ per cent.

Robertson Electric Lamps.—A scheme for the reduction of the nominal capital of this company from £100,000 in 10,000 shares of £10 each to the value of £3 10s. each was sanctioned by Mr. Justice Neville in the Chancery Division last week. By this means, £43,875 will be returned to the shareholders. It was pointed out that the company has been an exceedingly prosperous one, and that the resolutions for the reduction have been unanimously passed and confirmed.

Craigpark Electric Cable Co.—Interim dividend on 6 per cent. preference shares for the half-year to September 30th.

Cleveland & Durham Electric Power Co.—At a special meeting on Monday resolutions for reducing the capital from £1,000,000 to £700,000 were passed.

Electricity and Fogs.—During the course of a lecture upon the electrification of crops at the Midland Institute on Monday, Sir Oliver Lodge said that if the Government would encourage universities in research and were wise enough to provide £100,000 a year for purposes of experiments, he would apply electricity not only to accelerating plant growth, but to the influence of weather, and the dispersal of fogs at harbour stations. He would not undertake to deal with town fogs, which, in his opinion, ought never be produced. But there were fogs over harbours which would be much better for electrical treatment.

Telegraph Traffic.—Telegraphic communication between Rome and Constantinople was restored on the 9th inst., and on the 11th inst. the cable between Bonny and Duala was also repaired. On the 12th inst. the Indo-European Telegraph Co.'s lines were interrupted between Berlin and Emden for a short while, and another part of the company's system between Odessa and Kertch failed on the 14th inst. The *via* Fao and Hanekin routes were down between Adana Alep and Angora Diarbekir on the same day, as well as the route *via* El Arich between Adana and Lattaguil. The two former routes were, however, restored on the 15th, leaving the last-mentioned line still interrupted.

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November, 1910.

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WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

NO. 204 [VOL. VI., NO. 47] THURSDAY, NOVEMBER 24, 1910. [PRICE ONE PENNY.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

OFFICIAL NOTICES and TECHNICAL COLLEGE ANNOUNCEMENTS are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

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SUMMARY

THE action for alleged libel against Sir John Benn by the G.B. Surface Contact Co. is still being heard in the King's Bench Division. Mr. B. H. Bedell was in the witness-box for four days, and detailed at great length the manner in which he alleged the officials of the L.C.C. Tramways Department altered his system, and so brought about its failure. He put the value of his patents at the time the London County Council took the system up at £100,000, but Mr. Griffiths, his co-proprietor in the patents, placed the figure at £250,000. Mr. Bedell said he was firm in the opinion that the Council's tramway staff were hostile to the use of the system. He also drew attention to the fact that when the Council placed half a mile of track in his hands for reconstruction after Mr. Mordey had reported, he adopted the system as laid down at Lincoln, and it worked perfectly satisfactorily. On Monday Mr. W. M. Mordey gave evidence, and said that he was unduly cautious in his first report on the system, and when he afterwards ran cars over the track reconstructed by Mr. Bedell, he obtained more satisfactory results than he had anticipated. A feature of the case has been the manner in which Mr. Justice Ridley has disagreed with the contention of Sir Edward Clarke that Sir John Benn's statements were comments upon the system as laid down in London, and not statements of fact in regard to the G.B. system wherever it was laid down. (Page 743.)

A LETTER from Mr. F. Broadbent calls attention to a method of connecting motor starters to allow a larger current to pass at starting than would blow the fuses on full load. (Page 744.)

FOLLOWING on last week's description of the Blackfriars generating station of the General Post Office, we give particulars of the sub-stations and the lighting and power supply in the different buildings. The new King Edward building is supplied with three-phase current for lighting, the load being balanced across the different phases. (Page 745.)

AN illustration is given of a lay-out of special points and crossings for a "car-fan" for Leeds, which is said to be the largest of its kind yet constructed in this country. (Page 747.)

THE electric clock under construction for the Royal Liver Building will be the largest electric clock in the world. (Page 748.)

AN article on aluminium *v.* copper cables for low-tension feeders and distributors reviews the whole question of the use of aluminium cables, comparing the cost of the cables themselves, describing experiments and tests on the best system of jointing, and giving particulars of the underground aluminium cables that are already being utilised in this country. (Page 749.)

SOME interesting information as to the difficulties met with in the electrical work in the Navy was given by Mr. C. H. Wordingham (Electrical Engineer-in-Chief to the Admiralty), in the course of an address to the students of the Institution of Electrical Engineers. (Page 751.)

WE give particulars of some of the Bills of electrical interest, of which notice has been given for the next session of Parliament. (Page 752.)

AMONG the specifications published by the Patent Office on Thursday last was one by L. Milne for a device to take the place of inspection boxes in conduit wiring systems. A hot-plate with the heating element enclosed between two metal plates is described by A. F. Berry. A patent by A. E. Angold relates to a method of relieving the abutment carbon in arc lamps of the stop pattern of the weight of the guiding parts. Three patents relating respectively to the manufacture of storage-battery plates, electric cranes, and wiring fittings, in which connections are made without cutting the cable, have been granted in spite of opposition. The grant of a patent to J. Keith for a roof ventilator for railway carriages is opposed. (Page 753.)

A MAJORITY of about 200 ratepayers are in favour of transferring the Acton electricity undertaking to the Metropolitan Electric Supply Co.—In consequence of

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the Board of Trade decision regarding a winter service, the Scarborough Tramways Co. threaten to abandon the undertaking.—Mr. W. W. Lackie has introduced a new system of charging in Glasgow, whereby current for heating, cooking, &c., may be taken off the lighting circuits.—There is considerable opposition to the proposal of the L.C.C. to abandon the tramways in Liverpool Road, Islington.—Gloucester Corporation have rejected the proposal of the Electricity Committee that they should accept orders for electrical apparatus, &c., and pass them on to contractors on a commission basis. (Page 754.)

ADDITIONAL generating machinery is to be installed at Greenock, Leek, and Lowestoft.—Rotherham Corporation require high-tension feeders, rotary transformers, switchgear, &c.; Wigan Corporation require low-tension cable; and Birmingham Corporation, 60 tramcars.—Tenders are invited for the working of tramways in Constantinople. (Page 754.)

The Committee for the Protection of Electrical Interests.—This Committee has decided to hold a general meeting to discuss the advisability of undertakers under the Electric Lighting Acts being empowered to wire premises and supply apparatus for the consumption of electrical energy, on loan, or otherwise, on Wednesday, December 7th, at 8 p.m. This meeting will be open to all members of the electrical industry, and those who would like to take part are invited to send in their names to the Hon. Secretary, Mr. R. Borlase Matthews, Bank Buildings, Kingsway, W.C. By courtesy of the Council, the meeting will be held in the lecture theatre of the Institution of Electrical Engineers, Victoria Embankment, E.C. In the unavoidable absence of the President, the chair will be taken by the Vice-President, Mr. Robert Hammond. Arrangements have been made for those who would like to dine together before the meeting to do so at Gatti's Restaurant in the Strand. The price of the dinner is 3s. 6d., but no tickets will be issued. It would, however, he a convenience if those who purpose dining would let the Hon. Secretary know of their intention to do so. As the dinner is, of course, informal, ordinary dress will be worn.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, NOVEMBER 24TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. "Street Lighting by Modern Electric Lamps," by Haydn T. Harrison.

FRIDAY, NOVEMBER 25TH.

Physical Society.

5 p.m. At Imperial College of Science. (1) "The Electric Stress at which Ionisation begins in Air," by Dr. A. Russell. (2) "Exhibition of a Surface Brightness Photometer," by J. S. Dow.

Faraday House Old Students' Association.

8.30 p.m. Smoking Concert at Holborn Restaurant.

SATURDAY, NOVEMBER 26TH.

Association of Mining Electrical Engineers.

3.30 p.m. Notts and Derbyshire Branch, at University College, Nottingham. (1) Presidential Address to be further discussed. (2) "Inspection and Repair of Electrical Plant Underground," by R. R. Smith.

5 p.m. Yorkshire Branch, at Royal Victoria Hotel, Sheffield. Continuation of discussion *re* Examinations.

5.30 p.m. Warwickshire Branch, at Imperial Hotel, Birmingham. Business same as Notts Branch.

6.30 p.m. Lancashire Branch, at Grand Hotel, Manchester. Paper by R. R. Smith, as above.

MONDAY, NOVEMBER 28TH.

Royal Society of Arts.

8 p.m. Cantor Lecture II., on "Industrial Pyrometry," by C. R. Darling.

TUESDAY, NOVEMBER 29TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology. "What's Wrong with the Electrical Industry, and How to Put it Right—on Paper," by H. A. Carney.

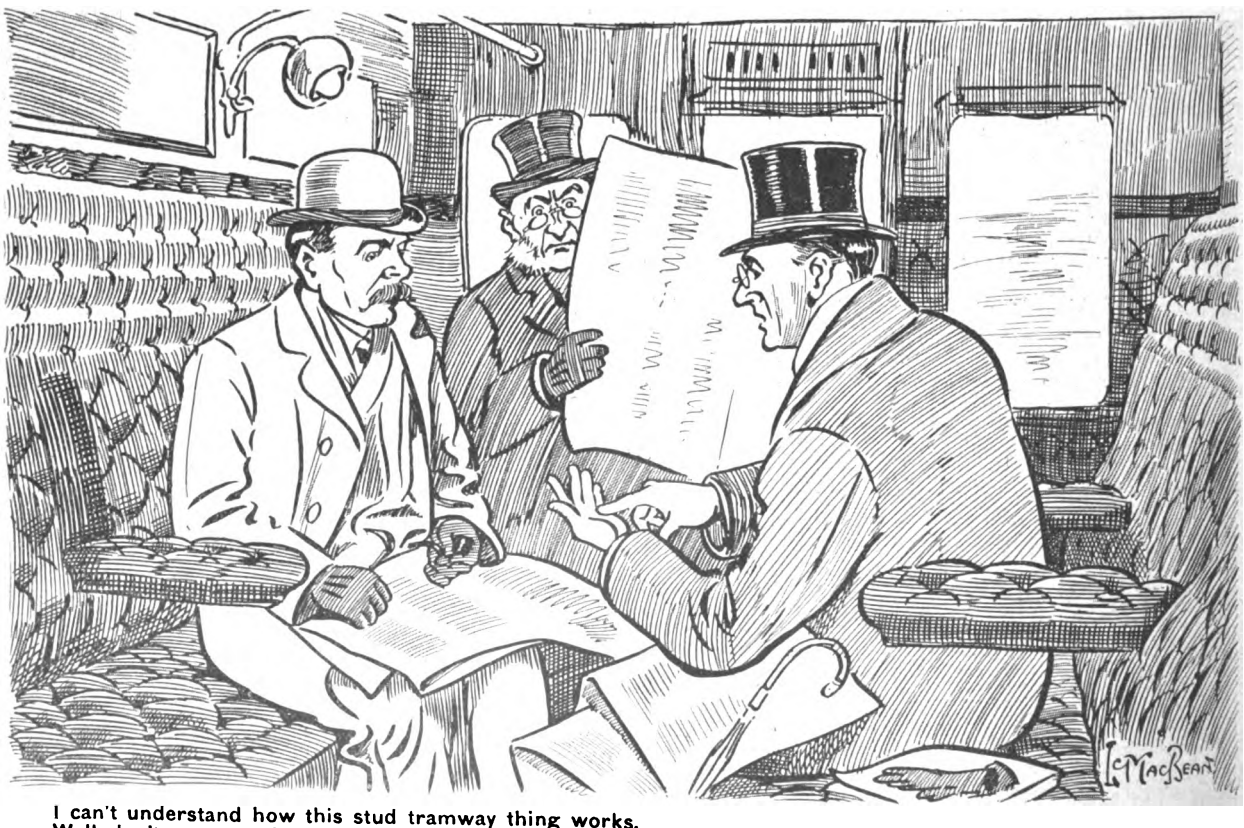
WEDNESDAY, NOVEMBER 30TH.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At Victoria Embankment. "Tramway Brakes and Brake Gear," by J. C. Rennie.

Wireless Telegraph Notes.—The Pacific Steam Navigation Co. have decided to fit all their mail steamers with a Marconi system.

The Spanish Government have signed a contract with Marconi's Wireless Telegraph Co. for the establishment of wireless telegraph stations in Madrid, Barcelona, Vigo, Cadiz, and the Canary Islands, among other places.



I can't understand how this stud tramway thing works.

Well, don't you see, when the car comes along this stud arrangement comes up and gives it a push and sends it on to the next; sort of jerks it along you know.

Yes, I see, but why do they call it the SURPLUS CONTRACT system?

Well, you see, they wouldn't let the inventors fix the things in the street themselves, but made a contract with some other Johnnies to do it, and they had to make another contract with the inventor Johnnies.

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THE G.B. SYSTEM IN THE MILE END ROAD

THE action by Messrs. Griffiths and Bedell against Sir John Benn for libel in respect of certain statements made by him relating to the G.B. surface contact system during the time the London County Council was experimenting with this in the Mile End Road, has continued daily before Mr. Justice Ridley since our last issue. In our last report we dealt with Mr. F. E. Smith's opening speech. At the close of this, some discussion took place as to the issues in the case, and eventually Mr. Justice Ridley ruled that, as Sir John Benn's statements were stated as facts and not as matters of opinion, it devolved upon him to prove that the system was an "inefficient" and a "mischievous and impossible one." If, continued the judge, a man said the system was a "jerry-built" one, he stated it as a fact and not as a comment.

Mr. Stanley Clegg, electrical engineer and tramways manager, Lincoln, was the first witness called, but Sir Edward Clarke, for Sir John Benn, objected to evidence as to the satisfactory working of the system at Lincoln. It was, he said, irrelevant as to what happened in the Mile End Road. Mr. Justice Ridley, however, over-ruled the objection on the ground that the system had been described as a "mischievous and impossible one," and it was evidence if it could be shown that it was not such a system. He disagreed with Sir Edward Clarke in saying that Sir John Benn's statements applied to the system as laid down in London. In his opinion, Sir John Benn referred in general terms to the system, and his speeches went to show that the system was of no use wherever it was put down.

Mr. Clegg, giving evidence, said that the guarantees in respect of the three miles of G.B. system at Lincoln were: (1) The total current consumption per car mile should not exceed 1·3375 units. During the first twelve months it was 1·2 units, and last year 1·07 units. (2) That the current to excite magnets on the cars should not exceed 580 watts. This was only 260 watts in the first year. (3) Not more than 18 studs per annum should be left "alive" on the road unrecorded. No such studs had remained. (4) The collection of current must be steady and judged by the car lighting. This guarantee has been quite fulfilled.

Continuing, he said there had been no accidents to persons, and only one horse had received a shock, and that was before the system was in operation. There had been no live studs at Lincoln through surface leakage, and in his opinion the system should have been quite suitable for London if laid down as at Lincoln.

Mr. B. H. Bedell went in detail through the negotiations with the London County Council, which led up to the arrangement that a licence was to be granted for the use of the patents on the basis of £500 per mile of single track for the first 30 miles, £250 per mile until the royalties reached £20,000, and £150 per mile afterwards. Thus, if the total length of 200 miles, as was suggested at one time, had been constructed, the royalties would have amounted to £42,500. The agreement with the County Council, however, gave the G.B. Company no voice as to the manner in which the system should be designed. Dealing with some of the details in which, from the beginning, the Company had expressed their dissatisfaction in regard to the design adopted by the London County Council Tramways Department, he said that the access boxes were not air-tight, and that they admitted gas and water, and further, that the necessary blower for ventilation had been omitted. In many cases the metal-work of the boxes was in contact with the tie-bars of the rails, resulting in short circuits. The lids were not packed properly, and trouble was caused by reason of their height in the roadway. The sump pits, instead of being galvanised iron tanks as at Lincoln, were concrete, thus admitting gas, and, but for his complaint just prior to the first trials, cars would have been run without the conduit having been ventilated, and gas explosions must inevitably have arisen. It was for this reason that the Vacuum Cleaner Company brought into use one of their cleaners to draw the gas out through the lids of the access boxes. The design of the resistance studs was defective owing to Mr. Fell having provided him with wrong information as to the necessary current for starting the cars. These were designed for 60 amperes, but it should have been 100 amperes. These resistance studs are placed at cross-over roads, and similar special points, in order to limit the short circuit current through the collector making contact with the stud-head and the rail. The cars were unable to start on these studs, and the current being left on, the resistance fused, the molten metal establishing a permanent short circuit.

After describing a suggested improved stud by Mr. Fitzmaurice as ridiculous, Mr. Bedell criticised the design of the car equipments. One of the most important things which he complained of was the reduction in size of the outer pole of the magnet in order that it should not affect the existing track brake gear, the portion cut away being replaced by a piece of gunmetal. All the alterations in the car equipments were made by the order of Mr. Fell. The safety breaker for detecting live studs had never worked efficiently, and the weakness in the car magnet tended to leave live studs, because the knock-off action did not take place. Later Mr. Fell substituted a two-magnet equipment, which, if anything, was weaker than the single magnet equipment with the gunmetal pole tip. In fact, he thought weak magnets were the chief cause of live studs during the trial runs. The energy used for exciting the magnets was about three times that required by the single magnet at Lincoln.

It was quite true that during the first trials of the system, 927 studs are recorded as "live," but, as a matter of fact, over 800 of them became dead by their own action within a few seconds of the car having passed over them. Difficulties had arisen through the magnet and collector on the car picking up pieces of scrap metal on the roadway, but this could easily have been avoided had the magnet been protected, but no effort was made to do this.

Coming to the period when Mr. Mordey was called in to report upon the system, Mr. Bedell said that practically none of Mr. Mordey's suggestions were adopted upon the half-mile of track which was then experimented with, the system being almost identical with that at Lincoln. The result was that Mr. Mordey confidently recommended the Council to equip the whole route in the same manner. When he came to overhaul the track, he found that the carbon brush in the stud was too near the cable, and in order to get over that it was necessary to pack up the stud heads. Entirely new equipments were put on the cars, and although two magnets were used it was found that the car ran up to a speed of over 20 miles per hour with a single magnet. The safety breaker was adjusted, and it never failed during this later experimental period. Similarly the arc killing devices—his own resistance device, and Mr. Mordey's condenser—worked perfectly satisfactorily, and no live studs were recorded whilst these were in use. The new collector which Mr. Mordey in his report referred to with satisfaction, was precisely the same as the one at Lincoln. It was whilst these trials were being made that the incident referred to by Mr. Smith of the track being salted arose. Mr. Bedell, Mr. Griffiths, and Mr. Hird were returning home at 4 o'clock in the morning after trials, at which members of the Highways Committee had been present, and noticed one of the County Council's salting carts depositing salt in two ridges on either side of the studs inside the rails. The driver of the cart stated that he had been doing that work for nearly a month, and the salt had only been applied on the experimental half mile. As a matter of fact, Mr. Mordey, on being informed of this, expressed his satisfaction, although he had not been officially informed that it was being done, as it had made the conditions abnormally severe and the system had come through the trial satisfactorily. Nevertheless, the Highways Committee recommended that the system should not be further experimented with. Finally, Mr. Bedell stated that when the system was taken up by the London County Council, he valued his patents at £100,000, but at present they were absolutely valueless.

Cross-examined by Sir Edward Clarke, Mr. Bedell expressed the opinion that the Council's officials were opposed to this system, and that, in order to prevent its success, they had altered it. Asked to name individuals in this connection, Mr. Bedell referred to the staff generally, but specially mentioned Messrs. Fitzmaurice, Fell, Horn, and Hunter as being opposed to the system. He further expressed the opinion that political considerations had influenced the Highways Committee in their recommendation to abandon the system.

During the cross-examination discussion arose as to the admissibility of the Highways Committee's reports, and their bearing on the case as affecting the alleged libels by Sir John Benn. Once again Mr. Justice Ridley disagreed with Sir Edward Clarke, and said that anyone reading the Highways Committee's final report recommending that the system should not be persevered with, would not think it was the same system as that referred to by Sir John Benn.

In further cross-examination, Mr. Bedell admitted that he had supplied the majority of the materials for the system

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as laid down by the London County Council, but they had all been supplied to the design of the Council's officials.

On Monday Sir Edward Clarke cross-examined Mr. Bedell at great length, both upon the technical details of the equipment and upon the alleged libels. He sought to show that the drawings for the access boxes, for instance, had been agreed to by Mr. Bedell, but correspondence was produced showing that they had been protested against. Sir Edward Clarke carried on this cross-examination in such detail and at such length, that eventually Mr. Justice Ridley expressed the opinion that it was carrying the matter no further, and that he was tired of it. Sir Edward Clarke then left the technical details for the moment, whilst Mr. Bedell went through the various statements, and pointed out what he considered to be unfair expressions and libellous statements, all of which were mentioned in the opening speech. The question of the design of the sump pits was then taken up, and Mr. Bedell insisted on saying that the arrangement for keeping them air-tight, used at Lincoln, was well known to the County Council's officials, but they would not adopt them. Further, the lids were not screwed down tight when they were first installed, with the result that the traffic stripped the threads of the screws.

Mr. Bedell's cross-examination was concluded on Tuesday. With reference to a patent which Mr. Mordey had taken out in connection with surface contact systems for an arc killing device, and which it was suggested was a material improvement on the G.B. system, Mr. Bedell said that it involved a principle which was already known to the G.B. Company, and that Mr. Mordey had offered to sell them this patent for £500. It was suggested, however, that if the patent were used by the Company, a royalty should be paid. Cross-examined as to the negotiations with the various Corporations already mentioned, he said that in every case they had fallen off after the first libels were published. At York, for instance, the councillors seemed convinced that there must be some truth in the statements, and it was only Mr. Hame, the City Electrical Engineer, who, as an engineer, understood the matter, and who was not misled by the malicious statements that were being circulated.

During this cross-examination yet another argument took place between Mr. Justice Ridley and Sir Edward Clarke. They seem to have been at cross purposes from the beginning. Sir Edward Clarke claimed that he was being forced to defend the officials of the London County Council, whose improper action had been said to have made the system inefficient. Both Mr. Fell and Mr. Fitzmaurice had had great experience in tramway matters, and were going to give evidence to say that in certain matters the system could be improved.

Mr. Justice Ridley said that it seemed to him that the person to make the system work was Mr. Bedell, but whether it was a good one or not remained to be seen. He was not attacking Mr. Fell or Mr. Fitzmaurice, but he thought that he himself would have preferred to trust the man who invented this very difficult system.

Mr. F. E. Smith said he was prepared to stand or fall by the statement that the G.B. system was an efficient one inefficiently laid down in London.

Sir Edward Clarke said his contention was that Sir John Benn had all through only been referring to the system as laid down in London.

Mr. William Griffiths, co-proprietor with Mr. Bedell of the G.B. patents, confirmed his evidence. He said that £15,000 had been spent in perfecting the system, and he claimed to recover this and a good deal more by the loss of business which there was every prospect of coming to the Company had the experiments in London not been libelled in the manner that they had. In his opinion, Messrs. Griffiths and Co. were not given the contract for laying the track in the Mile End Road owing to the spiteful attitude of Mr. Fitzmaurice towards himself. In cross-examination he denied that he was on the black list of the London County Council in connection with a previous contract. There was some trouble in connection with a contract in 1904, but since then he had carried out work for the Council and also supplied materials.

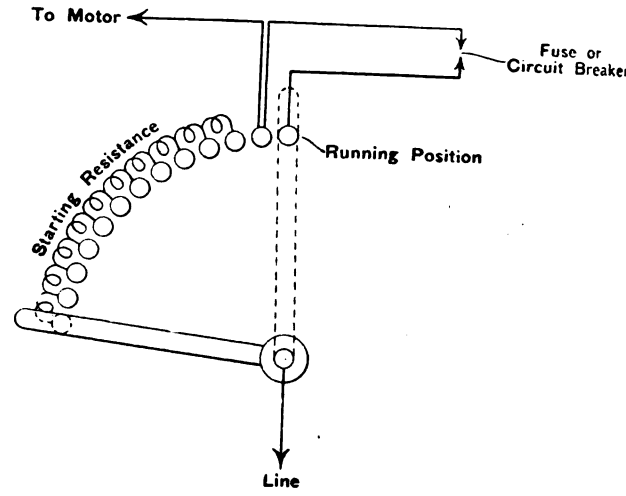
Mr. W. M. Mordey, who gave evidence on subpœna, corroborated the statements made in his reports to the London County Council that the G.B. system gave complete satisfaction after his experiments. When he made his first report he had not run any cars over the track, but later when he did so he found that he had been unduly cautious in his first report, and that the cars when run over the track worked even more satisfactorily than he had anticipated.

CORRESPONDENCE

STARTING OF INDUCTION MOTORS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Several interesting articles have recently appeared in ELECTRICAL ENGINEERING relating to the starting of induction motors, in particular one by Messrs. Moffett & Rosher, in the issue of September 22nd, 1910, which is the most interesting and instructive article I have recently seen on the subject. Several useful suggestions are made as to the method of protecting a motor against overloads and at the same time permitting the motor to take a heavy current, when starting, without blowing the fuse or bringing out the circuit-breaker. The use of a change-over switch which permits of the use of a heavy fuse during starting, and a lighter fuse when the motor has run up to speed, is probably the one most commonly adopted, but unless the switch is automatic and flies over to the running position on being released, there is always the risk that the switch will be left in the



starting position, when only the heavy fuse is in circuit. When rheostatic starting switches are used there is a simple method of getting over the difficulty, and as this is not mentioned in the article referred to, it may not be generally known.

From the point of view of the machinery insurance company it is the motor which needs protection rather than the cables leading to it. Any leakage or defect in the cable work rapidly develops into a short circuit, and therefore the cables may be more heavily fused than the motor which needs to be protected against say a 50 or 100 per cent. overload.

The simple method I refer to is to place the circuit-breaker or fuse between the last two contacts of the rheostatic starter, taking the motor connection from the contact next to the last, this being the last resistance contact. This fuse or circuit-breaker is not in circuit at all during starting, but only comes into action when the starter handle is pushed right over to the last stop, the starting resistance having in the meantime been all cut out, and the motor run up to full speed.

The rough diagram herewith will make the proposed arrangement quite clear. Only one circuit is shown in the diagram, but the method can, of course, be used either for single or polyphase motors, or to direct-current motors which have to start against excessive torques.

Yours faithfully,

FRANK BROADBENT.

4 Queen Street Place, E.C.
November 15th, 1910.

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ELECTRIC LIGHT AND POWER IN THE POST OFFICE

A DESCRIPTION of the new generating station erected for the lighting and power supply of the main Post Office buildings in London was given in our last issue. Six main feeders from this station supply three-phase current at 6,600 volts, 50 cycles, to three sub-stations at G.P.O. South, G.P.O. West, and King Edward Building respectively. Two cables run direct to each sub-station, while interconnecting cables are also provided. They are three-core, paper-insulated, lead-covered cables, 0·5 sq. in. section per core, and are provided with an earth shield of copper strip directly under the lead. The insulation thickness is 0·23 in. between cores and also between cores and copper sheath, as the system is required to work with an unearthed neutral. Standard 3½ in. P.O. duct is employed except over Blackfriars Bridge, where the cable is armoured and drawn into iron pipes. The lead and armouring are bonded to earth plates on each side of the bridge.

The sub-stations at King Edward Building and G.P.O. South contain only transformers and the necessary switchgear, but at the G.P.O. West station there are motor converters and a battery. Arrangements are provided for enabling the battery, in the event of an interruption of the A.C. supply, to maintain not only the D.C. supply but also the A.C. supply for a considerable time by running the motor converters reversed.

The G.P.O. West sub-station, illustrated in Fig. 1, is interesting on account of the special arrangement of the switchgear, rendered necessary by the shape and small size of the room available. The H.T. switchgear was supplied by the British Thomson-Houston Co., and is worked on the mechanical remote control system. Fig. 2 illustrates the connections for a feeder, a motor-converter, and the 'bus-bar switch. Each feeder or motor cable terminates, as shown, in a sealing and dividing box, from which bare copper conductors are led through porcelain insulators which project into the cellwork to the switchgear and 'bus-bars. There are no shields between phases, but ample clearance is maintained. The static dischargers on the motor-converter circuits are the only ones provided throughout the system. To lessen the shock to the motor windings on switching on, water charging-resistances are provided. These are connected to auxiliary contacts on the main oil switches. Each of the four Peebles-la Cour converters is rated at 300 kw. with an overload capacity of 25 per cent. for two hours. They supply a 220-volt D.C. three-wire system, the middle wire of which can be connected to the winding of each machine for balancing. The E.P.S. battery is divided into two halves, each connected to one side of the system through an E.C.C. 40 kw. reversible booster, which enables either half to be charged or discharged without affecting the voltage of the system. Each half consists of 55 cells, weighing about 17 cwt. each, and the whole has a capacity of 2,000 ampere-hours on the one hour rating. Each booster will give 1,000 amperes up to 40 volts for charging, or 3,000 amperes up to 13 volts for discharging. The booster-motor overload circuit-breaker is interlocked with the booster switch, so that the booster and booster field are short-circuited if the breaker comes out. Aluminium 'bus-bars and connections are employed for the battery plant. Interconnecting D.C. feeders are provided between the three sub-stations for supplying continuous current for the batteries, lifts, and fans from this sub-station. Electrically-driven reciprocating air-pumps with a total capacity of 500 h.p. are being installed at G.P.O. West for supplying the pneumatic service which comprises several miles of tubes radiating out from here to the Vere Street and other chief post offices.

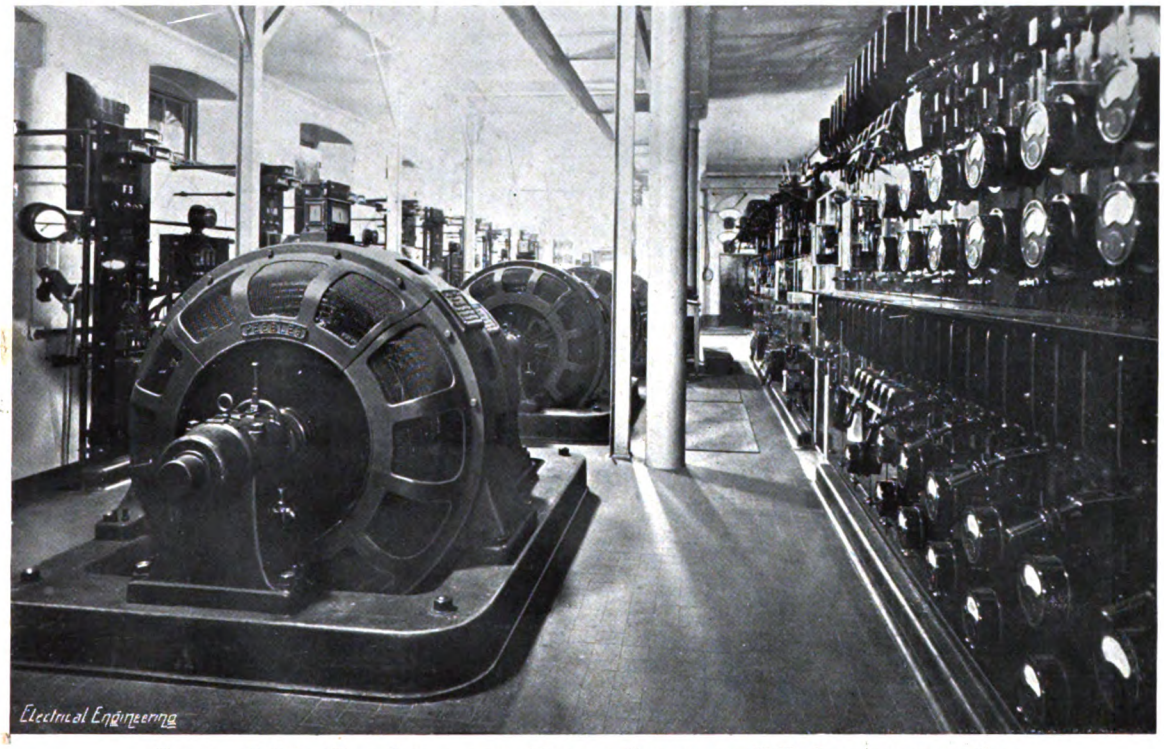


FIG. 1.—G.P.O. WEST SUB-STATION: CONTROL BOARDS FOR H.T. SWITCHGEAR ON LEFT.

The G.P.O. South sub-station is an A.C. station only, and consists of two sets of three air-cooled Berry single-phase transformers, with a capacity of 300 k.v.a. per set, connected in delta on both sides, and transforming down to 110 volts. They are connected by bare copper conductors supported on insulators, and are protected on both sides by switches fitted with overload relays.

At the new King Edward building, the sub-station contains four sets of three Berry transformers, con-

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nected in delta on both sides. Two sets are rated at 300 k.v.a., and transform down to 440 volts for power, while the other two sets have each a capacity of 150 k.v.a., and supply the lighting and small motor circuits at 110 volts three-phase. The wiring system is unique, the method of balancing the load being of particular interest. A ferro-concrete cable trench running right round the building under the basement floor connects the sub-station with thirty vertical chases in the outer ferro-concrete walls, which extend right up to the top of the building. Some twenty lead-covered, paper-insulated, three-core cables of from 0·125 to 0·35 section per core, are laid in this trench, and lead up through the chases to ten main distributing boards, two on each main floor, and one only on some of the upper floors. Each board is supplied by two cables, and either is large enough to carry the whole load of about 50 amperes. These boards are for the purpose of distributing the load equally across the three phases. Two bare wires from the like phases of each cable are brought up from the trifurcating boxes under the board to a phase 'bus-bar inside. The three bars corresponding to the three phases are arranged side by side, and

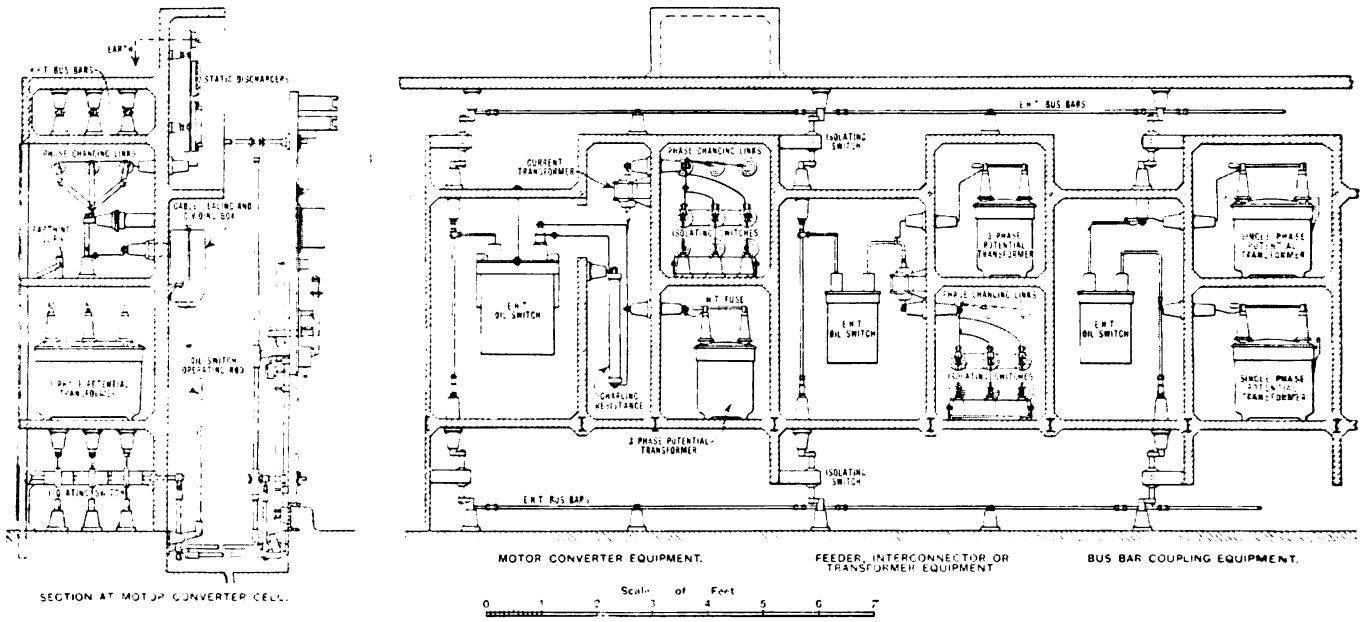


FIG. 2.—ARRANGEMENT OF H.T. SWITCHGEAR AT G.P.O. WEST SUB-STATION.

the hinge terminals of the switches for the nine or ten distribution board circuits are placed between the rows so that by switching them over to one phase or the other any circuit can be placed across any two phases. The circuits are thus connected *across* the phases, and not between one or other of the phases and a common neutral, as erroneously stated in a contemporary last week. To balance the load, ammeters are plugged in and the switches adjusted until the loads on the three sides of the system are equal.

Each balancing board supplies nine or ten distributing fuse boards controlling from eight to twelve five-ampere ways. There are 96 distributing boards, all of which are ironclad. These are connected to the balancing-boards on the same floor by lead-covered, paper-insulated single-core cables, either 19/16s or 19/18s, run in a 12-in. metal troughing erected round each floor. Sealing boxes are, of course, provided at both ends of all these cables. From the distributing boards, V.I.R. cables are carried in short lengths of conduit placed in chases in the wall up to the ceiling level, from which points they run in wood casing fixed along the beams supporting the arched ceiling. From various ceiling roses along this casing twin flexible is carried over hooks in the ceiling fixed at the points where the lamps are required to be suspended. Metal filament lamps are employed, arranged in groups of four in suitable fittings. On the ground floor alone there are 145 groups of four 100-c.p. lamps. In all there are 1,484 100-c.p. lamps, 493 50-c.p., 110 25-c.p., and 2,384 16-c.p. metal filament lamps, while 61 8-c.p. carbon filament lamps are also in use. Besides these, there are eighteen "Excello" flame lamps for the courtyard and exterior lighting. In the sorting offices an illumination of from two to three candle-foot is provided, and from one to two candle-foot where purely clerical work is done.

In order to ensure efficient earthing of all the ironclad boards, motors, &c., four earth plates are buried under the sub-station. These are connected to a copper strip 1 in. by ⅛ in., which runs the whole length of the trench under the basement, and from which bare copper 7/16 stranded wires run up all the vertical chases to connect with the boards, &c. The wiring installation was carried out by G. E. Taylor & Co.

The main features of the power plant are summarised below:—

There are thirteen electric lifts for goods or passengers, supplied by Messrs. R. Waygood & Co., and mostly operated from switches in the cars. The nominal loads range from 5 tons downwards, the average being 30 cwt., with a normal speed of 200 feet per min. The motors are supplied with three-phase current at 440 volts, but the controllers are worked by direct current. The D.C. controllers consist of two reversing solenoids, one solenoid controlling the main switch, and one starting rheostat solenoid. An interlocking switch, worked by the three-phase supply, breaks the D.C. control circuit on the failure of the A.C. supply.

A large number of fans driven by variable-speed D.C. motors are employed to blow air through ducts to each floor separately. Four large band conveyers for mail bags, one ropeway with wooden box carriers for letters, and six small band conveyers for letters are installed. Each is driven by a three-phase motor through belt and chain reduction gear, and controlled by an automatic starter comprising a single-phase motor, which gradually cuts out the rotor resistance. Trip gear operated off the D.C. supply enables the conveyers to be stopped by pressing small push-buttons provided at several points.

Mention should be made of the electric clock system installed by the Magneta Time Co., Ltd. A master clock, which acts as a generator to supply current at stated intervals to the several hundred dials which are all connected in series, is installed in a small room by itself. It is large enough to supply 900 twelve-inch dials. This clock is not synchronised from Greenwich, and has to be wound by hand every 50 hours. There are no batteries, and as the impulses are generated by induction, there are no contacts. We understand that in no other building in the world are there as many dials controlled from one master clock.

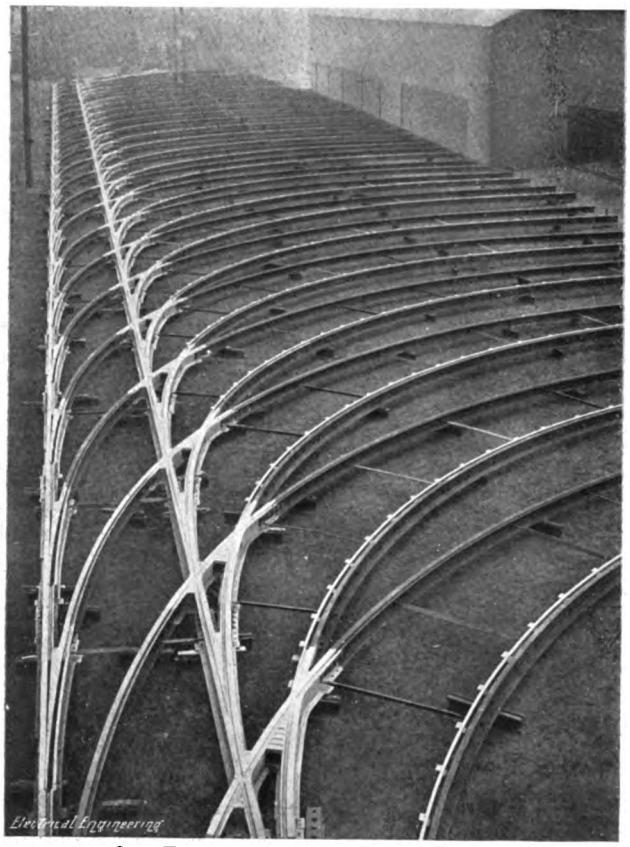
We are indebted to Mr. H. C. Gunton, Engineer to the Power Department, and to Mr. H. V. Cornish, Assistant Superintendent Engineer, for the information contained in this article.

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A LARGE CAR FAN

THE accompanying illustration represents a very large car fan constructed by the firm of Messrs. Edgar Allen & Co., Ltd., at their Imperial Steel Works, Tinsley, Sheffield, for the renewal of the car tracks in the Kirkstall Road Depôt of the Leeds City tramways. This is, we believe, the largest piece of work of this class that has been hitherto constructed in one lay-out in England, and, as constructed at Messrs. Allen's works, measured 346 ft. by 48 ft. wide.

The whole of the points on the main track couple together without intervening rails, thus reducing the number of joints. All the points are 75 ft. radius centre track. The left-hand points are all movables, the right-hand side consisting of compound open points and crossings cast in one piece, and repeated throughout, thus standardising the work. All curves off the main track are 35 ft. radius, spiralised to suit the varying distances of the pits in the depôt, thus standardising the castings as far as possible. All the curved tracks are fitted on the inside rail with Holt's patent guard rail—over



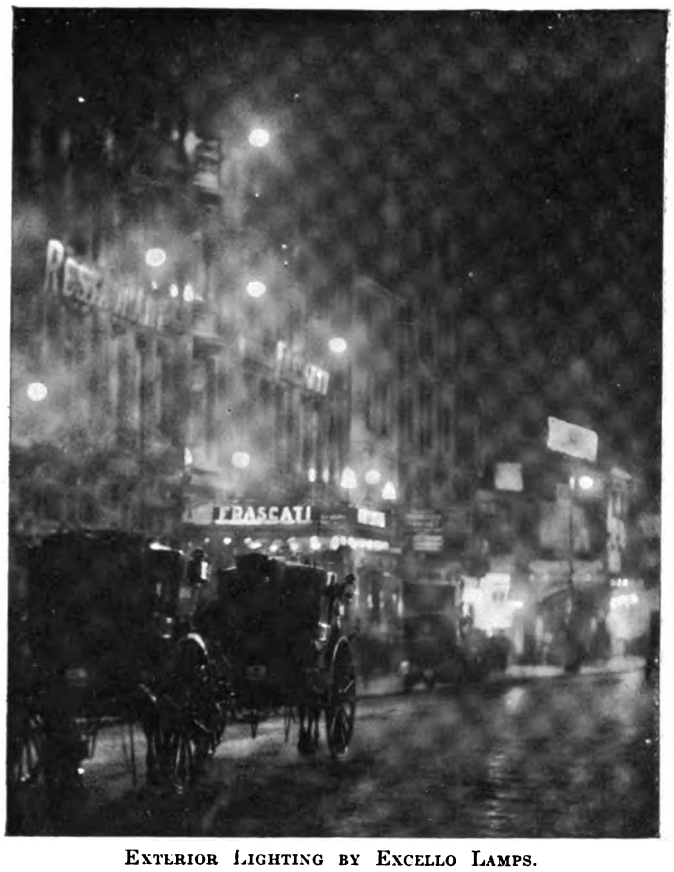
LAY-OUT OF CAR FAN FOR KIRKSTALL ROAD CAR DEPÔT, LEEDS.

1,200 feet being required—which has been rolled in 20 ft. lengths by Messrs. Edgar Allen & Co., Ltd., and being rolled to a miniature type of a bull-head rail, is consequently reversible, thus doubling the life of the guard. Messrs. Edgar Allen & Co., Ltd., have secured the sole right of supplying this guard rail, for which a great demand is expected. Our photograph clearly shows this guard rail in position. Special cast steel fishplates have been fitted to the castings at the places to which the guard connects. The total weight of the lay-out is approximately 85 tons, the points and crossings comprising over one-third of the total weight. The rails used were rolled by Messrs. Walter Scott, Ltd., of Leeds, to the new section adopted by the Leeds City Tramways, 105 lbs. per yard. The plans of the lay-out were prepared by Mr. J. B. Hamilton, general manager, and Mr. R. B. Holt, permanent way engineer, of the Leeds City Tramways, who inspected the lay-out before despatch.

Proposed Optical Convention in 1912.—The committee formed at the Optical Convention of 1905 appointed an Executive Committee, which has been ascertaining the views of those interested as to the holding of another Convention in 1912. As a result of the favourable replies received, a meeting of the full committee is to be held on Tuesday next at the rooms of the Chemical Society, Burlington House, under the chairmanship of Dr. R. T. Glazebrook (Director of the National Physical Laboratory). All interested are invited to attend.

EXCELLO LAMPS

THE Union Electric Co. (Park Street, Southwark, S.E.) have brought out a booklet with the attractive title, "Why the Excello Excels." This contains an interesting account of the development of the flame arc lamp and the way in which defects were overcome in the Excello designs. Attention is drawn particularly to the even burning of the carbons, which are designed specially for these lamps, the



EXTERIOR LIGHTING BY EXCELLO LAMPS.

form of the economiser, the ventilation arrangements, and way in which deposit on the globes is avoided. Some excellent illustrations, one of which is reproduced here, show these lamps in actual use. These are from untouched photographs taken at night by the light of the lamps themselves. Illustrations of the distinguishing features of the lamp are also given. The company will be glad to send a copy of this list to anyone who applies to them mentioning this notice.

Fencing Machinery.—At the Woolwich Police Court last week the Western Electric Co., Ltd., were summoned for not securely fencing the stamp of a power press as required by the Factory Acts. Mr. W. Williams, one of His Majesty's Inspectors of Factories, stated that he had sent notices to the company during the past two years respecting machines which had been the causes of several accidents. Last autumn a boy had the top of two of his fingers cut off by one of the presses. Some time ago the company had written him stating that they were experimenting with various guards, and they again made the same excuse for not fitting them. The company admitted the offence, and the magistrate adjourned the summons for 14 days in order that guards should be fitted in the meantime.

Institution of Electrical Engineers—Birmingham Local Section.—The opening meeting of the section was held at Birmingham University on Wednesday, the 16th inst. Mr. R. K. Morcom presided, and introduced the new chairman, Mr. M. Railing, in whose favour he vacated the chair. A vote of thanks to the retiring chairman was proposed by Mr. A. M. Taylor (Birmingham Electric Supply Department), and seconded by Mr. J. P. Kemp (Birmingham Electric Supply Department), and briefly acknowledged by Mr. Morcom. Mr. Railing then proceeded to read his address, of which an abstract was given in our last issue, and a vote of thanks was moved to him by Colonel Lister (Veritys, Ltd.), and seconded by Mr. J. H. Barker (Birmingham Metal and Munitions Co.). The meeting then adjourned at the invitation of Mr. Railing to the Grand Hotel, where an informal conversazione took place, music being provided by the band of the General Electric Co.

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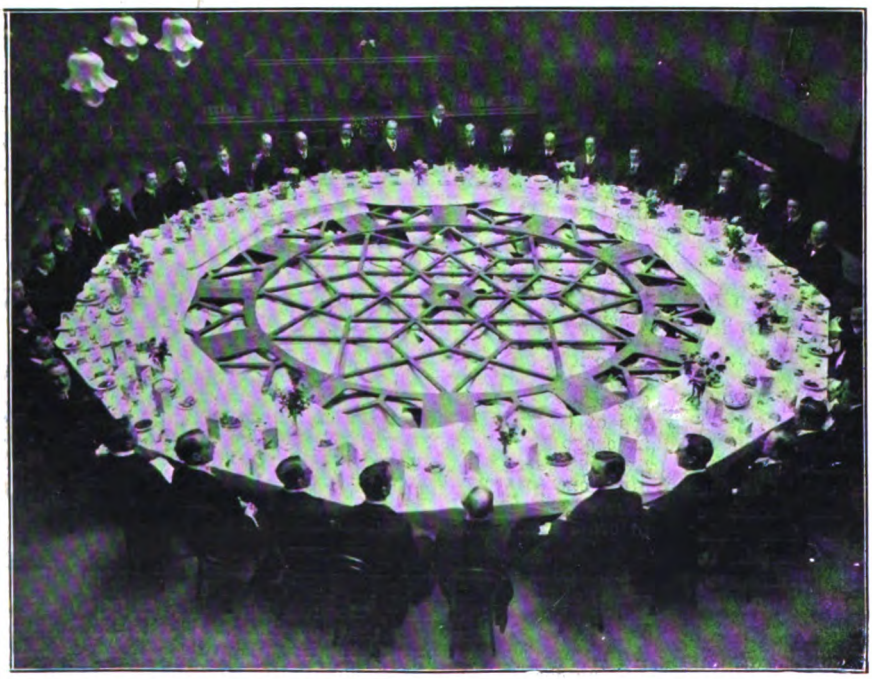
THE LARGEST ELECTRIC CLOCK IN THE WORLD

MESSRS. GENT & CO., LTD. (Faraday Works, Leicester), have under construction what will be when complete the largest electric clock in the world. The face of each dial will be no less than 25 ft. in diameter, and the happy thought occurred to the makers to use one of the dial frames as a round table at which, like King Arthur's knights of old, a company of invited guests partook of an excellent lunch in the Free Trades' Hall, Leicester. A photograph of the scene is reproduced here.

The clock in question is destined for the new Royal Liver Building, Liverpool, and will occupy a position about 220 ft. from the ground. It possesses four dials, each of which measures 25 ft. in diameter, and the minute hands measure 14 ft. long, and 3 ft. at their greatest width. Each of the huge hands is made of copper, with a 9 in. gun-metal backbone; it has been necessary to construct the opal face to withstand a wind pressure of over eleven tons. The outer circle of the dial is being constructed in 12 sections, each section measuring 6 ft. 3 ins., by 5 ft. 6 ins., and the spaces of 5 minutes each weighing 5½ cwt. The total weight of the frame work of each dial is 3½ tons, and no less than 5 cwt. of opal glass is used for each of the four dials. A special translucent opal glass will be used which, although only ⅛ inch in thickness, has been shown on test to be capable of withstanding a pressure of 600 lbs. per sq. ft. without breaking. The hours are indicated by twelve distinctive marks, instead of the usual Roman characters; each of these marks measures 3 feet by 1 foot 6 inches; and 1 foot 2 inches separates the minute marks.

The clock is worked on what is known as the "waiting train system" developed by Messrs. Gent & Co. The hands will not move forward in half-minute impulses as one is accustomed to see with ordinary electric clocks, but with a practically continuous motion, and will be governed by a special time transmitter. The "waiting train" system involves the use of a reciprocating slow-speed motor, the duty of which is to rotate the hands only, the timekeeping being effected by the time transmitter, which brings the movement under control at each half-minute. One of the advantages of this system is entire disassociation of the timekeeping element of the clock from the hand-driving element, with the very desirable result that the effect of the weather on the hands cannot react on the timekeeping, as is often found to occur with the ordinary mechanical clock. Another advantage of the system referred to is that a number of smaller clocks can be distributed throughout adjoining premises, and be driven from the same transmitter, the whole keeping the same good time. The transmitter will be connected through the G.P.O. wires to Greenwich, and will become automatically corrected when necessary, with the result that the clocks will indicate Greenwich mean time.

The dials of the large clock will be electrically illuminated, and a very ingenious switching apparatus is being made, which will automatically switch on the light at dusk and switch it off at dawn, making due allowance for the seasons, with an accuracy of 10 minutes in 30 years.



LUNCH PARTY ROUND THE FACE OF AN ELECTRIC CLOCK.

After lunch an inspection was made of the various portions of the clock in process of manufacture at the works, and we are informed that in the evening the staff of Messrs. Gent & Co. held a soirée round the clock face.

HOLOPHANE LIGHTING

WE reproduce here a photograph of the main entrance hall and corridors at the Newport Technical Institute, in which Tantalum Holophane "Arcs" and holophane spheres are installed. The even illumination effect obtained by these fittings, is not unlike that from an inverted arc lamp, but without the unsteadiness and flickering to which an arc lamp is liable. In addition to their use for the general lighting of the hall and corridors, this system of lighting has been adopted also in the art class-rooms, where it is desired to eliminate sharp shadows as much as possible. The quality of the light produced is also a great improvement on that from carbon lamps from the point of view of the discernment of colours. Messrs. Siemens Brothers' Dynamo Works, Limited (Tyssen Street, Dalston, London, N.E.), to whom we are indebted for this block, specialise in this particular type of fitting, and we understand that they can submit very promptly numerous designs of other holophane fittings which are equally effective.



LIGHTING BY TANTALUM LAMPS IN HOLOPHANE GLOBES AT NEWPORT TECHNICAL INSTITUTE.

The Royal Institution.—The Christmas course of experimentally illustrated lectures adapted to a juvenile auditory will be delivered by Prof. Silvanus P. Thompson on December 29th and 31st, and January 3rd, 5th, 7th, and 10th. The subject will be "Sound, Musical and Non-Musical."

Instantaneous Radiography.—An intensifying device for X-ray photography, known as the "Sunic" screen, has been introduced by Messrs. W. Watson & Sons, Ltd. (313 High Holborn, London). It consists of a thin card on which is a film of a patent emulsion, and is placed in the photographic slide so that this film is next to the film of the plate. It appears that the X-rays impinging on the patent film are absorbed, and highly chemically active, but invisible, rays emitted, with the result that only about one-twentieth of the exposure is required. It also appears that the density of the photograph is directly proportional to the time of exposure with these secondary rays. The film has an exceedingly fine grain, and the photographs obtained are said to be as sharply defined as in the case of those taken without the screen, but with twenty times the exposure.

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ALUMINIUM v. COPPER CABLES FOR LOW-TENSION FEEDERS AND DISTRIBUTORS ON UNDERGROUND NETWORKS *

By F. C. Raphael and J. B. Sparks

AT the present prices of aluminium and copper, it is possible to buy insulated aluminium cables cheaper than copper cables. Moreover, copper is now at a very low price—about £60 per ton—and a rise in the market value during the coming year is by no means unexpected, so that the question of using aluminium cables in place of copper is worthy of some detailed consideration.

Before dealing with the practical details in the employment of aluminium cables, which it is the main object of this article to discuss, the actual position as regards relative price must be made clear. The authors hasten to disclaim having made any new discovery in this respect. Eighteen months ago, Mr. E. M. Hollingsworth (Borough Electrical Engineer of St. Helens) pointed out, in a Paper read before the Incorporated Municipal Electrical Association, that, at the prices then prevailing, single-core aluminium cables with the current-carrying capacity and resistance of copper cables from 0·05 sq. in. upwards, were considerably cheaper than copper cables; he did not go deeply into the subject, however, as his purpose was mainly to raise a discussion on existing practice.

Within a fairly close degree of approximation, the conductivity of aluminium is three-fifths that of copper, so that an aluminium conductor of 0·5 sq. in. section will take the place of a 0·3 sq. in. copper conductor. The corresponding aluminium conductor is, however, much lighter, and, as the cost of aluminium per lb. is not very much greater than that of copper, the aluminium cable in its uninsulated state is far cheaper. The larger amount of insulation and lead necessary to cover the larger diameter to the same radial thickness diminishes the advantage, but the fact remains, as stated, that for cable above a certain size aluminium is cheaper. We have, for the time being, confined our investigation as to price to single-core, low-tension cables; with triple concentric, three-core, and also high-tension cables, the time is not ripe to substitute aluminium, but with ordinary unarmoured low-tension concentric cables there still appears to be some advantage. It must not be forgotten, however, that so far as the present types of cable with copper conductors are concerned, there is no great difference between the cost of three single cables and triple concentric and three-core cables if they are not armoured.

Taking paper-insulated lead-covered cable first, we will refrain from quoting actual prices, as it would be unwise to do so in the present state of the cable market; we will content ourselves with recommending cable users to obtain alternative prices when buying cable of 0·1 sq. in. upwards. As was recently reported in ELECTRICAL ENGINEERING (October 13th, 1910, p. 654), the Manchester Corporation has ordered a large quantity of 1·66 sq. in. aluminium cable (equivalent to 1 sq. in. copper), the Bolton Corporation have cable of similar size in use, and at least one supply company and one other municipal electricity works have made the experiment of buying smaller sizes. At our suggestion the British Aluminium Co., Ltd., have worked out the various sizes of aluminium cables corresponding to the standard copper sizes, and we quote some of the sizes, adding the diameter of the finished lead-covered cable. The radial thicknesses taken are those of the Engineering Standards Committee for the larger section, that is to say, for instance, in the case of 1 sq. in. aluminium equivalent to 0·6 sq. in. copper, the radial thicknesses that would be employed for 1 sq. in. copper are assumed. For aluminium conductors larger than 1 sq. in. we have assumed radial thickness as for 1 sq. in.

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Dimensions of Lead-Covered Paper-Insulated Aluminium Cables.

Nominal Copper Section (sq. in.)	External Diameter of Lead-covered Copper Cable (in.)	Equivalent aluminium Cable [Number and Size of Wires (in. diam.)]	Diameter of Aluminium Conductor (in.)	External Diameter of Lead-covered Aluminium Cable (in.)
0·1	0·75	19/·105	0·525	0·865
0·15	0·86	37/·092	0·644	1·024
0·25	1·04	61/·093	0·828	1·228
0·3	1·11	61/·102	0·918	1·318
0·4	1·25	91/·096	1·056	1·496
0·5	1·33	91/·108	1·188	1·668
0·75	1·57	127/·112	1·456	1·956
1·00	1·82	127/·129	1·670	2·170

For vulcanised bitumen cable, we are able to give actual prices quoted by a British cable works, on the basis of copper at £60 per ton (electrolytic wire bars c.i.f. port of arrival)—which is equivalent to drawn copper wire at 7¾d. per lb.—and aluminium wire at 10d. per lb. at the cable works. The prices given for the cable are actual net selling prices, for cable delivered in the United Kingdom. The radial thicknesses of insulation are, of course, larger than for paper cables.

Prices of Bitumen Insulated Copper and Aluminium Cables.

Nominal Copper Section (sq. in.)	Copper Cable per mile. £	Corresponding Size of Aluminium Cable.	Aluminium Cable per mile. £
0·025	51	7/·087	44
0·05	87	19/·074	70
0·150	200	37/·092	155
0·250	287	61/·093	240
0·300	315	61/·102	255
0·400	440	91/·096	350
0·500	550	91/·108	440
0·700	740	127/·108	640
0·750	780	127/·112	650
1·000	1110	127/·129	900

It is clear, therefore, that for ordinary vulcanised bitumen cables for laying on the solid system, aluminium is considerably cheaper in all sizes; in fact, the difference is so great that aluminium will also be cheaper for armoured cables. For shaft cables in mines aluminium will therefore be cheaper also, but it must be pointed out that, in the case of armoured cables, it will not be lighter, as the extra weight of armouring on the larger-diameter cable more than compensates for the lighter conductor.

We will now turn to the question of laying and jointing, and the application of aluminium cable in the various systems. The question of jointing and connecting to the cable is one of great importance if aluminium is to be employed for distributors. It is less important in the case of feeders, but even then the end connections have to be considered. Although solders for aluminium have been invented from time to time, we prefer to assume that the jointing of aluminium cable either by soldering or welding, is not a suitable process for general use in service joints on distributing networks. In welding the intense heat that is necessary implies a grave risk of damaging the insulation, and we believe we are right in saying that none of the solders can be employed, as with a copper conductor, to pour through the wires, and to sweat them into a solid conducting mass.

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Aluminium, when exposed to the atmosphere, becomes coated with a thin film of non-conducting oxide, and we have, therefore, carried out a number of experiments to ascertain whether the resistance and mechanical strength of this film is so great as to prevent the employment of ordinary clamped joints. Obviously, if the skin resistance is high and cannot be broken down by mechanical pressure, aluminium cables will not be suitable to use as distributors on

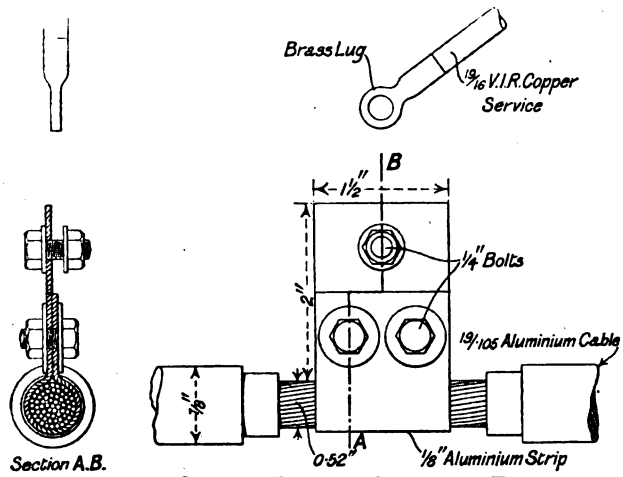


FIG. 1.—SERVICE CLAMP EMPLOYED AT EALING.

underground networks in the same manner as copper cables, as, if the service cables are simply connected to the conductors by clamps in the ordinary way, it would only be the outer layer of the stranded cable which would carry the current. Our experiments have shown, however, that the effect of the skin resistance of aluminium has been over-estimated in the past, and that for ordinary service connections, mechanical aluminium clamps similar to the brass clamps used in standard joint-boxes, can be employed for aluminium cables without any risk of connection not being made with the inner strands. It is important that the clamps should be screwed up rather firmer than usual so as to break down mechanically the insulating film on the outer strands, and to squeeze out the oil or other foreign matter which may have run between the individual strands and layers. A fairly good contact is then obtained right through, probably as good as the connections that would be made in a similar manner to a copper cable without sweating the strands together. In concentric cable it is advisable to place a thin metal sleeve on the insulation beneath the outer conductor, in order that the latter shall not cut into the insulation when tightening up the clamp.

The experiments referred to were made on a pair of aluminium distributing cables laid by Mr. J. Douglas Knight, Engineer and Manager of the Ealing Electricity Department.

They were single-core, paper-insulated, lead-covered 19/·105, equivalent to 19/14 copper, and their length was 1,869 feet each. The aluminium cables are provided at both ends with aluminium lugs cast round the end of the cable by running molten aluminium into a cast-iron mould into which the bared end of the cable has been inserted. It has been proved (by cutting through) that during this operation the cable end fuses, establishing an intimate contact between the lug and all the strands of the cable, so that it may be expected that a resistance measurement taken through these lugs will give the true resistance of the cable. There is only one service on this distributor, consisting of copper cables connected to the aluminium cable by a very simple form of clamp made from aluminium strip, as illustrated in Fig. 1; the joint was in a wooden box filled with compound, and the service had been in use for nine months. The distributor was first short-circuited at the far end, and the resistance of the total length was measured with the service cables disconnected from the clamps, so that the resistance corresponding to the distance from one end of the distributor to the service could be deduced. This agreed within 2 per cent. with the listed resistance of the cable. The far ends of the cable were then taken apart, and the two clamps for the service connection were short-circuited by a piece of stout copper wire. The resistance was then measured, and it was found that it only exceeded the resistance calculated from the previous test by 0·004 ohm, which showed that not only was the contact resistance of the clamp inappreciable, but that sufficiently good contact was established right through to the inner layers of the stranded cable.

The test was made by measuring the fall of potential (with a milli-voltmeter kindly lent us by Messrs. Everett, Edgcumbe & Co.), when a current was passing through the cable, and it was repeated with four currents from 8·9 to 16·1 amperes, all of which were measured with a Kelvin balance. The milli-voltmeter was recalibrated after the test and found accurate.

This figure of 0·004 represents not only the resistance of the two clamps, but also any additional resistance that may be introduced through the clamp not forcing all the layers of the cable into perfect contact.

In order to ascertain what proportion of the whole resistance was represented by the clamp joint itself, the milli-voltmeter was connected to the outside of the two cables just inside the clamps, so that the drop

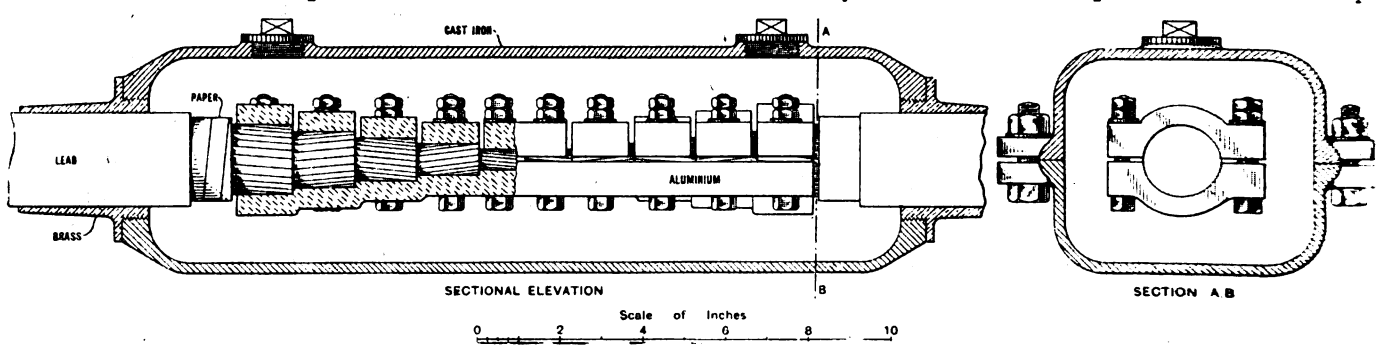


FIG. 2.—STRAIGHT-THROUGH STEPPED JOINT DESIGNED BY MR. S. L. PEARCE FOR 1·66 SQ. IN. ALUMINIUM CABLE AT MANCHESTER.

across the two clamps would be measured, and this gave a resistance of less than 0·002 ohm.

There are 2,500 yards of single-core aluminium distributing cable in use at Ealing, and the majority of the services on this are connected up in the manner illustrated in Fig. 1, but there are some cast T-joints which, though giving a feeling of greater security, have the disadvantage of taking longer to make, and requiring the stripping of a considerable length of cable. Mr. Knight informs us that a man who can make six service joints in a day on a copper cable takes the whole day to complete one of these cast-welded service joints on an aluminium cable.

Although the above tests show that a simple clamp joint over the outer layer is sufficient for service connections, something more effective is required for a straight-through joint, through which the whole current has to pass, or for the connection at the end of a

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large cable. The advantage of using aluminium is most apparent in the larger sizes of cable, as already explained, and, if currents of 500 to 1,000 amperes have to be dealt with, even a resistance of one-thousandth of an ohm will cause a large drop in voltage and a corresponding evolution of heat. For instance, a resistance of only 0·001 ohm in the path of 500 amperes means a fall of potential of half a volt, and a loss of 250 watts that must be dissipated in heat. It should be pointed out, however, that similar losses would occur with large copper cables if jointed by clamps without sweating the strands together.

Where there is room for the cable to be stripped back several inches, a "cast-weld" joint or end connection, as used at the ends of the Ealing cable, is most satisfactory. The mould and cable ends should be heated before pouring, so that the metal may not be chilled on entering. For connecting an aluminium cable to a copper cable, the cast-welded lug is bolted to the lug of a bronze ferrule sweated on to the copper cable in the ordinary way. It has been found best to have a flat surface between the two metals, and the joint must, of course, be protected from moisture and the atmosphere by paint or an insulating composition. This type of end connection is employed at Ealing. The joint between the connecting lugs on the aluminium and copper cables is enclosed in a wooden box and filled up with insulating compound. One of the authors inspected four such joints just after they had been opened up after nine months' service, and found them perfectly clean and free of corrosion at the junction of the aluminium and bronze surfaces.

Mr. Arthur A. Day, Engineer and Manager of the Bolton Corporation Electricity Works, informs us that he has nine large aluminium cables in use as feeders from a rotary converter sub-station to the works of Messrs. Dobson and Barlow. These are ordinary paper-insulated lead-covered cables laid in wood troughing, without filling, and carried over the roofs of the works. Each cable is 160 yards in length, contains 91 strands, and has a section of 1·67 sq. in., *i.e.*, the equivalent of 1 sq. in. of copper. Terminals clamped to the ends of these cables were not found satisfactory, and sweated terminals were used. In fixing these each strand of the cable was tinned separately under the flame of a blow lamp with a special solder provided by the makers, the British Insulated and Helsby Cables, Ltd. The strands were then inserted in the terminal, which was then filled, whilst hot, with very hot metal. These sweated terminals have not given any trouble.

We were permitted to make some experiments with clamp joints for end connections, on a drum of 37/12 aluminium concentric lead-covered cable belonging to the County of London Electric Supply Co., who are making trials of aluminium cable for feeders.

The cable is 0·3 sq. in. in section, corresponding to a copper section of 0·18 sq. in. Our tests were made on the inner conductor only. A parallel clamp made in three parts side by side, all establishing contact only with the outer 18 wires of the 37-strand, was fixed at one end, and a stepped clamp giving direct contact with the central 7-strand, the next layer of 12, and the outer layer of 18, was placed on the other end. An alternating current of 120 amperes (about two-thirds full load) was then passed through the cable for eight hours. At the end of this time, the parallel clamp was so hot as to be unbearable to the touch, but the stepped clamp was not too hot to be handled. The clamps were quite small, however, and a larger clamp which would not heat up so much would be quite practicable.

Resistance tests were made on the same cable, and it was found that with carefully cleaned wires at each end the resistance could be made as low with clamps connecting to the outer layer only, and screwed down very tight, as with a pair of three-part step clamps. The test on load demonstrated, however, that the stepped clamp is certainly preferable.

Similar tests, pointing to the advisability of employing stepped clamps for aluminium cable, have been made in the testing department of the Manchester electricity works, and, as a result of these tests, Mr. Pearce designed the straight-through joint illustrated in Fig. 2, which will be employed on the 8,000 yards of 1·66 sq. in. aluminium feeder cable (equivalent to 1 sq. in. copper) recently ordered from the British Insulated & Helsby Cables, Ltd.

Enough has been said to demonstrate that the jointing up of aluminium cables, whether for feeders or distributors, offers no insuperable difficulty, and that it should not be sufficient to deter any engineer from profiting by a fair saving in the price of the cable itself. He has merely to ensure that good joints are made at the outset by one of the methods given, and that all mechanical joints are placed in suitable boxes filled up with compound to prevent access of air and moisture to the joint and possible oxidation and corrosion.

As a good copper to aluminium joint can be made with proper clamps—an improvement on the design in Fig. 1 is, of course, no difficult matter—there will be no advantage in employing aluminium service cables at present prices. If copper becomes so dear as to make this advisable, the consumers' ends of the cable will have to be jointed to extensions of the terminals of the service fuse-box, and placed in a sealing chamber, as is done in the best practice with ordinary paper-insulated, lead-covered services.

Another question to be considered is the cost of ducts and laying. On the solid system, and also on the drawn-in system, an increase in the size of the ducts and excavation is conceivable in some cases, but we do not think that this is of great import. For "direct in ground" systems, on the other hand, if armoured triple concentric is employed, copper cables will be cheaper than aluminium, and it is doubtful whether the gain with ordinary armoured concentrics will be great until the prices of aluminium and copper are more widely divergent.

The design of the service boxes has been considered by some to be a deterrent from using aluminium cable, but standard sizes and designs can practically be employed throughout. The clamp connectors ordinarily employed for copper cables will be as efficient as the clamp in Fig. 1, if properly fitted and screwed down, and the box itself need only be of a size corresponding to the outer diameter of the cable; whether the cable is led in through a sealing chamber or the lead is wiped on to a sleeve, a certain amount of clearance is always permissible. In estimating the cost, therefore, it should only be necessary to make allowance for the larger service boxes and fittings required for the aluminium cable, owing to the diameter of the conductor and lead being larger than in the equivalent copper cable, and to add a provision for the extra cost of the comparatively few straight-through joints and of the end connections.

An advantage in favour of aluminium cables, which, however, only comes in for short lengths of large section, may also be mentioned before closing this article. Owing to the larger conductor as compared with the equivalent copper cable, the radiating surface is greater, and it is found that the cables can carry a greater current than copper cables of the same resistance without overheating. This will probably only be of practical application in the case of cables of short length, as in most cases networks are designed on the basis of drop of voltage and not of current-carrying capacity.

We will conclude by expressing our thanks to Mr. A. Jacob, of the British Aluminium Co., Ltd., and to Mr. T. Horne, his assistant, for giving us useful information and helping in the carrying out of the tests, and also to Mr. S. L. Pearce, of Manchester, for particulars and drawings in connection with his large aluminium cables, to Mr. A. A. Day for the details we have given of the Bolton cables, and to Mr. Knight for permitting us to test the cables at Ealing.

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ELECTRICAL WORK IN THE NAVY

IN the course of an address to the students of the Institution of Electrical Engineers on Wednesday of last week, Mr. C. H. Wordingham (Electrical Engineer in Chief to the Admiralty), made some interesting remarks on electrical work in the British Navy. After referring to his organisation of the Admiralty electrical staff some seven years ago, Mr. Wordingham explained how the Admiralty standard sizes of cable had originated in the fact that a 16-c.p. lamp took one ampere at 60 volts (the pressure then employed), and that one No. 20 S.W.G. wire carried this nicely. Thus a 10/20 cable was specified for 10 lamps, a 50/20 for 50 lamps, and so on, such strange cables as 80/20's and 60/20's being in common use. Among the special terms in use among electrical naval men is "balancing," meaning the testing of insulation resistance, and derived from the Wheatstone bridge or balance now replaced by the "Megger." Lead-covered, rubber-insulated cables are known as "armoured" cables; circuits are spoken of as being "charged" instead of "alive," and the expression "fork in" is used for connecting in parallel.

The conditions on board warships are particularly exacting. Some of the gear has to be exposed to the weather, but the worst conditions are met with below, where the temperature may rise to 180°, or even 200° Fahr., and where the air is extremely moist. Hygroscopic insulating materials must not be exposed, and great attention must be paid to surface leakage and the provision of long paths to earth from all live parts. Mica and micanite have, however, enabled as high a standard of insulation to be maintained as on shore. The usual rubber cable ratings are based on the assumption that the final temperature shall not exceed 130° F., and as the initial temperature on board ship often exceeds this, the difficulties met with in cable work are obvious. It has been found possible to introduce paper-insulated cables for some of the largest cables, but not for the smaller sizes, chiefly on account of the difficulties of fitting and maintaining the sealing of the ends when the ship is in commission. The high temperature also leads to difficulty with fine wire copper windings, main contacts, oil dash-pots, &c. An important feature of naval work is the necessity of keeping down the weight of apparatus, as it has all to be floated. Tubular construction for switchboards, the use of pressed sheet steel in place of cast metal, the elimination of slate and marble, are all partly results of this. The use of aluminium has, so far, not been attended with success, for it readily corrodes in the presence of moist sea air, and threads tapped into it consequently strip. On the other hand, strength is essential, and in this connection Mr. Wordingham mentioned that a massive gun-metal key, provided on naval telephones, had been frequently known to shear off a pin over $\frac{1}{8}$ in. diameter, on account of the excessive energy with which the average bluejacket considers it necessary to carry out the instruction "Press." A capstan motor designed to work at full load for a few seconds has been kept running for hours at a time at full load, and coal-hoists designed for high speeds have been used to haul up torpedo nets very slowly. All gear must of necessity be watertight on account of the frequent and thorough use of the hose for cleaning after coaling. Any means of adjustment are invariably tried over their whole range by the curious sailor.

Turning to the question of standardisation in naval work, Mr. Wordingham pointed out how necessary this is in view of the carrying of the gear to all parts of the world, far from facilities for repair, and the transfer of men from ship to ship. The difficulties in the way, however, are almost insurmountable. The Admiralty naturally wish to benefit by the continuous progress in design, and to obtain their designs from manufacturers who have had experience in turning them out in large quantities, and, on the other hand, repeated selections from designs tendered by different firms result in several different types being introduced. However, it has been found possible to standardise rigidly such details as brushes, terminals, watertight glands, and the policy now is to specify most definitely the requirements of the apparatus and to lay down the general lines of construction, leaving the actual design to the manufacturer.

Continuing, Mr. Wordingham explained that the electrical plant on board ship is exclusively in the care of naval men. The officer primarily responsible is the torpedo-lieutenant; under him are electricians who have had experience in the dockyards and on H.M.S. *Vernon*, and various ratings of torpedo-men. Costs and commercial efficiency do not concern the naval man, whose idea of efficiency is that the gear shall do what it is expected to do without breaking down. The [illegible]tion of the gear is done exclusively by civilians. There are three grades of electrical engineer in the Admiralty service, namely, electrical engineer, first assistant, and second assistant. An electrical engineer is in charge of each dockyard; the first assistant looks after the supply of light and power to the yard, and the second assistant is engaged on fitting up the ships and doing repair work. The whole of the designing is done at the Admiralty, where there are a number of electrical engineers and second assistants. The only posts open to outsiders are those of first assistants, and all other men are selected from the dockyard electrical staff, to which entrance is gained by apprenticeship at the age of fourteen years.

Mr. Wordingham also gave his audience some excellent advice and outlined his views of the education question. The engineer's training, he said, should be of the broadest possible nature. On leaving school at sixteen, the student should go direct to an engineering college for three years, and then enter an engineering works as an articled pupil or apprentice, the whole training thus occupying five or six years. Mr. Wordingham then discussed the different branches of the profession, pointing out the special qualities and knowledge required in each. Referring to wiring work, he expressed the opinion that this work should be relegated to the "despised plumber" and ironmonger, who, however, should be properly trained for the work.

ELECTRICAL BILLS IN PARLIAMENT

WE give below some particulars of those private Bills of electrical interest which are to be promoted in the next session of Parliament, of which notice has been given. The period for giving notices has not yet expired, and we shall refer to the remainder in our next issue.

Central London Railway Co. propose to construct additional lines in order to join up with the Great Western Railway; London County Council are applying for powers in respect of 14 new tramway routes; London United Tramways Co. are asking for an extension of time for the construction of tramways in Richmond; London Electric Railways Co. propose to extend their line from Edgware Road to Paddington, to connect the District and Charing Cross, Euston & Hampstead Railways at Charing Cross, and to make further provision with regard to the company generally; Metropolitan District Railway proposes the appointment of a Joint Committee to purchase or lease the Lots Road power-house and to supply electrical energy to any person or company, and, among other things, to construct new lines in Kensington and Fulham.

Fife Electric Power Co. will seek power to supply energy in their power area for lighting purposes.

Schemes for the installation of trolley omnibuses are proposed for Malvern, Rotherham, Oldham and Saddleworth, and Brighton and Hove.

Tramway Bills are being promoted by the Belfast Corporation, Bristol Tramways Co. (extension of time); Metropolitan Electric Tramways, Ltd. (new lines in Walthamstow, Enfield, Edgware, Hendon, Willesden, Hampstead, and Edmonton, &c.); Notts and Derbyshire Tramways Co. (revival of power, extension of time, &c.).

Electric Lighting Provisional Orders will be applied for in respect of Acton (transfer of undertaking to Metropolitan Electric Supply Co.), this Bill depends upon the plebiscite of the ratepayers now being taken; Truro; Littlehampton and Bognor; Winchester (transfer of undertaking to Corporation); Uxbridge (transfer of undertaking to Callender's Cable & Construction Co.); Witney; Newcastle-upon-Tyne Electric Supply Co. (extension to Kenton); Accrington (extension of area); Bermondsey (extension of area).

London Electric Supply Bill.—In the House of Lords on Monday the London Electric Supply Bill was read a third time and passed. This Bill, which has already passed the House of Commons, constitutes the London County Council the purchasing authority of the undertakings of the West End electric lighting companies, which were omitted from the London Electric Supply Act of 1908

British Trade with Australasia.—His Majesty's Trade Commissioners in Australia (Mr. C. Hamilton Wickes) and in New Zealand (Mr. G. H. F. Rolleston) will visit this country early next year with a view to visiting the industrial centres and giving British manufacturers and merchants an opportunity of consulting them with regard to trade conditions in the Dominions referred to. Representative commercial associations interested should place themselves in communication with the Director of the Commercial Intelligence Branch of the Board of Trade at 73 Basinghall Street, London, E.C., before the end of January. His Majesty's Trade Commissioners report to the Board of Trade any opportunities in the form of contracts open to tender, the nature and extent of foreign competition and other matters of commercial interest, including changes in Customs duties and regulations, financial and trade conditions, changes in regard to means of transport, and legislation affecting trade and commerce, and they furnish periodically lists of probable buyers of European goods in the Dominions.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published November 17th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

24,561/09. **Wiring Conduit.** L. MILNE (London). To avoid the use of inspection boxes, the conduit is interrupted for a few inches at any point where inspection or manipulation is desired, and the two ends are splayed out and threaded so that a short tube of larger diameter can be screwed on. The threads are such that the tube can be screwed off by rotation and then slid along over the conduit so as to expose the wires. An externally and internally screwed auxiliary collar is employed for connecting up the tube to the conduit. Seven figures.

24,813/09. **Cooking Apparatus.** A. F. BERRY (Ealing). In electric hot-plates comprising resistance windings mounted upon insulating carriers, and supported between sheets of insulating material, the carriers consist of segments or quadrants of a disc of thin sheet mica with the heating windings wound over the segments so as to be equally disposed on both sides. Further sheets of mica are placed on both sides of the heating elements, and the whole is fixed between recessed metal plates supported on a disc of heat insulating material, so as to throw the heat upwards. Four figures.

24,843/09. **Locomotive Motors.** A.-G. BROWN, BOVERI & CIE. (Baden, Switzerland). This patent covers an improved driving gear for large electric locomotives in which the wheel axle is driven by a coupling rod attached to a crank on the end of an auxiliary shaft passing through the hollow shaft of the motor. The interior shaft is connected at the other end to the hollow motor shaft by a universal joint in order that irregularities set up from the wheel axle will not be transmitted to the motor. The wheel axle and interior shaft are also connected by a distance rod with sleeves or bearings at each end. Four figures.

29,069/09. **Arc Lamp.** H. HIRST and A. E. ANGOLD (Salford). In a flame lamp of the stop pattern, the carbon and its abutment are relieved of some of the weight of the frame and guiding parts by providing the abutment carbon with a combined clutch and guide pivoted to its carbon holder. This lessens the risk of breaking the carbon, and allows it to burn to a longer point, so that the arc is further removed from the abutment. Three figures.

2,263/10. **Arc Lamp Mechanism.** H. C. BLACKWELL. Both the cores and coils of the controlling solenoids are moveable and are connected together mechanically by links or chains. The two parts react upon each other, and take up a position of magnetic balance. Stops are provided to limit the motion. It is stated that a feed of remarkable steadiness is obtained. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: MENSING [Arc lamps] 25,373/09; HEIMANN and SCHAFFER [Running arc lamps in series with incandescent lamps] 747/10 and 11,583/10; SIEMENS SCHUCKERTWERKE-GES. [Searchlights] 11,054/10.

Dynamos, Motors, and Transformers: LANCASHIRE DYNAMO & MOTOR Co. and MASON [Electrical operation of planing machines and other reciprocating tools] 22,234/09; DE COSTER [Dynamos] 4,758/10; SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke-Ges.*) [Moveable coil constant current transformers] 13,015/10; HOSKINS [Rotary transformers] 15,938/10; SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke-Ges.*) [Starting arrangements for single-phase series commutator motors] 18,848/10; CASE [Motor control] 22,708/10.

Electric Ignition: BROOKS and ALSTON [Sparking-plugs] 12,820/10.

Electrometallurgy and Electrochemistry: GUYE and DARIER [Manufacture of alkali nitrates] 15,525/10.

Heating and Cooking: KRATT [Water heater] 25,296/09; LOFQUIST [Heating apparatus] 10.097/10.

Incandescent Lamps: KUZEL [Exhaustion of metal filament lamps] 25,889/09; SIEMENS BROS. & Co. and HUDDLESTON [Lamp cap contacts] 1,597/10.

Switchgear, Fuses, and Fittings: ROYCE and SHARP [Automatic switchgear] 25,040/09; SMITH, MITCHELL, ASKHAM and HEY [Electric irons] 27,816/09; PARKINSON, and W. & B. COWAN, LTD. [Street lamps] 29,093/09; ELECTRIC CONSTRUCTION Co., and CLOSE [Motor controllers] 29,200/09; SCHRÖDER [Time switches] 30,216/09; SIEMENS BROS. & Co. and HUDDLESTON [Lampholders] 1,597/10; EVERSHED & VIGNOLES, LTD., EVERSHED and PAYNE [Terminals] 11,277/10; SCHREIBER [Lamp protectors] 11,616/10.

Telephony and Telegraphy: MUIRHEAD & Co. [Condensers and artificial line for duplex telegraphy] 25,103/09; VON KRAMER [Inductive wireless telephone system (for trains)] 25,407/09; MATTHEWS [Wireless telephony] 25,639/09; AMERICAN AUTOMATIC TELEPHONE Co. and GOODRUM [Selective switches] 25,896/09; SMITH [Telegraph strip feeds] 26,784/09; NUSSBAUM [Microphones] 3,179/10; ESPARZA [Reinforced concrete poles] 10,676/10; BAEHR [Telephone diaphragm] 21,328/10.

Traction: HEENAN & FROUDE, LTD., and SCHOLEFIELD [Motor suspension] 26,963/09; WALTERS ELECTRICAL MANUFACTURING Co. and MOORE [Device for warning of approach of train] 4,541/10; VAN DAALEN [Traction controllers] 11,437/10; GRUPE [Signalling] 15,175/10.

Miscellaneous: COWPER-COLES [Smoke consumption] 22,783/09 and 25,437/09; RICHARDS and PRINGLE [Distillation of coal for production of fuel] 25,019/09; WORTH, MACKENZIE & Co. [Control of winding engines] 25,516/09; METZGER and SMITH [Electric and electro-pneumatic organs] 25,932/09; LEFEVRE [Advertising device] 552/10; LUMIÈRE [Advertising signs] 4,270/10; JACOVIELLO [High-frequency oscillatory generator] 7,184/10; BRANTINGHAM [Advertising signs] 11,068/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: SIEMENS SCHUCKERTWERKE GES. [Search-lights] 14,354/10.

Incandescent Lamps: CERVENKA [Filaments] 8,341/10.

Instruments, &c.: BECKER [Speedometers] 22,045/10; EHRHART [Hydraulic dynamometer] 22,285/10.

Switchgear, &c.: NÈPLE [Lamp supports] 24,818/10.

Telegraphy, &c.: CARPENTIER [Baudot perforated strip transmitter] 19,102/10; NEUHOLD [Automatic telephone system] 23,669/10; GOLDTHORP [Wireless receiving apparatus] 25,280/10.

Traction: TH. GOLDSCHMIDT [Butt-welding of rails] 24,389/10.

Miscellaneous: DR. C. OTTO & Co. GES. [Distillation of coal] 19,552/10; WEINTRAUB [Boronised conductors] 25,032/10.

Opposition to Grant of Patents

8,875/09. **Storage Battery Plates.** G. OKILL. This patent has been granted in spite of opposition. It covers a process of manufacturing plates of the rolled grid type (see ELECTRICAL ENGINEERING, May 19th, 1910, p. 330).

11,773/09. **Wiring Fittings.** S. JOHNSTON. The opposition to this patent has been unsuccessful, and the patent allowed. It relates to ceiling roses, junction boxes, &c., in which the connections are made without screws and without cutting the main cables, by plunger contacts pressing on to bared portions of the cable.

14,318/09. **Cranes.** STOTHERT & PITT, and W. PITT. This patent has also been allowed in spite of opposition. It covers various mechanical details of electric cranes and transporters.

29,960/09. **Fan.** J. KEITH and C. TUSON. Opposition has been entered to the grant of this patent. It relates to a roof ventilator for ship's cabins, railway carriages, &c., comprising a fan runner direct driven by a vertical motor suspended in an open frame. A volute fan case is mounted on ball bearings on the upper end of the frame, and can swivel round the axis of the fan by the action of the wind on a guide vane attached to the casing.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON Co. (*A. D. Lunt, U.S.A.*) [Three-wire distribution system] 13,972/00; E. PARRY and F. W. BIDDER [Manholes for cable conduits] 17,224/02.

Dynamos, &c.: BRITISH THOMSON-HOUSTON Co. (*C. P. Steinmetz, U.S.A.*) [Starting and speed-regulation of induction motors] 18,095/97, and [Rotary converters] 13,972/00; ELEKTRICITÄTS A.-G. vorm. W. LAHMEYER & Co. [Compensated single-phase commutated motor] 11,441/05.

Electrometallurgy, &c.: COMPAGNIE FRANÇAISE DE L'OZONE [Water sterilising apparatus] 27,621/04.

Incandescent Lamps: A. E. GIMINGHAM [Candle-lamp] 17,190/04.

Instruments, &c.: J. HIKELY and NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY Co. [Prepayment meters] 15,969/05.

Storage Batteries: M. ROLOFF [Increasing capacity of negative plates] 16,008/05.

Switchgear, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Automatic motor starters] 17,021/04, and 17,024/04; R. F. YORKE [Wiring system] 15,836/05; F. F. ROBINSON [Bell pushes] 15,862/05.

Telephony, &c.: P. M. JUSTICE (*Rowland Telegraphic Co., U.S.A.*) [Intercommunication telegraph system] 15,474/01; E. DUCRETET [Helical coil transformers for wireless telegraphy] 17,034/03.

Traction: BRITISH THOMSON-HOUSTON Co. (*E. W. Rice, U.S.A.*) [Traction motor control] 16,716/98; Y. SANZ [Life guard] 16,761/03.

Miscellaneous: A. V. GROUPE [Braiding machine] 15,608/01; G. B. BOWELL and PEARSON FIRE ALARM SYSTEM [Electric fire alarm] 16,920/02.

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LOCAL NOTES

Acton: *Proposed Sale of Electricity Undertaking.*—The poll of the ratepayers with regard to whether the electricity undertaking shall be transferred to the Metropolitan Electric Supply Co. has resulted in a majority of 202 in favour. About a half of the members of the Council have expressed their intention of refusing to abide by this result, on the ground that the case against selling the undertaking has not been fully placed before the ratepayers.

Australia: *Fremantle: Accounts.*—The income from the municipal lighting and tramway accounts for the year to August 31st was £38,041, and the working expenses £27,881, an increase of £1,646 over the previous year. After meeting capital charges there is a net balance of £9,095. Of this a sum of £1,717 has been set aside for depreciation.

Adelaide: Tramway Purchase.—The Council have been recommended to enter into negotiations for the purchase of the Adelaide Electric Supply Co.

Ayr: *Tramway Extensions.*—Bailie Copland proposes to move at the next meeting of the Council that the extension of the tramways to Hawkhill, for which Parliamentary powers have already been obtained, should be put in hand.

Birmingham: *Hospital Equipment.*—The new Electrical Department of the Birmingham and Midland Hospital will be opened to-day. The total cost of the Department has been £2,000.

Blair Atholl: *Cheap Electric Light.*—With reference to the recent statements as to the supply of electricity to cottages at Eccles for a fixed weekly charge, it is pointed out that the Duke of Atholl, who is at present engaged in lighting the village of Blair Atholl with electricity at the rate of 5s. per 16 c.p. lamp per annum, which is worked out at $1\frac{7}{13}$d. per light per week. Current is supplied from the installation which supplies Blair Castle, three Pelton wheels being used in connection with the Slainthe River. The streets are also being lighted by electricity.

Bognor: *Electric Lighting Order Transferred.*—The Council recently decided to apply for an Electric Lighting Provisional Order, and at least one member of the Council has cherished the impression that they would be able to sell it at a profit to a company. The Town Clerk, however, has brought to the notice of the Council the views of the Board of Trade on this matter, which are strongly against this class of transfer. A resolution has now been carried in favour of applying for an Order, and apparently an effort is to be made to induce the Board of Trade to grant a clause allowing the Council to deal with the Order as they think fit.

Canada: *Electric Power Commission.*—The *Board of Trade Journal* states it has on file at 73 Basinghall Street, London, the first and second annual reports of the Hydro-Electric Power Commission of Ontario, a Department of the Provincial Government, undertaking the distribution of electric power from the Niagara Falls to municipalities in Ontario.

Dartford: *Tramway Extension.*—The lessees of the tramways propose to extend the lines to link up with Gravesend. The following agreement has been come to for the charge for power supply during the next five years: 1½d. per unit for the first 100,000 units per annum, 1⅜d. per unit from 100,000 to 250,000 units, 1¼d. per unit from 250,000 to 400,000 units, and finally 1d. per unit for all consumption over 400,000 units per annum.

Donaghadee: *Electric Lighting.*—The Council have definitely decided to apply for an electric lighting Provisional Order.

Fleetwood: *Electric Lighting Charges.*—At the last meeting of the Council a suggestion was made that a Sub-Committee should be appointed to revise the electric lighting charges. It was stated that there are seven different rates for lighting, but it was decided to wait until the end of the present financial year before moving in the matter.

Glasgow: *Electricity Charges.*—Mr. W. W. Lackie, the Chief Engineer to the Electricity Department, has presented a report upon the supply of electrical energy for cooking and heating from the lighting circuits. From an examination of a large number of consumers' accounts, he has come to the conclusion that the maximum demand averages 800 hours' use of the maximum demand per annum. The present charge for lighting is a flat rate of 3d. per unit, and he suggests, in order to meet the growing demand for all domestic purposes, that the charge should be 3d. per unit for the 800 hours' use for the maximum demand, all current over that to be charged at 1d. per unit. Mr. Lackie believes this will lead to a considerable use of electricity for intermittent heating in spring, summer and autumn, when only occasional heating is required. This is the time of the year when they have a considerable amount of plant standing idle, so that heating units supplied at 1d. would be profitable. Since the Smoke Abatement Exhibition, Mr. Lackie has had numerous applications for electricity at power rates from domestic consumers for the use of electric irons. The Electricity Committee recommend that the proposals be given effect to as from June last.

Gloucester: *Municipal Wiring.*—The proposal of the Electricity Department that they should pass on to local contractors orders for heating and cooking apparatus and meters, and to charge a commission at such a rate as would prevent undue competition, on the distinct understanding that the Department does not actually sell fittings, etc., or undertake the wiring of houses, was defeated at the last Council meeting.

London: *County Council: Tramways.*—The proposal of the Highways Committee to remove the existing horse tramways in Liverpool Road between Holloway Road and the Angel, Islington, is receiving considerable opposition in Islington, and when the proposal comes before the Council a motion will be made and seconded by the two members for Islington that the recommendation be referred back to the Committee, with instructions to bring up the necessary estimates for converting the lines to electric traction.

Hammersmith: Ventilation of Street Boxes.—The Woolwich Borough Council has been in communication with the Hammersmith and other Borough Councils with regard to the ventilation of street boxes constructed by the Post Office and the Telephone Company in connection with underground lines laid by them. It is pointed out that although in most cases similar boxes constructed by Electric Light Authorities are required to be ventilated, no conditions are generally made as to the ventilation of street boxes fixed by the Post Office and Telephone Company, and with a view to preventing the possibility of explosions owing to the escape of gas into these boxes, the London County Council is to be asked to consider the advisability of framing regulations to ensure a uniform system of ventilation.

Middlesbrough: *Tramcars and Transporter Bridge.*—A proposal is before the Council that tramcars should be transported across the river on the transporter bridge when this is completed. The transporter bridge will be worked by the Corporation, and the proposal is that the Tramway Company should pay a minimum charge of 1d. per passenger carried across. In view of the somewhat early stage of the work of constructing the transporter bridge, the Corporation have decided not to deal with the matter at present.

Portsmouth: *Light Railways.*—The Board of Trade have confirmed an order reviving the Portsmouth and Hayling Island light electric railway.

Scarborough: *Winter Tramway Service.*—The Board of Trade have given their decision with regard to the objection of the Scarborough Tramways Co. to running a winter service. The decision is that a 20 minutes' service shall be run on certain routes, and a half-hour service upon another route. It is said that the Tramways Co. contemplate abandoning the undertaking altogether if this decision is persisted in.

Southampton: *Electricity Showroom.*—The Electricity Committee recommend the Council to authorise an expenditure of £500 in the fitting up of a showroom for the Department.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—Specifications are being prepared, says the *Australian Mining Standard*, for the erection of wireless telegraph stations on Thursday Island and Port Morsby, Papua. Tenders will shortly be invited. Each station is to have a range of about 600 miles.

The Sydney Municipality invite tenders by February 6th for the supply of arc lamp carbons.

The High Commissioner for the Commonwealth of Australia, 72 Victoria Street, London, notifies that he has received tender forms, &c., for the supply of 5¼ miles of telephone cable from the Deputy Postmaster-General, Melbourne. Tenders must reach Melbourne by January 10th.

Austria-Hungary.—The *Board of Trade Journal*, quoting from a Vienna contemporary, states that a loan of £54,000

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has been applied for by the Salzburg Municipality for electric tramways.

Canada.—According to the *Board of Trade Journal*, an Ontario Company intend to construct an electric railway from Niagara Falls to the Porcupine gold-mining district. It is anticipated that some ten or fifteen miles will be completed this year. The name of the Company may be obtained at 73, Basinghall Street, London.

Greenock.—An expenditure of £4,047 has been sanctioned for a new turbo generating set.

Leek.—An additional generating set is to be installed at the Electricity Works.

Lowestoft.—A loan of £4,050 is to be applied for as follows:—Machinery, £1,300; alterations and additions to buildings, £150; steam pump, £100; meters, £1,500; public lighting, £1,000.

Rotherham.—Tenders are invited for the supply of high tension feeders, rotary converters, transformer, and a switchgear. (See an advertisement on another page.)

Switzerland.—*The Board of Trade Journal* states that a concession has been granted to the Societa delle Tramvie Ellectriche Locarnesi for the construction of an electric railway from Gordola to Bellinzona. The line will be about eight miles long, and the estimated cost is put at £39,680.

Wigan.—Tenders are invited for the supply of low tension lead and paper covered cables, and low tension lead, paper and armoured cables. Particulars from the Borough Electrical Engineer, and tenders by November 28th.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Extensions to new public offices, Westminster. H.M. Office of Works, Storey's Gate.

Proposed new chemical laboratories at University College, Gower Street.

Buildings upon site of Nos. 7 and 9 Broadway, Hammersmith.

Cinematograph theatre at 33 Grove Vale, East Dulwich.

Proposed extension to Hampstead Town Hall.

Electric theatres, 44b Portland Road; 76a Beulah Road; 6 Brighton Road, and 131 Cherry Orchard Road, Croydon.

Tenders are invited for the electric wiring of the Salway Place School, Stratford. Architect, W. Jacques, 2 Fen Court, Fenchurch Street, London, E.C.

PROVINCES.

Brierley Hill.—Additions and alterations to police station, County Surveyor.

Chester.—Alterations and additions to Lymm Grammar School. Architect, H. Beswick, Newgate Street, Chester.

Dover.—Carriage Builders' Institute at Cherry Tree Avenue.

Dunfermline.—Extension of West Fife Infectious Diseases Hospital. Architect, E. Simpson, 16 King Street, Stirling.

Edinburgh.—Alterations at old police station, Torphichen Street.

Glasgow.—Conversion of workshops in St. George's Road to theatre or concert hall. Architect, C. Henry, 32 Minerva Street.—Erection of shops, warehouses and offices in Union Street, Argyle Street, and Mitchell Street. Architect, H. E. Clifford.—Electric theatre in Castle Street. Architect, G. A. Boswell.

Hastings.—Electric lighting at Workhouse premises.

Lancaster.—Conversion of old Municipal buildings for free libraries.

Leicester.—Pavilion and concert hall in Victoria Park.

Maidstone.—Kent County Council Offices.

Margate.—Roman Catholic Church in Cliftonville.

Nottingham.—Extensions to Nottingham and Midland Eye Infirmary. Architect, Arthur Marshall, King Street.

Paisley.—Four-storey tenements in Well Street.

Perth.—Reconstruction for rebuilding of the Academy.—Alterations to Sharp's Institution.

Plymouth.—New Church of St. Martin's.

Stockport.—Extension to Dial Stone Lane Isolation Hospital.

Swansea.—Refreshment rooms and other buildings in Cwmdonkin, Victoria, Dyfatty and Llewellyn Parks. Town Clerk.—Fifty houses in Cwm Road, and fifty-three houses at Trewyddfa. Town Clerk.

Tipperary.—Tenders are invited for an electric lighting and power laundry installation at the Union Workhouse. Consulting Engineer, Mr. L. J. Lawless, 27 Castlewood Avenue, Rathmines, and tenders by December 10th.

Wellingborough.—Rebuilding of Empire Theatre.

Wolverhampton.—Proposed King's Memorial wing at General Hospital.

MISCELLANEOUS

Aberdare.—Tenders are invited by November 26th for incandescent lamp fittings for street lighting; electricity meters; current limiters; time switches and fuses. Particulars from the Town Clerk.

Birmingham.—The Corporation require 60 electric tramcars. Particulars from the General Manager, and tenders by December 12th.

Newcastle-on-Tyne.—The Trimdon Grange Colliery Co. require tenders for electrical fittings, etc., during the coming year. Particulars from Walter Scott, Ltd., Trimdon Grange, County Durham, by December 10th.

Spain.—According to the *Board of Trade Journal* a concession has been granted to the Societa Anonima Varese per Imprese Elettriche for the construction and working of an electric tramway from Varese to Masnago.

A concession has been granted to the Companie General de Tranvias de Valencia for the working of an electric tramway from Catarroja to Silla (Valencia).

Turkey.—*The Board of Trade Journal* states that the date for receiving tenders for the construction and working of tramways in Constantinople has been extended to December 28th. A copy of the specification may be seen at 73, Basinghall Street, London.

TENDERS RECEIVED AND ACCEPTED

London: *Battersea.*—The tender of Messrs. Spagnoletti for three feeder pillars at £78 has been accepted.

Lowestoft.—Subject to the consent of the Local Government Board to the necessary loan, a tender for new condensing plant has been accepted at £1,224.

Perth.—A tender of Messrs. Babcock and Wilcox for mechanical stokers at the Electricity Works has been accepted.

Sheerness.—The Gas and Electric Lighting Companies are in competition for street lighting. The Works Committee favour the use of electricity for street lighting, and recommend the acceptance of a tender by the Electric Lighting Company for 75 lamps at £2 2s. per lamp per annum, which is nearly 50 per cent. less than that of the Gas Company.

APPOINTMENTS AND PERSONAL NOTES

Mr. F. M. Long, Borough Electrical Engineer at Norwich, has been allowed to undertake the work of superintending the running of the Cromer Electricity Works.

Mr. C. E. D. Greenhalgh, late Assistant Engineer at the Malvern Electricity Works, has been appointed Resident Electrical Engineer to the Rainhill Asylum, Liverpool.

Mr. W. Perren Maycock, M.I.E.E., has been appointed lecturer on electric wiring and wiring calculations at the South-West London Polytechnic, Chelsea, S.W.

A foreman stoker is required, with experience of water tube and Lancashire boilers, economisers and superheaters. (See an advertisement on another page.)

The salary of Mr. E. E. Hoadley, Borough Electrical Engineer at Maidstone, has been fixed at £300 per annum and a bonus of one-fifth of the saving in cost per unit sold each year, the maximum salary not to exceed £500 per annum.

The Stoke-upon-Trent County Borough require a meter reader, arc lamp trimmer and mains jointer. (See an advertisement an another page.)

Mr. Lloyd Jones, Station Superintendent at the West Ham Electricity Works, has resigned, in order to enter into partnership with the firm of Messrs. Murray and Co., 21 Walbrook, London, who have business relations with many of the principal power users of this country. Mr. Jones will devote his attention to consulting upon steam raising. He has been presented with a desk by the staff of the West Ham Electricity Department and a silver cigarette case by Mr. H. H. Couzens, the West Ham Electrical Engineer.

Telegraph Traffic.—On the 18th inst., the line between Saigon-Annam and Tonkin was restored, but on the same day communication between Rome and Constantinople was down for a short while, and failed again on the 19th. The El Arich-Hanekin route stopped working on the 19th inst., and on the same day the cable between Tangier and Cadiz was interrupted.



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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 15s. to £60 per ton (last week, £59 15s. to £60).

Vitrite Lamp Cap Patents.—The following firms announce that they are prepared to defend, at their own expense, any action in respect of patent infringement regarding the use of vitrite caps on lamps of their manufacture:—The British Thomson-Houston Co., Ltd., Cryselco, Ltd., The Edison and Swan United Electric Light Co., Ltd., Imperial Lamp Works (Brimsdown), Ltd., Osram Lamp Works, Ltd., Pope's Electric Lamp Co., Ltd., Robertson Electric Lamps, Ltd., The Sunbeam Lamp Co. Ltd., and The "Z" Electric Lamp Manufacturing Co., Ltd. Particulars regarding the patents in question were given in ELECTRICAL ENGINEERING, November 3rd, page 695.

Lantern Slides.—Messrs. Siemens Brothers' Dynamo Works, Ltd. (Caxton House, Westminster, S.W.), have issued an extended list of the lantern slides of electrical engineering subjects, which they keep in stock and are willing to lend lecturers, etc., free of charge. Many new subjects are included since the last list was issued, and the total number of slides is now 117.

Liquidations.—A meeting of the "Z" Electric Lamp Syndicate, Ltd., will be held at Orient House, New Broad Street, London, on December 9th, to hear the liquidator's account of the winding up. This, of course, is merely the pioneer company of the present "Z" Electric Lamp Manufacturing Co., Ltd.

We are requested to state that the voluntary liquidation of the Westminster Tool & Electric Co., Ltd., of Palace Chambers, Westminster, is due entirely to private reasons, and is not in any way due to its inability to meet its obligations. Not only have all creditors been paid in full, but the shareholders also have been paid in full, with the addition of a substantial dividend.

In consequence of the sale of the business of Telegraph & Telephone Instruments, Ltd., to the Helsby Wireless Telegraph Co., Ltd., the company is to be wound up voluntarily. Particulars of claims should be sent to Messrs. A. Baker and J. H. Webb, 25 Victoria Street, London, not later than November 23rd.

Bankruptcy.—The last day for receiving proofs in the bankruptcy of J. A. Bauer, trading as the Electrical & General Engineering Co., 17 Gracechurch Street, London, is November 30th. The trustee is Mr. G. Corfield, Balfour House, Finsbury Pavement, London.

Dissolutions of Partnership.—R. G. Nye and R. C. Budge, electricians and dealers in electrical apparatus, 69 Leather Lane, London, have dissolved partnership. R. G. Nye continues and P. J. Budge joins the firm.

R. E. Robson and A. E. Coleman, Electrical Engineers, Haymarket Lane, Barras Bridge, Newcastle-on-Tyne, have dissolved partnership. R. E. Robson continues.

Buenos Aires Exhibition Award.—Messrs. Pirelli, Ltd., have been awarded the Grand Prix for their wires and cables by the International Jury at the Buenos Aires Exhibition.

Concert.—The Satinette Association (Employees of Messrs. Pinchin, Johnson and Co., Ltd.) will hold their third annual concert on Friday next, at the Stratford Town Hall, in aid of the funds of the West Ham Hospital. Mr. A. C. Hill, managing director of the company, will take the chair.

Plant for Sale.—Messrs. Leo Sunderland and Co., 39, Victoria Street, London, have a quantity of electrical apparatus, including motors, switches, etc., for sale.

Manufacture of Storage Batteries.—The Sandycroft Foundry Co., Ltd., announce that they have taken over the accumulator business previously carried on by Messrs. W. O. Rooper & Co. and the Epstein Accumulator Co., and have erected up-to-date premises at Sandycroft (near Chester) for the manufacture of storage batteries. A note on these batteries is given in our "Catalogues Received" column.

Forthcoming Books.—Messrs. E. & F. N. Spon (57 Haymarket) announce that the 1911 edition of their "Architects' and Builders' Price Book" will be divided into two sections: "Memoranda and Tables" (2s. 6d. net) and "Prices and Diary" (2s. 6d. net). The work has been carefully brought up to date.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ARC LAMPS.—A leaflet and a folder from G. Braulik call attention to the 1910 pattern "Eclipse" flame arc lamp. This was fully described in ELECTRICAL ENGINEERING, July 14th, page 462. The lamps are made for 6, 8, 10, and 12 amperes for continuous and alternating current for 10 hours' burning. The mechanism is very simple and entirely without clockwork.

METAL FILAMENT LAMPS.—A new folder relating to Foster metal lamps is being issued by the Foster Engineering Co., Ltd. (Morden Road, Wimbledon, S.W.). These can be supplied in large quantities to the trade, and can be over-printed with any contractor's name and address.

ARC LAMPS.—A new illustrated catalogue of "Davy" flame and enclosed arc lamps is being issued by Arc Lamps, Ltd. (Sphere Engineering Works, St. Albans). The Davy "Sunrae" flame lamp is constructed on the four converging carbon principle without clockwork clutches or shunt coils. The carbons are held in V frames, and pass through a nozzle at the lower end of the frame where they meet and support each other, being fed downwards by a gravity weight, making contact at the lower end of the carbons through the frame nozzle, and thereby all need of the metallic strip through, or electro coppering of the carbons. The lamp is fitted with a special patented form of ventilating corona, by means of which the globe is kept free from carbon ash deposit; therefore the full illuminating efficiency is maintained throughout the entire run of the carbons. No inner globe is used. The enclosed lamps, which are listed in a number of forms, are also shuntless.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

STORAGE BATTERIES.—The Sandycroft Foundry Co., Ltd. (Sandicroft, near Chester), who, as announced in our Business Notes, are taking up the manufacture of storage batteries, have produced a complete catalogue giving full particulars of the cells in question. The positive plates are of the Planté type, and special measures are adopted to eliminate all impurities. The design of the plates is such that the useful formed area is eight times the face area. The negatives are of the box pattern, and a special mixture is employed for the active material. Glass separators are used. The sizes at present listed range from 70 to 2,520 ampere hours for lighting and central station cells. Small ignition batteries are also made.

ARC LAMPS.—A revised list of arc lamps for continuous and alternating currents is to hand from Siemens Brothers Dynamo Works, Ltd. (Supplies Dept., 39 Upper Thames Street, E.C.). This contains particulars of the well-known Siemens open type shunt and differential lamps, as well as of the "Caxton" flame arc lamp with vertical carbons. Single and double enclosed lamps are also dealt with, and the lists of accessories and spare parts are very complete.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Companies to be Struck off Register.—The following will be struck off the register of Joint Stock Companies in three months unless cause is shown to the contrary: General Electric Inspection Co.; Simplified Underground Conductor Co.; Telephonic Bell Push Syndicate; Anglo-Spanish Electricity Co.; Chemical & Electrolytic Syndicate; Cycle Electric Lamp Co.; Electrical Castings & Engineering Co.; Greville Electric Inventions; Harwich Electric Lighting & Tramways Co.; Mexican Gas & Electric Light Co.; North Wales & District Light Railway and Electric Power Syndicate; Peru Telephone Co.; Traction Company of the United Kingdom; Tramway Traction Co.

Provincial Tramways Co.—The accounts for the year to September 30th show that a total dividend of 1s. 5d. per share has been paid on the ordinary shares for the year. The sum of £8,000 has been set aside for reserve and depreciation, and £2,831 carried forward. The annual meeting was held on Friday, Mr. Andrew Beattie, chairman of the company, presiding. He drew attention to the great tendency on the part of local authorities to increase the valuation of tramways, and hoped that a better state of things might soon exist. The Portsmouth Street Tramways Co. propose to extend tramways at Gosport to Lee-on-the-Solent. This at present is very inadequately served, he said, and it was difficult to get from there to Portsmouth.

Richardsons, Westgarth & Co.—The report for the year to August 25th shows a profit of £15,142, but after providing for debenture interest and directors' fees, there is a loss of £5,157. This result is an improved one compared with the previous year, and all departments of the three works at Hartlepool, Middlesbrough, and Sunderland are well occupied with work. The auditor's report calls attention to the fact that no provision has been made for depreciation for the past three years.

Buenos Aires Lacroze Tramways.—The gross receipts for the year to June 30th were $3,820,500. The sum of $555,110 has been transferred to repairs fund, and $47,500 to reserve. The sum of $750,000 has been distributed as dividends, and a balance of $3,152 carried forward.

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ELECTRICAL ENGINEERING

No. 205 [Vol. VI., No. 48] THURSDAY, DECEMBER 1, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

Official Notices and Technical College Announcements are inserted at the rate of Ninepence per line (column width).

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Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

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SUMMARY

Our monthly Supplement on Electrical Engineering in Mines is given with this issue. It opens with an illustrated description of the electrical equipment of the Leven Colliery, Fife, which includes mixed-pressure turbine plant. An official report on electricity in mines in 1909 is reproduced, and accounts are given of various meetings where electrical mining matters have been discussed. At one of these Mr. Clothier read a Paper on "Switchgear for Mines." Mr. S. Mavor also chose the power equipment of collieries as the subject of his address to the Glasgow Section of the Institution of Electrical Engineers; while Mr. J. G. Wilson opened a discussion on "Electric Winders," at the Newcastle Section. Some new motor controllers and a fire-damp safety cut-out are also described.

The libel action by Messrs. Griffiths & Bedell against Sir John Benn has again occupied Mr. Justice Ridley and a special jury throughout the week. The evidence on both sides has been completed, and the final speeches are now being delivered. Evidence was given by Prof. S. P. Thompson, F.R.S., Mr. S. Sellon, and Mr. R. W. Weekes in favour of the G.B. system, and Mr. A. P. Trotter spoke to having witnessed some satisfactory trials in the Mile End Road. Sir John Benn contended that all his criticisms were based upon the reports of the Council's officers, who disagreed with Mr. Mordey's reports. He also claimed that many of the statements objected to were pure political criticism not directed against the system or the owners of it. Mr. Justice Ridley on Tuesday suggested ignoring the statements made in the L.C.C., as he thought they were privileged, and, in any case, would not help either side if the case rested on these statements alone. (Page 759.)

A demonstration was held last week of an automatic electric recording target designed by Mr. S. A. M. Rose, of Melbourne. (Page 760.)

Gustav Byng, chairman and founder of the General Electric Co., died last week. (Page 761.)

A mono-rail hoist with power-driven travel, suitable for large works, goods warehouses, &c., is described and illustrated. (Page 762.)

A paper by Mr. Haydn T. Harrison on "Street Lighting" was discussed last week at Manchester and in London by the Institution of Electrical Engineers. The Paper gave particulars of cost of lighting by tungsten lamps in cases where gas had been superceded, and dealt also with various questions relating to efficiency, distribution of light, and cost of street lighting, both by tungsten and arc lamps. In the discussions the need for improved street illumination as the traffic became faster was emphasised, and the suggestion was made that a committee of the Institution might draw up a specification for street lighting. (Page 763.)

Mr. Robert Hammond has given his award in the arbitration between the Paisley District Tramways Company and the Paisley Corporation as to the price to be paid for electrical energy. He has decided that the price should be at the rate of £4 15s. per kilowatt per annum *plus* 0·475d. per unit. He describes the method by which the maximum demand is to be arrived at. (Page 765.)

Among the specifications published by the Patent Office on Thursday was one by the Lancashire Dynamo & Motor Co., for a system of driving planing machines, in which a quick return movement is obtained automatically. C. Kratt describes a water heater comprising a tube of insulating material filled with carbon granules, through which the current is passed. The water is both heated and filtered by its passage through the tube. Opposition has been entered to the grant of a patent to A. F. Berry for a heat storage system for cooking apparatus, and other patents are opposed. Siemens-Schuckertwerke Ges. offer to sur-

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render a patent for a three-carbon flame arc lamp, in which the swinging carbon is not impregnated. (Page 766.)

Potteries Electric Traction Co. are seeking authority to abandon certain lines authorised a few years ago.—The Beckenham Council are sending a letter of protest to the Local Government Board at the manner in which Mr. H. R. Hooper conducted a recent inquiry.—The Scarborough Tramways Co. have not yet commenced a winter service; a receiver has been appointed in respect of debenture interest.—A public electrically-controlled time service is to be inaugurated in Blackpool.—The Cornwall Electric Power Co. are commencing operations.—London County Council Fire Brigade Committee have suggested certain precautions in respect of Coronation electrical illuminations next year.—A further difficulty has arisen between the Stepney Council and the L.C.C. with regard to the overhead trolley system. (Page 767.)

The Barking Council require a 400-kw. Diesel engine set, reversible booster, &c.; Leyton Council, a 600-kw. mixed-pressure turbo-generator; Islington Council, a high-tension switchboard; and the London County Council, tramway materials. Loans are proposed as follows:—Leicester, £12,000; Ealing, £20,000; Edinburgh, £37,000; Heckmondwike, £24,159; Llandudno, £2,322; Newport, £31,000; Finchley, £10,000; and Southwark, £6,909. (Page 768.)

At the meeting of the Oxford District Tramways Co. last week, it was stated that the arrangement to have a combination of conduit and overhead traction has caused delay in raising the necessary capital. (Page 770.)

Postponement of Institution Dinner.—On account of the General Election, the annual dinner of the Institution of Electrical Engineers (originally fixed for December 6th), has been postponed to Thursday, February 2nd, 1911.

ARRANGEMENTS FOR THE WEEK

SATURDAY, DECEMBER 3rd.

Association of Mining Electrical Engineers.

3.30 p.m. Newcastle Branch, at the Durham University. (1) Continued discussion on "Examination Question." (2) "Inspection and Repair of Electrical Plant Underground," by R. R. Smith.

MONDAY, DECEMBER 5th.

Royal Society of Arts.

8 p.m. Cantor Lecture III. "Industrial Pyrometry," by C. R. Darling.

TUESDAY, DECEMBER 6th.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At University. "The Methods of Braking in Electric Winding Engines," by Dr. E. Rosenberg.

WEDNESDAY, DECEMBER 7th.

Institution of Electrical Engineers: Yorkshire Section.

7 p.m. At Sheffield University. "The Cost of Cooking and Heating by Electricity," by A. J. Cridge.

Association of Engineers-in-Charge.

8 p.m. At St. Bride's Institute, Fleet Street, London. "Practical Notes on the Working and Control of Steam Boilers," by J. B. C. Kershaw.

Committee for Protection of Electrical Interests.

8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Discussion *re* wiring premises, &c., and powers under Electric Lighting Acts.

THURSDAY, DECEMBER 8th.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. "The Magnetic Properties of Iron and its Alloys in Intense Fields," by Sir Robert Hadfield, F.R.S., and Prof. B. Hopkinson, F.R.S.

Institution of Electrical Engineers: Dublin Section.

8.20 p.m. At Royal College of Science.

Rugby Engineering Society.

8 p.m. At 29 Regent Street, Rugby. "Electricity in the Himalayas," by B. F. McMurtrie.

FRIDAY, DECEMBER 9th.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. "Recent Progress in Electric Lighting," by Prof. E. W. Marchant.

Telegraph Traffic.—The cable between Oran and Tangier was repaired on 26th inst.—The El Arich route was stopped between Jaffa and Gaza, but was restored on the following day.—Communication between Rome and Constantinople is still down.



PERPLEXED CONSUMER (*quoting from Mr. Balfour's speech at the Albert Hall on Tuesday night*): "... I believe it has only to be *understood* to be approved by the mass of our fellow countrymen."

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THE G.B. SYSTEM IN THE MILE END ROAD

In the action by Messrs. Griffiths & Bedell against Sir John Benn for libel in respect of certain statements made by him relating to the G. B. contact system in the Mile End Road, Mr. W. M. Mordey continued his evidence on Wednesday last week. Mr. Mordey's argument was that the system is a perfectly feasible and possible one, even under conditions of London traffic, there being no more practical difficulty in running it than the conduit system. Immediately he found out the difficulties that had to be met it was a simple matter to overcome them. The only alteration he made in the original design by Mr. Bedell was the addition of the condenser device for extinguishing arcs. He said that experiments had shown that the extra current consumption on the system compared with the conduit system involved an expenditure of only 1/100th of a penny per car mile.

In cross-examination by Sir Edward Clark, Mr. Mordey said he was very surprised that the London County Council officials had been salting the track without notifying him, apparently with the desire to make his task more difficult. He was confirmed in this opinion by the fact that the salting car seen by Mr. Bedell had only been traversing the half-mile of track then being experimented with. As a matter of fact, it was not at all improbable that the track had been salted during the summer months before he was called in, as samples of mud and water taken at that time showed 2½ per cent. of sodium. He was at a loss to account for the 19 per cent. extra current, which, according to one of the reports of the Lorain system at Wolverhampton, was required. The effect of Mr. Mordey's evidence was that he stood by every statement made in the report to the London County Council, in which he recommended that the whole of the track from Whitechapel to Bow should be treated in the same way as the experimental half-mile was treated under his supervision.

Professor Silvanus P. Thompson, F.R.S., gave evidence in support of the G. B. system, which he regarded so highly that he had abandoned the system which he had invented in conjunction with Mr. Walker, as he realised he was superseded. Mr. A. P. Trotter, Electrical Adviser to the Board of Trade, spoke as to what he had seen of the G. B. system, but was prevented by his official position from expressing any opinion as to the merits of this or any other surface-contact system. Mr. Stephen Sellon and Mr. R. W. Weekes also spoke highly of the system, the former having recommended it at Oxford.

The case for the plaintiffs was concluded by evidence from Mr. Maurice Hird, assistant engineer to Mr. Bedell, and the foreman of the men supplied by the G. B. Company to instruct Messrs. Dick, Kerr & Co's men in the laying of the electrical portion of the road work. Both these witnesses stated that they had repeatedly complained as to the manner in which the work was being done in respect of the details mentioned by Mr. Bedell, but that all the objections were without avail.

Sir Edward Clark then submitted that there was no cause for action on the part of the plaintiffs, on the ground that neither of them were personally mentioned in the alleged libels. He admitted that there might be cause for action in respect of a trade libel applied to them in respect of a system with which they were connected, but they had to show malice and special damage, but there was no evidence of either. He further claimed that the statements made by Sir John Benn in the London County Council, which were included in the libels, were privileged.

Mr. F. E. Smith, for the G. B. Company, stated that the mention of the G. B. system in the libels clearly referred to Messrs. Griffiths & Bedell, and that Sir Edward Clark's submission on this point was not well founded. He further contended that the libels complained of were not trade libels in any sense of the word, and further that the use of language purporting to express knowledge and authority upon a certain subject could in itself be evidence of malice. As to speeches in the London County Council, he contended that they were only privileged in a qualified manner, and that this privilege could be absolutely destroyed by evidence of indirect motive.

Mr. Justice Ridley said the case should go to the jury.

Sir Edward Clark then briefly addressed the jury. He argued that all the statements made by Sir John Benn were comment upon the matter of public interest, and only in respect of the system as laid down in the Mile End Road, and that he was as clearly entitled to an opinion upon it as the highest expert in the country. It was Sir John Benn's duty, holding the position he did in London government, to draw attention to what was going on in the Mile End Road. He complained of the attack made upon the officials of the London County Council in connection with the system, and felt it was his duty to put in evidence which would clear them from the very serious charges that had been made.

Sir John Benn, in his evidence, said that he had no malice against either Messrs. Griffiths or Bedell, and that throughout he was only criticising the system as laid down in the Mile End Road. The basis of his criticisms was a report of Mr. Fell on July 21st, 1908, in which the Council were recommended to withdraw the cars from public service, and in which figures of accidents were given, and the generally unsatisfactory conditions described. He had also had information from Mr. Gordon, L.C.C. Member for Stepney, and Mr. B. S. Strauss, M.P. for that district. This information referred to the terror of the inhabitants and the accidents to horses, which were described to him as having been roasted. He further stated that, as a business man, he did not think any surface contact system was a desirable thing for London, and had been opposed to its adoption from the commencement. Sir John Benn also referred to the report of Sir Alexander Kennedy, who first advised the Council with regard to tramways in which surface-contact systems were generally condemned for a place like London. He felt he was justified in calling the system the "Mordey" system as it had been modified by that gentleman in a most important respect.

In cross-examination Sir John Benn expressed the opinion that business firms dealing with public bodies were liable to their goods being made the subject of public discussion. He agreed that any criticism in this way must be based upon true facts, and he was there to justify the facts upon which he relied. If the system as laid down in the Mile End Road represnted the G. B. system, then he had attacked it, and meant to do so. He agreed that the G. B. system had been used against him as a political weapon, and that he had used it to retaliate. Asked as to whether he had made inquiries to satisfy himself that the officers' reports were true, Sir John Benn said he had made every inquiry, but Mr. Justice Ridley interposed that he did not think he had. With regard to the statement as to "roasted horses," this was obtained from Mr. Gordon, and it was generally known that a horse had been badly burned on one of the studs. In reply to this Mr. Greer, K.C., who has been called in to assist in the case for the plaintiffs, went through the list of alleged accidents, and pointed out that in the majority of cases no claims had been made for compensation, and that in the case of one horse £45 had been paid. His other expression as to "trusts," "financiers," "company influences," "royalties," and so on, Sir John Benn said were merely political controversy, and must not be applied in a commercial sense in any way. In reply to questions by Mr. Justice Ridley as to whether he had inquired of the G. B. Company regarding the system, witness said he had not, but pointed out that on the opening day both Mr. Griffiths and Mr. Bedell made no complaint to anybody, and seemed perfectly satisfied.

In re-examination Sir John Benn said until the writ was served upon him in the action he was not aware of the statements that were complained of, and was not even given the opportunity of denying the imputations suggested.

Mr. H. H. Gordon, L.C.C., was then called, and mentioned numerous mechanical details in which, in his opinion, surface-contact systems were unfitted for adoption in a place like London. Apart from his own inspections of the system in London and at Lincoln, he had information from text-books that these systems were more inefficient than other systems, and in cross-examination instanced an article by Mr. I. E. Winslow in the 1904 edition of "Modern Electric Practice." In no surface-contact system was there, in his opinion, adequate provision for the safety of the public.

Mr. A. L. C. Fell, Chief Officer of the London County Council Tramways, dealing with the car equipments, said that difficulties arose immediately the G. B. Company were not granted the contract for the road work, and the officials of the Council were placed in the difficult position, that the Company, although supplying drawings and parts of the equipment, refused to be responsible for any of it. It was clearly understood from the beginning that the car equipment had to be fitted to the existing bogey cars without alteration, and every facility had been given for this to be done. The reason was that the London County Council had spent a considerable sum of money in standardising the parts of their cars, and alteration would interfere with the whole plant.

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It had been complained that he had only given approximate measurements, but he could not do otherwise owing to the large number of parts under the cars that were rough castings and not machined. He had always told Mr. Bedell to get his measurements direct from a car. So far as he was aware the Tramways Department had not suggested the gun-metal insertions to the magnets complained of by Mr. Bedell.

Mr. Fell continued his evidence on Monday. Although the G. B. Company had objected to the Board of Trade inspection, he understood from an interview he had had with them that the objection was withdrawn, and that the difficulties with the magnet on the cars had been overcome. He had, as a matter of fact, recommended the purchase of 12 further equipments for the cars, and this hardly indicated that he was trying to condemn the system. Mr. Bedell had promised to help to produce a magnet that would be effective, as the first equipment fitted by the Company was not successful. Neither the single nor double-magnet equipment gave satisfactory results, and although he differed from Mr. Bedell as to the pull of the two types, the first two-magnet equipment made by himself actually gave a stronger pull in practice than did Mr. Bedell's. He attributed the difficulties mainly to the higher speeds run in London as compared with Lincoln, and denied that he had ever suggested 40 amperes as the starting current of the cars. It was fixed at 60 at an interview between him and Mr. Bedell, but the resistance designed by Mr. Bedell would not allow 60 amperes to pass through it. The experiments on the half mile which was overhauled by the Company were, in his opinion, inconclusive, and all through the running was unsatisfactory and the system inefficient, having in view the public safety. There was also the consideration that a large number of lines elsewhere in London were not being proceeded with owing to this experiment not proving the success it was anticipated. He personally had no knowledge of the salting complained of. He only hammered studs on one occasion in order to test his theory that a horse's hoof could make a live stud, and he succeeded in getting five live studs out of seven.

During his cross-examination Mr. Greer said he wished to make it clear that he did not suggest dishonesty on the part of Mr. Fell by the hammering of the studs. It was Mr. Fell's opinion that the current consumption was excessive compared with other systems, and Mr. Bedell himself had put the energy required for the magnets at 7 per cent. There was also the extra weight of the cars to be taken into account, and other things. The magnets which he had made were of soft axle steel, and gave quite good results, although they were only used temporarily. He disagreed with Mr. Bedell's views that his own magnets were the cause of live studs: there were a considerable number during the time that Mr. Bedell's own magnets were being used. He was honestly of the opinion that Mr. Mordey's experiments were inconclusive, although the results were better after those experiments than before.

On Tuesday it was decided between the parties that the access boxes and sump pits had had nothing to do with the failure of the system.

Mr. Maurice Fitzmaurice, Chief Engineer to the Council, said that he had persevered with the system, and was quite desirous of making it a success, but after the public running he had come to the conclusion that it would not stand the conditions of London traffic. He had suggested the modification of the access boxes because he was convinced the design of Mr. Bedell's would not stand London traffic. He had only suggested an alteration in the construction of the stud, and when Mr. Bedell objected he did not press the modification, and he did not think there was much complaint to be made on that point. He was certainly under the impression that the reduced royalty to £500 per mile was upon the same basis as the original offer of £800 per mile, and that Mr. Bedell would superintend the construction and advise the Council's officers generally in regard to it. Many of the difficulties had arisen through Mr. Bedell refusing to do this. He emphasised the point that Mr. Bedell's complaints about the sumps only referred to the leakage of mud and water through the concrete and not to gas. After Mr. Mordey's reports there were still live studs, and it was for that reason that he decided it was inadvisable to go on.

Mr. Bowden, Rolling Stock Superintendent to the L.C.C. from 1905-8, denied that he had done anything more than make suggestions in order to assist in fitting the G. B. equipment to the cars. Evidence was also given by Mr. J. C. Way, Assistant to Mr. Fitzmaurice; Mr. Horne, Resident Electrical Superintendent of the Northern Section of the L.C.C. Tramways; Mr. A. S. Campbell, Engineer for the Construction of Tramways; and Mr. Venn, Clerk of Works in Charge of Construction Work. All these witnesses gave evidence to the fact that everything that was done in the laying of the track and electrical equipment was tested, and passed by the men provided by the G.B. Surface Contact Co. The driver of the salting cart on the occasion mentioned by Mr. Bedell, was also called, and proved that he had salted both tracks between Aldgate and Bow under the general instructions, owing to the conditions of the weather.

This closed the case for the defendants, and Sir Edward Clark commenced his final speech to the jury. At the close of the day, Mr. Justice Ridley suggested that, in order to reduce the number of points to go to the jury, he proposed to ignore the alleged libellous statements made in the County Council. He considered they were privileged, and did not think they would help the plaintiffs if the case went against them, and that no attention would be paid to them if the jury found for the plaintiff on the first libels.

AN ELECTRICAL RECORDING TARGET

WE were present at the invitation of Rose's Recording Targets, Ltd. (13 and 14 Abchurch Lane, E.C.), at a demonstration on Wednesday of last week of an electric recording target which has been developed by Mr. Sydney A. M. Rose, of Melbourne.

The principle on which the apparatus works is as simple as the way in which it is worked out is ingenious. Inside the target is a roll of paper which can be wound from one drum to another by an electric motor when required. The paper passes behind the actual card target, upon which the bull's eye or other design is marked, and the bullet passes through both. At the time of shooting the paper band is at rest, but when the shot is made and the signal of the position of the hit is desired, the motor is started through a relay from the firing position by a push button, and the paper is drawn over a metal roller over which is a row of spring contacts. As soon as the hole in the paper passes over the roller, the spring corresponding to the position of the hole makes contact, and a signal is sent in the manner described below

Between each adjacent pair of spring contacts is a section of a resistance, more or less of which is placed in the signal circuit according to which spring makes contact, and therefore according to the position of the hit. A source of constant voltage is included in the circuit, and thus the current sent depends on the vertical co-ordinates of the hit, while the horizontal co-ordinate determines the time which elapses from the starting of the motor to the receipt of the signal.

The receiving instrument at the firing position takes account of these two variables in the following way.

In the interior of the instrument there is a moving coil milliampere meter, with its pointer working vertically. This is mounted on a swivelling platform, which can turn the whole movement round so that the pointer is given a horizontal motion. The tip of the pointer carries a small white ball, and moves behind the suitably curved glass screen forming the front of the instrument, and having painted on it the bull's-eye, &c. The glass is sufficiently obscured to allow only the white ball on the pointer to be visible. The rotating platform carrying the milliampere meter is driven through a worm and a pulley mechanically connected by cords to the motor at the target, and thus moves the pointer across the screen with a motion corresponding to that of the paper of the target. The vertical movement of the pointer when a signal current is flowing is determined by the strength of the current supplied, and therefore by the position of the hit on the target. So that, if all adjustments are correct, at the moment of signalling the position of the visible tip of the pointer relatively to the screen corresponds exactly to the position of the hit on the target.

To follow the cycle of operations, suppose the apparatus is set for a shot, that is to say, a fresh section of the paper roll in the target is exposed, and the paper is at rest. The shot is made, and the button is pressed to start the motor. The milliampere meter starts turning round as the paper is rolled in until the hole caused by the bullet passes under the contacts, when a current is sent which deflects the pointer to the right extent, and at the same time actuates another relay which stops the motor. The pointer is thus brought to rest in the required position. When the apparatus is to be reset, the button is pressed again, the motor starts once more, and rolls up the rest of the section of paper until a permanent hole dividing the sections of the paper is reached, when a current is sent and the motor stops automatically. The turning platform in the indicator, having reached the end of its travel, is returned mechanically to the starting position by a spring device, which causes the disengagement of the worm during the return.

It is easy to see that, if desired, a running man can be painted on the paper and shot at while the paper is in motion, when the position of the shot will be recorded as soon as the paper reaches the end of its travel. It should be mentioned that only three wires are required to connect the target and the indicator.

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OBITUARY

GUSTAV BYNG.

GUSTAV BYNG, one of the pioneers of the electrical industry in this country, the founder and chairman of the General Electric Co., died on Wednesday, November 23rd. Although he was only fifty-five years of age, his constitution had, for many years past, been undermined by a mortal complaint, against the remorseless advance of which he made a brave but unavailing fight. A few years since, his health became too impaired to allow him to take much part in the administration of the great firm, of which, in conjunction with his intimate friend and co-worker, Mr. Hugo Hirst, he had been founder some twenty-seven years ago. But he continued to take the deepest interest in the General Electric Company, who were able, almost to the last, to profit by his valuable advice and that genius for finance and decision in affairs which had raised the General Electric Company from comparatively small beginnings to its



Gustav Byng.

present proud position amongst the electrical companies of the world. To the late Mr. Byng's family, to whom, in conjunction with his intimate friends and business associates, we proffer our deepest sympathy, his loss is, of course, a cruel blow, yet they have one great consolation inasmuch as he was privileged to enjoy that which has been denied to many great men who have made their mark in the world. It was his happy lot to see two of his sons taking an active part in the business; one of these young men as a member of the directorate, has developed a remarkable aptitude in practical organisation, and has displayed great business acumen. A third son, who carried off a gold medal at Faraday House, is pursuing a further course of studies at Harvard University, while a fourth son is studying law with a view to joining the General Electric Co. in another capacity.

Born in Bavaria in 1855, Gustav Byng received a sound education at the Augsburg Polytechnikum, a school of higher scientific instruction. He came to this country in 1873, at the early age of eighteen, and in 1879 he became a naturalised Englishman. It was about this time that he commenced business on his own account as an electrical engineer and manufacturer of electrical apparatus, and found a kindred spirit and co-worker in Mr. Hirst, whose administrative talents and technical ability was of the utmost value to him in the great work of his life—the building up and constant expansion of the General Electric Company. This great work has occupied some twenty-seven years. The works were originally at Manchester, at the old Peel Works, where the Peel-Connor telephones are now made. But the main works of the company were moved some years ago to Witton, near Birmingham, where 106 acres were purchased as the site of the necessary workshops and other buildings. Mr. Byng took the keenest interest in this great work of development, and supervised with the utmost care the necessary financial arrangements. At Witton, as is well known, there are now, besides engineering shops for the manufacture of the largest electrical machinery, spacious arc lamp and switchboard shops, electrical carbon and chemical factories, steel and brass tube works, an iron foundry, and power-house with a present capacity of 2,500 h.p., and the comfort of the employees is provided for by comfortable mess-rooms, club houses, and workmen's cottages adjoining the works. An idea of the magnitude of the business can be obtained from the fact that no less than 8,000 people are now employed in the various manufacturing and other establishments of the firm in this country alone, there is another large factory in Birmingham, one in London, and, besides the head office in London, branch offices and agencies in all the more important towns in the United Kingdom and abroad.

Mr. Byng was an ardent Tariff Reformer, and long before that movement had reached its present development had placed his views on the necessity of protecting the economic life of the nation, by means of a scientific tariff, in a work entitled "Protection," a source from which such distinguished champions of tariff revision as Mr. Joseph Chamberlain and Mr. Bonar Law have publicly acknowledged having received inspiration. He fought the fight for Tariff Reform when that policy had but few adherents, and it was largely due to his own efforts that the Tariff Reform League, of whose Council he was a member, was founded.

Mr. Byng was a member of the Institution of Electrical Engineers and many other technical and public bodies, and was a strong advocate of combination and co-operation in industry. In the latter connection he has done valuable work as chairman of the Manufacturers' Association of Great Britain, in dealing with industrial legislation, and procuring modifications in foreign and colonial tariffs in favour of British manufacturers.

CORRESPONDENCE

STARTING OF INDUCTION MOTORS.

To the Editor, Electrical Engineering.

Sir,—Mr. Frank Broadbent's description and sketch of connecting protective gear in a motor circuit is interesting, but how does he propose to adapt same to an induction motor where the starter is usually in the rotor circuit while the overload gear is connected on the stator side?

Yours, &c.,

Rugby, A. C.
November 25th, 1910.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 *Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.*

"British Standard Specification for Steel Conduits for Electrical Wiring." The Engineering Standards Committee's Report, No. 31. Revised. (London: Crosby Lockwood & Son.) 5s. net.; by post in U.K. or abroad, 5s. 2d.

"Standard Handbook for Electrical Engineers." Third Edition. (London: McGraw-Hill Book Co.). 17s. nett. By post in the U.K., 17s. 4d.; abroad, 17s. 6d.

"*Mechanical World* Pocket Dairy and Year Book for 1911." (Manchester: Emmott & Co.) 6d. nett. By post in U.K. or abroad, 8½d.

The Deinhardt-Schlomann Series of Technical Dictionaries: Vol. X.: "Motor Vehicles, Motor Boats, Airships, and Aeroplanes." (London: Constable & Co., Ltd.) 12s. net, by post in U.K., 12s. 4d.; abroad, 12s. 8d.

"Exercises in Electrical Engineering." By Prof. T. Mather and G. W. O. Howe. (London: Edward Arnold.) 1s. 6d. net; by post in U.K. or abroad, 1s. 8d.

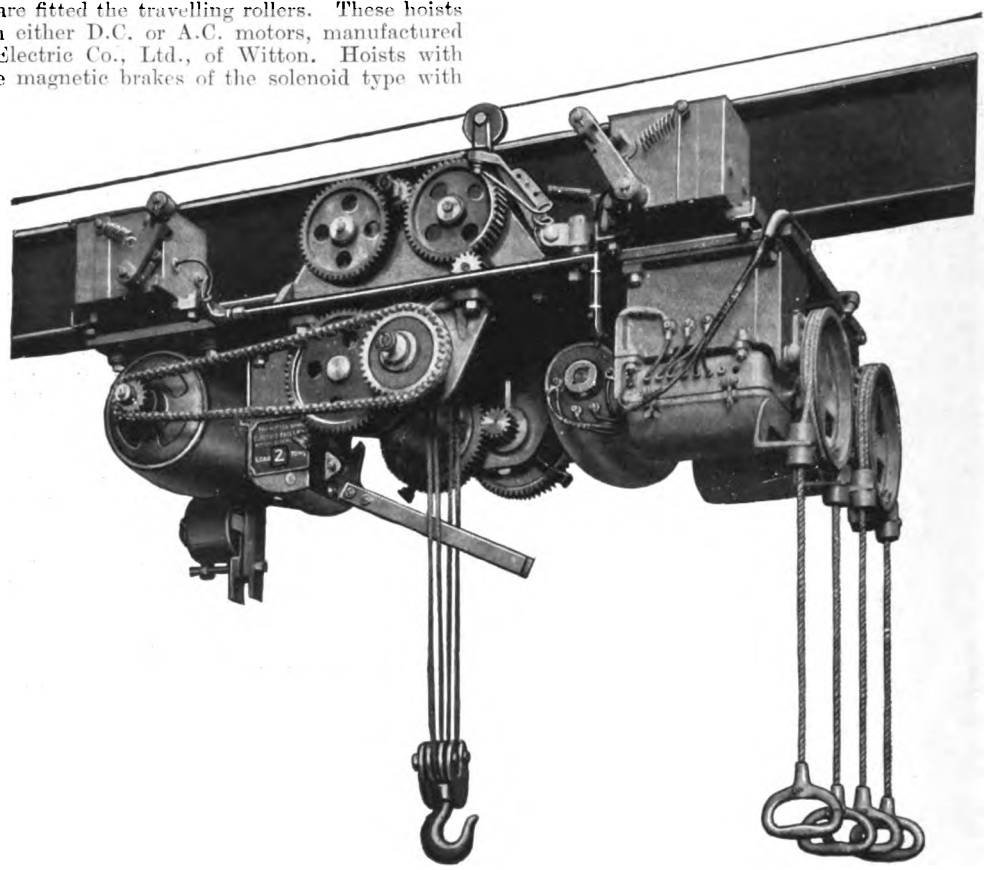
"Elektrische Beleuchtung." By Dr. Ing. Berthold Monasch. Second edition, enlarged. (Hanover: Dr. Max Jänecke.) Paper cover, 9s. 3d.; cloth, 10s.

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ELECTRIC TRAVELLING HOISTS

THE accompanying illustration shows a 2-ton mono-rail hoist manufactured by the Witton-Kramer Electric Tool & Hoist Co. (Witton, Birmingham), and suitable for transport duty in works, warehouses, gasworks, railway goods stations, &c. As shown, it is constructed to run along the under flange of an I-section steel joist, and is controlled from below by four ropes which operate the motor controllers. One motor drives the winding drum, and a separate motor is geared to the four travelling rollers. The motors and controllers are bolted to the under side of a steel plate, on the top of which are fitted the travelling rollers. These hoists are provided with either D.C. or A.C. motors, manufactured by the General Electric Co., Ltd., of Witton. Hoists with D.C. motors have magnetic brakes of the solenoid type with



2-TON ELECTRIC POWER TRAVEL HOIST.

leather-lined brake shoes. This brake is electrically interlocked with the controller, so that it opens when the current is switched on and closes when the circuit is broken, holding the full load in any position. Hoists with A.C. motors are usually provided with mechanical brakes operated from the controller shaft. When required, provision can be made for opening the brakes by means of a separate pendant cord, so that the load can be lowered by gravity without employing current. The controllers are of the drum reversible pattern, with wire or grid resistances, and can be worked by pendant cords as shown, by remote control from a controller fixed on a wall, or from a cab fixed to the hoist itself. A high-speed chain drive is generally used for the first reduction; the remaining reductions are obtained through machine-cut spur-gear. A rope-guiding device permits considerable side pull without the rope overlapping or coming off the drum. Current is collected from the stretched contact wires by trolley wheels with universal swivel motion. The over-winding switches are of the self-replacing swivel-lever type, and are actuated by the sheave block when it reaches its highest position.

Besides the above pattern, this firm makes suspension hoists, comprising a similar gear for suspension from a beam or girder, or for converting the hoisting motion of an existing hand or steam cranes to electric drive by attaching the hoist to the lifting hook of the crane.

A number of illustrated lists have been issued by the Witton-Kramer Co., and can be obtained from them or from the General Electric Co., Ltd. (67 Queen Victoria Street, London, E.C.). Besides the above specialities, these deal with electric winches of various patterns and capacities, with worm, spur, or friction gearing, electric capstans, portable tools, and lifting magnets for loading, unloading, and transporting pig-iron, scrap, plates, steel joists, rails, &c.

TANTALUM AND ONE-WATT LAMPS

AN example of the use of the tantalum lamp for outdoor decorative illumination purposes, where, of course, they are subjected to all the rigours of the weather, is shown in the accompanying illustration of a band-stand in London. Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston), report increasing sales of these lamps, and anticipate a heavy demand in connection with Christmas.

The firm are now placing upon the market a 200-c.p. "Onewatt" lamp. This lamp will be made for voltages from 100 to 130 and 200 to 250 in 200 c.p. The efficiency of the lamp will be precisely the same as that of the 100-c.p. "Onewatt" lamp at present on the market, and the filaments are made of drawn tungsten wire. The prices of the 200-c.p. "Onewatt" lamp will also compare favourably with those of



BAND-STAND LIGHTED WITH TANTALUM LAMPS.

other types of high c.p. lamps at present on the market. They will be supplied with E.S. or B.C. caps as required in spherical bulbs only, the sizes of which will be $9\frac{7}{8}$ in. long by $6\frac{3}{4}$ in. diameter.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203-206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

ELECTRICAL EQUIPMENT OF THE LEVEN COLLIERY

THE Leven Nos. 1 and 2 pits belonging to the Fife Coal Company have formed a very good subject for a comprehensive scheme for electrifying the wasteful steam haulage and pumping plants which were formerly in use above and below ground, so reducing to a marked degree the big coal bill that was formerly a very serious item in the operating costs. With this end in view the Company considered favourably the adoption of mixed pressure turbo-generators, and installed in their power-house two British Thomson-Houston Curtis 750 kw. mixed pressure units, designed to give 450 kw. on exhaust steam and the remaining load on high pressure steam at 100 lbs. per square inch. The generators are wound for 2,750 3,000 volts 50 cycles, and each has its own direct-coupled exciter. A separate steam-driven exciter is also installed for stand-by purposes.

The governing and regulating arrangements for both high pressure and low pressure valves are controlled automatically on the hydraulic principle, and the makers guarantee that the variation in speed from no-load to full-load is not more than 2 per cent. Emergency valves are fitted on both high-pressure and low-pressure inlets. The general arrangement of the set is seen in Fig. 3, and a view of one of them is given in Fig. 1.

The condensing plant by Messrs. Körting Brothers is of the multi-ejector type, designed to pass 2,200 gallons of water per minute. To deal with the circulating water two Körting pumps, coupled by "Zodel-Voigt" couplings to a B.T.H. 80 h.p. squirrel-cage induction motor running at 945 r.p.m., have been installed in the basement. These motors are controlled by oil-immersed auto-transformer starters with fuses on the running side. One pump deals with cold water from the cooling pond and discharges through the condenser. The second delivers the hot water from the hot well through the cooling apparatus, comprising Körting spray nozzles, which operate over an area of 1,000 square yards. The spray nozzles, however, are only designed to deal with 1,600 gallons of water per minute, the additional 600 being made up from the pit, and the equivalent quantity allowed to overflow to waste from the hot well. The last condenser to be installed, which is of an improved type, has given exceedingly good results, a 29 in. vacuum with the barometer at 30·3 having been obtained. Steam being available at this point, the company have put in Körting ejectors to prime the pumps in the place of having foot valves on the suction ends of the pipes, the time taken to fill the 12 in. suction pipe 100 ft. in length being only two minutes.

The switchboard, part of which is seen in Fig. 1, was supplied by the British Thomson-Houston Company, and is of the stone cell type, each panel being equipped with isolating switch, interlocked with the doors, so arranged that it is impossible to open them till the oil switch is tripped. There has also been a small transformer and switchgear installed in the power house to enable small motors to replace the steam engines about the pithead, and so dispense with a large network of small steam pipes.

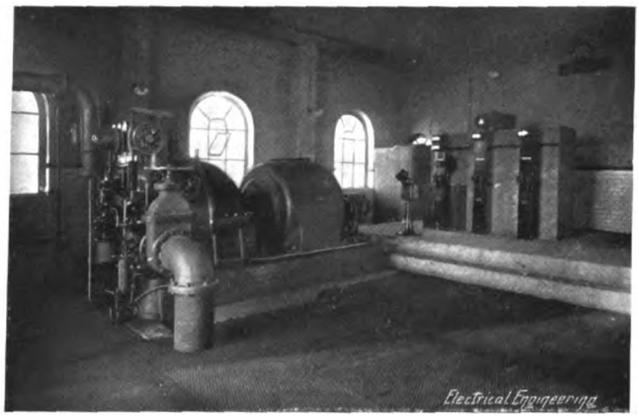


FIG. 1.—EXHAUST STEAM CURTIS TURBO-GENERATOR AND H.-T. SWITCH GEAR.

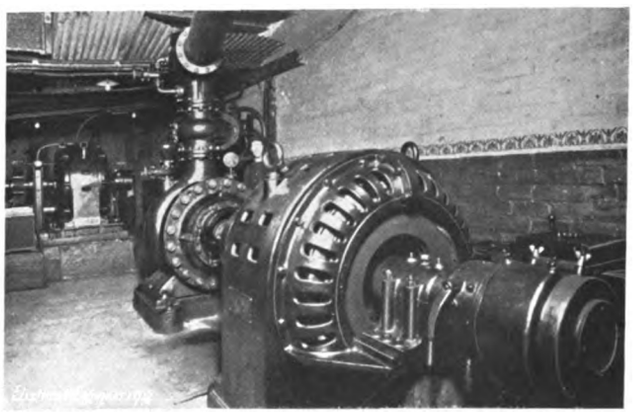


FIG. 2.—UNDERGROUND PUMP ROOM.

When dealing with the underground plant one of the first considerations was the pumping question. To deal with this, the existing pumping plant comprises on the surface, a single cylinder direct-acting pumping engine operating spear rods, the cylinder being 100 in. diameter by 11 ft. 6 in. stroke. This pump is capable of dealing with about 1,000 gallons per minute when working at 3½ strokes per minute. As a stand-by there

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are two steam pumps which raise the water in two lifts, one pump situated in the shaft bottom lifting 30 fathoms, the second pump being placed at a 30 fathom level, and discharging the water to the surface, a distance of 120 fathoms.

It was decided to discard the underground steam pumps, and these now have been superseded by a high-lift turbine pump. The pump is of the 5-stage Sulzer type, capable of delivering 1,200 gallons of water per minute to a head of 900 feet, and it is direct coupled by a flexible coupling to a 510 h.p. Dick, Kerr motor of the slip-ring type. This pump runs continuously during the week, and the shaft pump, which forms a stand-by, is run during the week-ends. The turbine pump above mentioned is the biggest in Scotland.

The old steam-driven haulage gears underground being within the radius of some 80 yards from the pit bottom, the question of cable distribution is not a very big one. Five complete conversions were carried out. The motors with the extension shafts and outboard bearings were mounted on substantial cast-iron base-plates, which also carried the second motion shafts. The first motion gear was all steel with cut teeth with cast-steel pinion on the second shaft to gear into the existing spur wheel on the haulage drum shaft, the old steam-driven haulages being all geared up. In two cases only was it found possible to keep in the old steam engines, but the work of the conversions was carried out between Friday and Monday, thereby causing very little interruption to the working of the colliery.

The haulage motors are by Dick, Kerr & Co., of Preston, and are of the continuous rating type, capable of developing two and a half times normal full-load torque at starting. The controllers are of the special oil-immersed reversing type, with resistances to give 75 per cent. speed reduction, and special high resistance in the first step for slow starting.

The pumping plant which pumps out of the low workings has also been increased, a turbine pump having been installed. This set is made up of a B.T.H. 150 h.p. slip-ring motor, direct coupled to a Worthington high-lift pump, capable of delivering 600 gallons of water per minute through 1,000 yards of piping against a vertical head of 80 fathoms. Each motor is controlled by a motor panel containing oil-immersed triple-pole automatic switch with ammeter, and potential transformer for pilot lights.

The cable for the underground distribution is of the 3-core solid bitumen type, with a single layer of galvanised steel armour. The shaft, however, being very wet, it was thought advisable to put in single-core in special grooved casing made for the purpose.

Several high-tension motors have been installed on

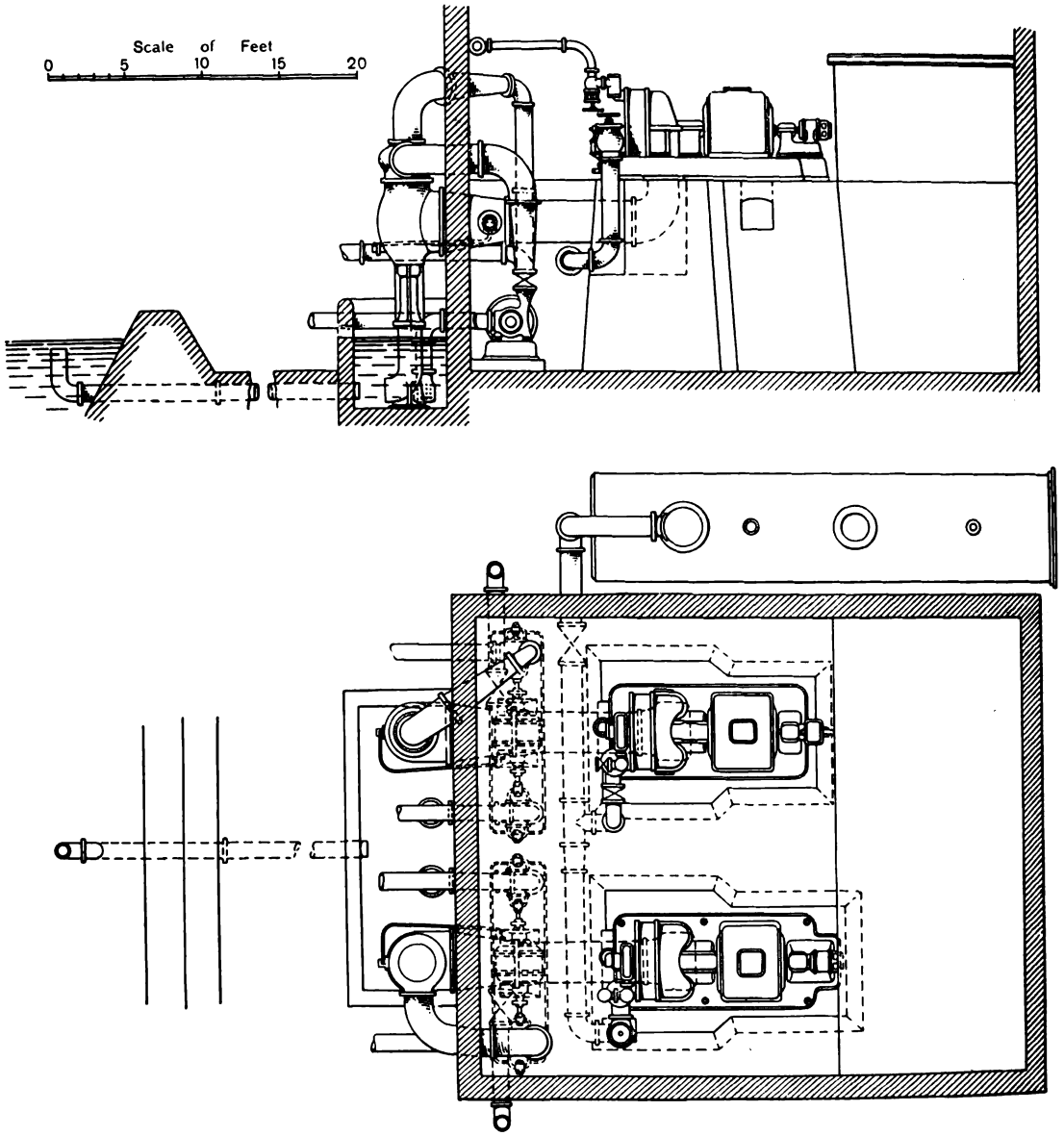
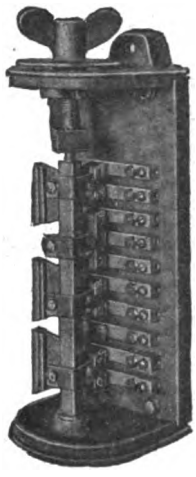


FIG. 3.—GENERAL ARRANGEMENT OF TURBO-GENERATORS.

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"Electrical Engineering
Dec. 1, 1910.

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THREE-PHASE CONTROL GEAR

These Star-mesh Switches are designed for starting motors with short-circuited Rotors; they are simple and soundly constructed, and suited for the most severe working conditions. Quick make and break—ratchet device to prevent controller shaft being turned the wrong way— : : these are two of their good points : :

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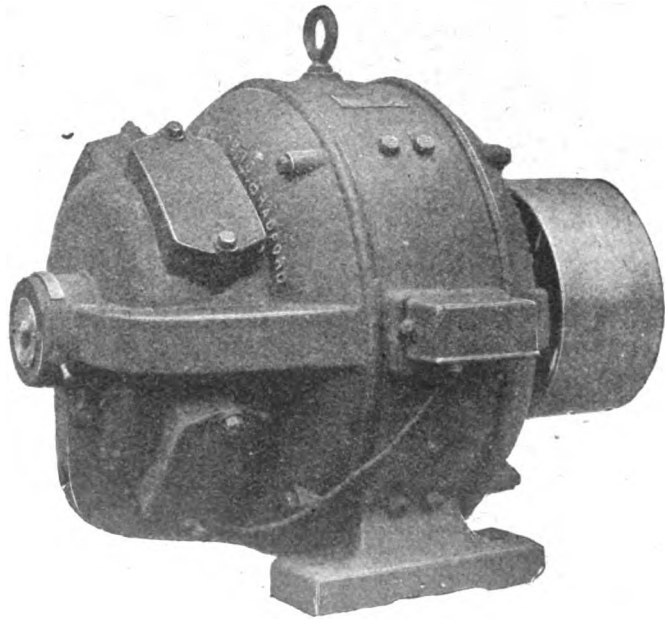
Union Electric Co Ltd
PARK ST. SOUTHWARK. LONDON. S.E.

And at NEWCASTLE-ON-TYNE, CARDIFF, GLASGOW, MELBOURNE, SYDNEY, JOHANNESBURG, &c., &c.



D D O Switch.

PHŒNIX



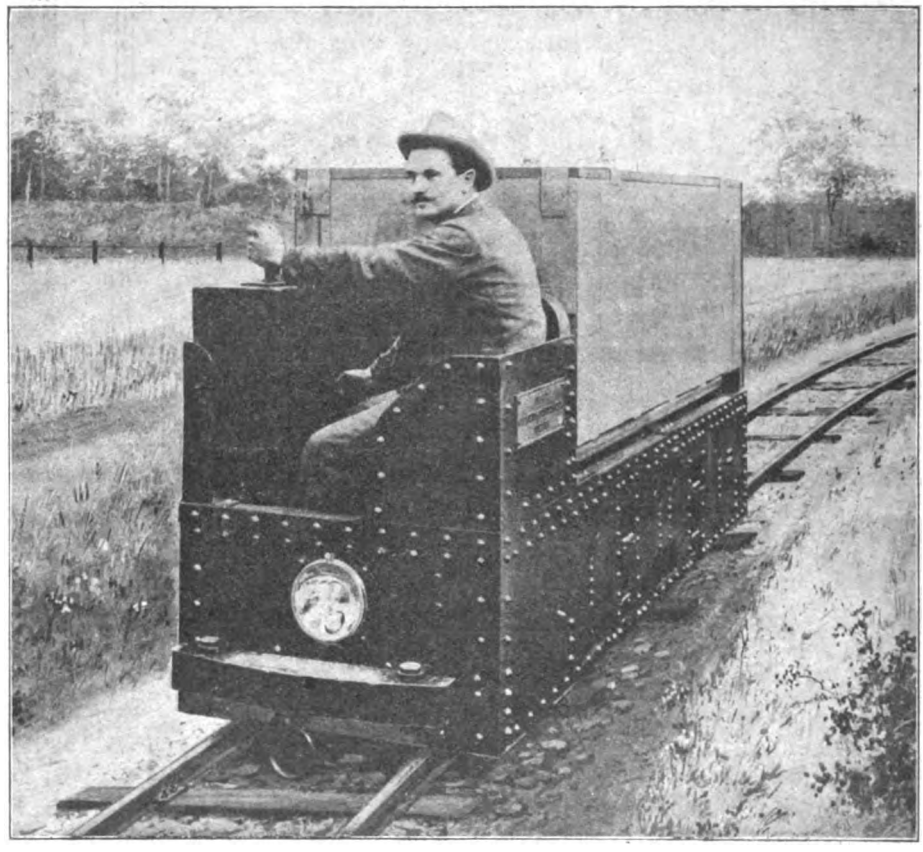
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the surface, and the washery, screens, and workshop have all been electrified. To enable the steam to be entirely cut off the shops, the steam hammer has been removed and a Massey compressed air hammer has been substituted. These hammers have been found to give very good results. The total horse-power in motors for pumping and haulage is 1,440, and the average load on the turbine is about 700 kw.

The question of earthing of the various apparatus at this colliery has been very carefully attended to. In every machine room a copper bar has been fixed up in a suitable place and a stranded earth-wire attached to this from the various pieces of machinery, and an earth-wire is carried from the bar and fixed to the armouring of the feeder cable with a substantial gland.

In conclusion, we wish to express our thanks to Mr. H. Gordon Fraser, chief engineer to the collieries, for the information contained in this article, and for putting drawings and photographs at our disposal.

ELECTRICITY IN MINES IN 1909

IN Part II. of the general report and statistics for 1909 of the chief inpector of mines, some interesting remarks by Mr. R. Nelson (Electrical Inspector of Mines) are included on the subject of electricity in mines. Mr. Nelson remarks that it is not possible accurately to determine what increase there has been in the aggregate horse-power of electric motors in use in mines during 1909, but that increase must have been very substantial. As regards coal-cutting machines, an increase over last year's figure of 40 machines is reported, representing, perhaps, 1,200 h.p. Altogether, at the end of the year there were 777 electrically-driven coal-cutting machines in use, representing not less than 20,000 h.p. in the aggregate. It is, however, obvious that the all-round use of electricity in mines cannot be estimated from a consideration of this figure, for electricity is now applied to every operation requiring mechanical power in and about a mine. The three-phase system of distribution is now firmly established. Apart from the question of electric shock, continues Mr. Nelson, this is a development which will promote safety in operation, and is to be welcomed. As regards electric shock, statistics would seem to indicate that a shock from alternating current is more likely to prove fatal in underground conditions than one of the same voltage from direct current; though it may be that one year's statistics is not sufficient upon which to base a generalisation of this kind.

During the year 1909 there were in all 15 fatal accidents as a result of the use of electricity in coal mines, causing 23 deaths. Three accidents causing nine deaths were due to ignitions of explosive gas by electricity. Two of these, causing seven deaths, were the result of using open-type apparatus, the presence of gas being unexpected by the workmen in both cases. The third was due to a defective "gas-tight" joint between a switch-box and its cover. Of the remaining 12 accidents, 11, causing 13 deaths, were electric-shock accidents, and all took place underground. There was no fatal accident from electricity on surface works throughout the year. Six out of a total of 13 deaths caused by the 11 electric-shock accidents were due to inefficient earthing of outer coverings of apparatus. The most important safeguard there is from electric shock is an efficient connection to earth for all parts liable to become "live" in case of breakdown, and liable to be touched by any person. Three deaths due to defective apparatus were due in each case to contact with bare "live" parts of cables. Three deaths were due to ignorance or excess of zeal in attempting to examine or repair defective apparatus before taking the precaution to cut off the pressure. One death was due to the failure of apparatus, which was unsuited to the circumstances of its use. The eleven electric-shock accidents are tabulated as below:—

Accidents on direct-current systems	2	Deaths ...	2
Accidents on three-phase systems	9	Deaths ...	11
	11		13
Accidents from shocks of 250 volts or less ...	4	Deaths ...	5
Accidents from shocks between 250 volts and 650 volts	6	Deaths ...	7
Accident from shock above 650 volts	1	Death ...	1
	11		13

Ignitions of fire-damp and electric shock account for 14 out of a full total of 15 fatal accidents. The remaining accident, causing one death, was due to a fire which broke out in a motor room in a mine near the down-cast shaft bottom. The smoke and fumes were carried in-bye, and they caused the death of the only man in the mine at the time of the accident, a fireman who was examining the workings before the commencement of a shift. If the fire had occurred after the shift had gone in the loss of life would in all probability have been great. The use of inflammable material, such as timber, in the construction of underground motor rooms should in all cases be avoided.

A number of non-fatal accidents were also reported. The most common occurrence was apparently "shock and slight burns," but in two cases "severe burns" were reported. There were at least three instances of successful resuscitation. In each case the Sylvester method was used, and in two out of the three cases efforts at restoration had to be continued for over an hour before the patient recovered consciousness.

On October 27th the Secretary of State appointed a Committee, consisting of R. A. S. Redmayne, H.M. Chief Inspector of Mines, C. H. Merz, Electrical Engineer, and R. Nelson, H.M. Electrical Inspector of Mines, "to inquire into the working of the existing Special Rules for the use of Electricity in Mines, and to consider whether any, and if so what, amendments are required." The Committee was engaged throughout the year on the work committed to it, and its report may be expected towards the close of the present year, 1910.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS—WEST OF SCOTLAND BRANCH

ON November 4th, a meeting of the Scottish Section of this Association was held in the Glasgow Technical College, at which Mr. Alexander Anderson presided.

The chairman, in his presidential address, briefly referred to the increasing application of electricity to colliery work. He therefore considered it necessary for colliery electrical engineers to obtain a better technical education.

The members of their Association principally consisted of (1) colliery managers; (2) consulting engineers; (3) manufacturers; (4) colliery electrical engineers.

Whilst all these members should be conversant with the applied uses of electricity in mines, he considered the colliery manager, with his many responsible duties, was unable to devote adequate attention to the subject. In favouring the advisability of the employment of trained electrical engineers on the colliery staff, or the engaging of a consulting engineer, he considered that the companies would thus obtain best value for the initial expenditure, and the most efficient installations manufacturers offer could then be arranged on their merits by adopting a fair standard of comparison, thereby tending to eliminate apparatus of inferior quality, and such as was not most suitable for the individual requirements of the work.

The consulting engineer should not be a pure theorist, but rather an electrical engineer with experience in colliery work, and thoroughly conversant with the necessity of advising the adoption of electrical improvements where the financial aspect was commercially sound.

It was undesirable to have separate mechanical and electrical engineers in charge of the same plant. It was preferable to have one man duly qualified in both branches, besides being able to attend to himself below ground without the guidance of the roadsman or other miner.

The secretary (Mr. D. Martin) intimated that the branch was now composed of 76 members.

Cumberland Branch of the Association of Mining Electrical Engineers.—A meeting of this branch was held on Saturday, Nov. 19th, at Whitehaven. No formal paper was read, but there was a general discussion as to procedure in respect of papers, and on the scope of the proposed examinations. Mr. Maurice's paper on "Electrically-caused fires and ignition of firedamp" is to be discussed on Dec. 17th.

Association of Mining Electrical Engineers—East of Scotland Branch.—A general meeting of this recently-formed branch was held on November 12th at the Carlton Hotel, Edinburgh, when Mr. H. Gordon Fraser gave an address on the objects of the Association. Mr. C. A. Carlow, of the Fife Coal Co., has accepted the office of honorary president of the branch, and Mr. T. Davidson (16 Rutland Square, Edinburgh) has been appointed honorary secretary.

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SWITCHGEAR FOR MINES

A PAPER entitled, "Switchgear and other Protective Gear for Use in Mines," was read by Mr. H. W. Clothier (Messrs. Reyrolle & Co., Ltd.), on November 12th, at the Heriot Watt College, Edinburgh, before the National Association of Colliery Managers. He said that we should endeavour to free electricity from the bad name attributed to it in some quarters in the past, by improving the controlling apparatus, and he proceeded to point out various directions in which this was possible, both as regards high tension and low tension work. Several interesting lantern slides were shown, illustrating the improvements in switchboard construction during the last 20 years, especially demonstrating the disastrous effects of having inflammable material on the boards. He expressed the opinion that automatic switches were more trustworthy than fuses; and one instance was recalled of a switchboard being completely destroyed through a fuse arcing instead of blowing when the circuit was overloaded. There was no attendant in the station, so that the terminals were burned away until the oil in the adjoining switch became ignited, thereby being the means of destroying the building and entire plant, and leaving a town in darkness for three days. The duty of a "system engineer" is to see that no stoppage of the supply occurs, and for this purpose he is provided with indicating instruments, and a chart of the entire network of distribution. At the Carville power station, where the high tension network and sub-stations are connected to a ring main, his services have proved of great value. It was specially mentioned that accidents might occur, whatever precautions were observed in the design and manufacture of switchgear, although these would be minimised by observing certain precautions. Several types of up-to-date iron-clad high and low tension switchgear were shown, both for use in mines and generating stations. A number of these were switch-pillars of the draw-out type, in which the complete gear could be drawn out of the high tension connections for inspection. Regarding isolating switches in air, the occasional short-circuiting of the cables causes a magnetic field, which may blow the link out of place unless locking gear is provided.

He classified the most important requirement in switchgear design as follows:—Accidental contact with metal whilst alive must be impossible. The insulation must be able to withstand any excessive pressure that is liable to arrive, even under abnormal conditions. The designs should not allow dust, dirt, moisture, or vermin to diminish the insulation. Fire risks must be eliminated. There should be a minimum amount of cleaning necessary to maintain the gear in a good condition. Parts requiring inspection and cleaning must be readily and absolutely detachable from the gear, to enable such operation to be carried out with safety. The sectional area of conductors must be such as to carry, without deterioration, the maximum overload to which they are likely to be subjected. Moving parts, such as switch mechanisms, must be situated where they can be observed, the chance of switches sticking must be reduced to a minimum. Automatic protection to be included, which will isolate the faulty section without interference with healthy sections. The construction to be mechanically strong in order to resist rough usage and accidental impact. The switches must be capable of breaking, without disturbance to other parts, the maximum power which may instantaneously pass through the switch when acting under the worst fault condition. The simplest construction is required, consistent with economy in operation and low maintenance costs. In cases where automatic protection is installed, more especially for coal-cutter work, it is preferable to make the design such that it is impossible for the men who are working the apparatus to lock off the automatic gear wilfully. Special attention in design is necessary to facilitate the removal of oil-switch tanks for the inspection of switch contacts. All connections and supporting framework to be held by means which cannot shake loose by vibration, that is, split pins, locking nuts, and washers to be freely adopted. Special attention is necessary to good mechanical design in attaching the armouring of cables to switchgear and such apparatus.

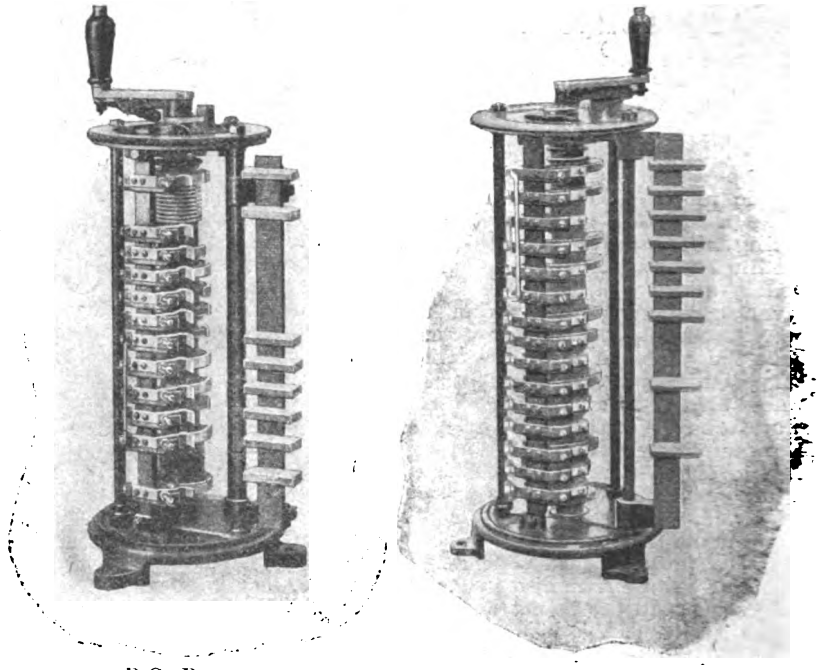
Discussion.

Mr. McGuppie agreed with Mr. Clothier in regard to totally enclosing all switchgear and making it fireproof. In his opinion it would only be a matter of time until the system advocated was generally adopted. He had heard that managers proposed to reduce the current inbye, whereas he considered they should reduce the pressure instead, as accidents arising from coal-cutters would then be less frequent.

Mr. Stevenson referred to the analogy between the strain thrown on pipes due to water hammer when a tap was suddenly closed, and the effect when an inductive electric circuit was broken. He agreed that iron-enclosed switchgear was most satisfactory underground, whilst concrete was to be preferred for surface work. Wood pillars should be substituted for iron in oil-break switches.

MOTOR CONTROLLERS

A NEW line of reversing controllers for A.C. and D.C. motors has been introduced by Messrs. A. Reyrolle & Co., Ltd. (Hebburn-on-Tyne). These are especially designed for severe service, as in shipyards, quarries, mines, &c., and on cranes, and are supplied either protected with a simple steel casing or oil-immersed in flame- and explosion-proof cast-iron tanks for use in fiery mines. The accompanying illustrations show a D.C. and an A.C. pattern respectively. The design is very simple, and in all cases the fingers are easily and cheaply renewable. These controllers can be supplied for all voltages up to 650, and in capacities up to 500 h.p. Star-delta switches for squirrel-cage induction motors and controllers with shunt regulators for D.C. motors, are also manufactured in this pattern. Our attention has also been drawn to the special advantages of the firm's double-revolution drum-type starter regulators, which, we understand, are selling in large quantities. This pattern was described and illustrated in Electrical Engineering, May 6th, 1909, Vol. V., p. 417. It is standardised in sizes up to 50 h.p., 500 volts, but larger sizes can be supplied.



D.C. Pattern. A.C. Pattern.

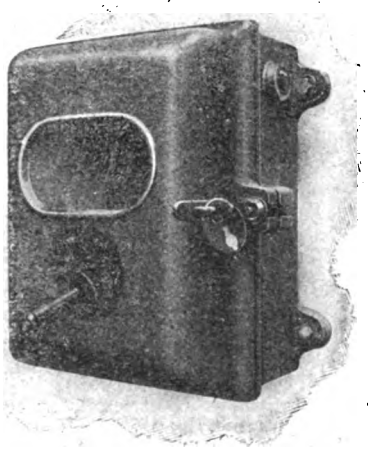
Reyrolle Reversing Controllers.

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28, HATTON GN LONDON, E.C.

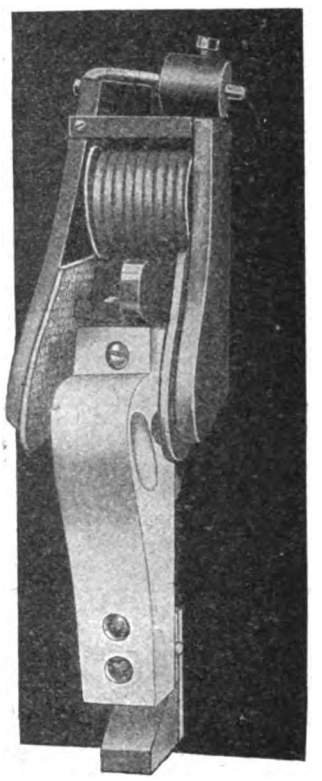
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SAVES FUSES **SAVES TIME** **SAVES MONEY**

D. P.
In Iron Case.



A BOON TO MOTOR USERS



Avoids the trouble of Fuses

"EASY REPLACEMENT"
(Patent)
CIRCUIT BREAKER
with Magnetic Blow Out from 20/-

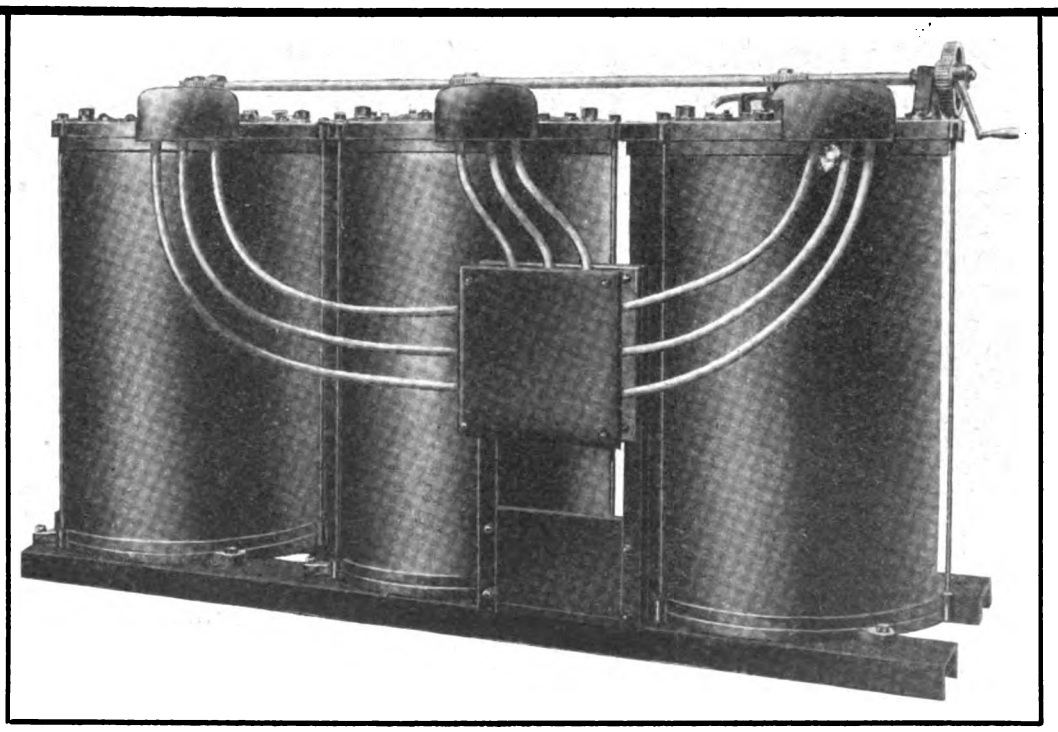
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THE POWER EQUIPMENT OF COLLIERIES

THE above was the title of the inaugural address of Mr. S. Mavor, as Chairman of the Glasgow Section of the Institution of Electrical Engineers. The introduction of electric power had been, he said, an inestimable boon to many industries, but to none were its services of greater value than to coal mining. In recent years, the demand for power at collieries had been greatly augmented owing to acceleration in the rate of winding, increased pumping, a higher standard of ventilation, the replacement of manual and horse haulage by mechanical means and the introduction of coal-cutting and conveying machinery at the face. Screening and washing plants were also extending, particularly in Germany, where also the by-product recovery plants that had been developed in connection with coke ovens had introduced new conditions.

Increased attention was now being paid to the cost of power with the increased magnitude of the plants and the greater stress of competition, and the electrical power engineer was becoming a more and more important man in mining work. Mr. Mavor drew some comparisons between German and English power plants, pointing out the more expensive and elaborate nature of the Continental generating stations, &c. As with the material, he said, so with the *personnel*; the colliery manager's standard of qualification was much higher in Germany than in this country, and he had at his command a highly educated staff of mechanical and electrical engineers. The capital expenditure in Continental collieries often amounted to £1 per ton of coal produced per annum. There was much of suggestion in the Continental practice, but there was at the same time much of warning.

In speaking of recent development of power plant, he remarked that turbine machinery of to-day owed its position to association with electric generators and motors, but was about to repay handsomely its debt to the electrical engineer by enormously increasing the demand for turbo-generators and high-speed motors. He then spoke of the great developments taking place, unfortunately more on the Continent than in this country, in turbo-pumps, turbo-blowers, and turbo-air compressors. In many foreign stations, not a single piece of reciprocating machinery was to be seen. He referred to the economies that had been brought about by the mixed-pressure turbine, but remarked on its tendency to "eat its own tail." An ample supply of exhaust steam from uneconomical engines might at first be available, but the electric motor had a way of displacing these engines, and as the electric load increased, the supply of exhaust steam diminished.

As regards the principal power application in a colliery, that of winding, Germany had given the lead in electrical methods, but the cost of equipments and restrictions imposed by power companies as to load fluctuation, had hindered its adoption here. With regard to pumping, he again emphasised the rapid supercession of the reciprocating pump by the turbo-pump. Turbo-air compressors were also being now built on the Continent up to 20,000 h.p. in single units. Electric motors had also gone far to displace other methods in underground haulage, but he uttered a word of warning against the use of too high-speed motors for this class of work. He thought that the rope haulage system of this country was more economical than the underground locomotives which are widely used on the Continent and in America. With regard to air-driven percussion tools, the electrically-driven compressor inbye had led to great gains in economy, particularly where a closed pneumatic circuit for individual machines had been used. Attempts to use inbye compressors for working long wall coal-cutters had, with one or two qualified exceptions, failed, owing to want of appreciation in the difference between the conditions. He suggested various ways by which better efficiency could be obtained, but thought that the arrangement had only a very limited sphere of application.

Coming to more general questions regarding electricity in mines, Mr. Mavor thought that the recent prosecutions for alleged infringement of the special rules had had a salutary effect. He awaited the report of the special committee on these rules with interest. One great difficulty was in the definition of flame-proof apparatus; more experiments were wanted on the subject, and he urged that the Home Office should encourage the testing of actual apparatus either in the experimental gallery at Woolwich Arsenal or that of the Association of Colliery Owners at Altofts, in Yorkshire. Fortunately for Scotland, the dangers from explosion were less than in other districts, and the restrictions in the use of electricity in their own mines need not be so strict as elsewhere. The Chairman then dealt further with the subject of compressed air transmission, and, in conclusion, put in a strong plea for the more extensive adoption of the long-wall system of machine mining, which could effect economies on a much larger scale than any amount of attention in the amount of fuel consumed for power purposes for the same extra capital expenditure.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during November.

Nov. 3rd.—Monthly supplement on ELECTRICAL ENGINEERING IN MINES, opening with a critical article on the Association of Mining Electrical Engineers, and containing an illustrated description of the electrical equipment of the Oakdale Collieries. Notes are given on mining electrical patents of interest published during October. A report of one of the branch discussions of the Association of Mining Electrical Engineers is also published, and the causes of some recent electrical accidents dealt with.

Nov. 10th.—Descriptions of some new fittings of robust design and some new patterns of arc lamps. Electric railway economics (single-phase *v.* continuous current), by H. M. Hobart. Electricity at the Motor Car Exhibition.

Nov. 17th.—Illustrated descriptive article on the new steam turbine power station at the Post Office. Account of some researches on the induction motor. The manufacture of stone from quarry debris. Westinghouse-Leblanc condensing plant. The electrical testing of water.

Nov. 24th. A letter suggesting a method of connecting motor starters. An article on the electric light and power scheme of the General Post Office. An original article on the relative advantages of aluminium and copper for low-tension feeders and distributors on underground networks.

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ELECTRIC WINDERS

ON Monday, November 21st, a meeting of the Newcastle Local Section of the Institution of Electrical Engineers was held at Armstrong College to discuss electric winders. Mr. C. Faraday Proctor took the chair. In opening the discussion Mr. J. G. Wilson pointed out that starting and stopping occurs once or twice a minute—less or more, according to the depth of the shaft. The net power exerted in raising the coal is relatively small, as the mass to be set in motion is 10 to 20 times as great as the coal lifted. At Harton Colliery the coal lifted at each wind is four tons, requiring a power, including friction, windage, &c., at full speed of about 700 h.p., but the maximum power required in acceleration is 1,500 h.p., as the total mass moved is 72 tons, and the rate of acceleration over three feet per sec. per sec. Mr. Wilson compared this with an electric train on the North-Eastern Railway, where 58 tons accelerated at one foot per sec. per sec., reaching a speed comparable with that of the pit-cage, takes 250 h.p. during acceleration. Some electric winders have speeds nearly double, and accelerations half as big again as at Harton. The cost of the plant increased very rapidly with increased speed of wind. The load factor of electric winders is very low; in the Newcastle area, on the basis of maximum power, half the total power employed in collieries is in winding; if considered on the basis of annual consumption, supposing all the colliery power work were done electrically, only about a quarter of the units consumed would be used in winding. The annual saving due to electric drive is proportional to the power averaged over the whole year, while the capital expenditure is more nearly proportional to the maximum power exerted.

Turning to the question of type of motor, Mr. Wilson stated that with three-phase motors, starting involves mechanical devices in connection with the liquid rheostat of the rotor (either to withdraw the electrodes or to pump the electrolyte), and as the time occupied has to be kept in practice to five to fifteen seconds, in large winders it can only be effected by an auxiliary motor. The power-factor at starting is low, especially if the motor is direct-coupled. When a D.C. motor is employed, it receives power through a motor generator with Ward-Leonard control. The large rheostatic loss is avoided, and a finely regulated control over the whole speed-range is effected. Automatic overwinding devices are easily applied, and the control can readily be made fool-proof. The disadvantage is that three machines involving increased first cost, losses, and risk of accident, are required. Where the speeds and accelerations employed are low, the motor-generator losses approach the rheostatic loss of the three-phase system, and these losses become relatively more important if the motor-generator has to be kept running for any time beyond regular working hours to wind men, &c. In the speaker's opinion winders of small size should be three-phase unless a D.C. supply is already in the colliery. From 200 h.p. upwards the D.C. winder has considerable claims. If a synchronous motor is used instead of an induction motor for the motor-generator in the Ward-Leonard system, the supply can be taken at unity power factor.

Mr. Wilson then dealt with flywheel systems. For a local supply the extra cost and complication is justified as the cost of extra plant to supply the peak during acceleration is more than the cost of the flywheel plant. For power-in-bulk systems the question is a matter for collaboration between the colliery and supply authority. The advantages of geared *versus* direct drive are obvious respecting first cost and facility for repairs. With double helical gearing 98 and 99 per cent efficiencies have been established. As with deep shafts nearly half the total mass to be accelerated is on the drum itself, doing away with this, and substituting a pulley of the Koepe or similar type, carrying only one convolution of rope, is a decided advantage. The Koepe pulley involves balancing the tension in the ropes connected to the cages by a balance rope, however.

Factors determining the economic advantage of electric as against steam winding are the value of coal available at the pit, and the cost of current available. The Eight Hour Bill has had a favourable effect by lengthening the working hours. Referring to the method of retaining the steam winder and installing exhaust steam generators for supplying the rest of the colliery power, Mr. Wilson pointed out that where cheap power was not available this deserved consideration, but was costly in capital and upkeep.

In a written communication, Mr. G. J. Hooghwinkel stated that the results obtained at the Great Western Colliery with their electric winder had fulfilled the expectations of the management. It had been regularly in operation for two years without stoppages due to breakdown. At one time a little trouble was experienced with the flywheel set, and this was shut down and winding continued without it. Although the current was taken from a power company on the basis of a fixed payment on the maximum demand for each month plus a small charge per unit (the whole charge totalling about ½d. per unit), the flywheel set was only used occasionally, as the fluctuation without the flywheel set was not excessive. The load factor of the engine was about 12 to 15 per cent., and the cost of coal wound was under 2d. per ton raised, including capital charges. Three-phase winders with liquid control gear, and supplied from turbine plant, could often be installed without flywheel sets. Messrs. Brown, Boveri had installed a plant lifting 7½ tons of coal thirty times per hour in a shaft of 800 yards depth at a colliery in Silesia. This comprised a turbine driving a D.C. generator for the winding motor (controlled on the Ward-Leonard system), and a three-phase generator for the colliery supply. The demand on the winding motor varied between 565 and 1,400 h.p., the turbine sets gave 1,740 kw. and 625 kw. respectively. The total first cost without boilers was £15,000. With a load of 115 tons of coal per hour, or half the useful load for which the engine was designed, figures of 15·5 lbs. of steam per unit, and 17 lbs. of steam per useful shaft h.p., were obtained. The speed variation was less than 2 per cent. between full load positive and full load negative on the winding generator, and the three-phase generator could not be thrown out of step. He had recently calculated the figures for a winding plant of about double the size of the one described for the same depth. The cost of the complete installation with Ilgner equaliser, and current at ½d. per unit, was £19,000, while with direct turbine drive it was £32,000. The cost per ton of coal wound in the first case was 2·7d., and in the second 1·7d.

Mr. W. C. Mountain (Ernest Scott & Mountain, Ltd.) thought that it was worth considering whether one could utilise the waste steam from existing engines. From the point of view of simplicity the three-phase winder with a slow-speed motor, preferably with plain copper bars inserted in mica tubes, had great advantages. In the Ilgner system there were several electrical links in the chain of operations, any one of which could go wrong. With regard to the question of cost, steam winders could work at a lower figure than that quoted by Mr. Hooghwinkel. The highest cost of winding by steam winders was 16s. per 100 tons. He did not see how electric winders were going to compete with steam winders unless the coal from the collieries was worth at least 10s. With regard to machine-cut helical gears, he had installed gears up to 100 h.p. running in oil perfectly silently and working satisfactorily. The Koepe endless rope wheel depended for its action on the grip of the rope on the wheel, and if the rope slipped the cages might break loose and go to the pit bottom. The use of a balance rope had in one instance caused a saving of 15 per cent. in coal consumption.

Mr. Woodyatt (Siemens Bros., Ltd.) said that the advantages of a simple direct drive with rheostatic control were that the first cost was less than in either the Ilgner or Ward-Leonard systems, and much less floor space was required; but the efficiency was not so good, and the control and regulating gear for large plants became unwieldy because the main current was dealt with. In South Africa existing steam winders had been converted to electric drive by coupling up a three-phase motor with rheostatic control. For new winders of medium and large size D.C. motors with Ward-Leonard control were supplied. His firm had in hand two large winding engines of the Ilgner type where the peak h.p. reached about 1,000. By heavy flywheels the demand from the mains would never exceed 400 h.p. With regard to the Koepe pulley, in small plants the question of the drums was not serious, but from the point of view of first cost and actual running expenses, heavy conical drums on big winders were a matter of great importance. The use of Koepe pulleys on large winders had made such plants compare favourably in capital cost with steam winders, as owing to the lighter weight to be accelerated the size of the winder motor and converter set could be reduced. It was impossible to get such high accelerations as with a drum, but there were several Koepe pulleys working satisfactorily with a hoisting speed of 66 ft. per second.

Dr. Rosenberg (British Westinghouse Electric & Manufacturing Co.) said that it was difficult to understand why the Koepe pulley had not been introduced in this country when its success on the Continent was considered. The climatic conditions could not be the cause, as the rope was always wet and greasy. An installation including a Koepe pulley would shortly be in operation about 40 miles from Newcastle, in connection with a plant winding 900 tons of coal daily from a depth of 800 feet; the machine was being installed by his firm on the Ward-Leonard system.

Mr. G. Stoney (C. A. Parsons & Co.) advocated the use of mixed pressure or exhaust steam turbines, using the waste

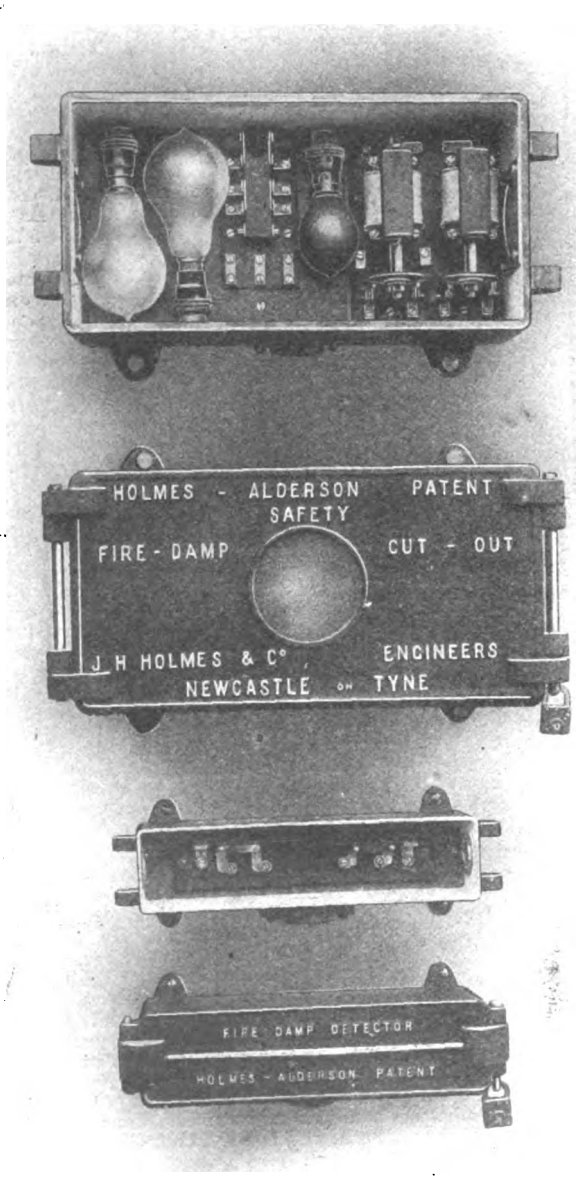
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steam from the winding engine. With regard to double helical gears, his firm's experience had been very satisfactory. The steamship *Vespasian* had a turbine of 1,600 revolutions connected by such gear to a propeller shaft running at 80 r.p.m., about 1,000 h.p. being transmitted through the gear. The vessel had made a considerable number of trips from the Tyne to Rotterdam without any noticeable wear on the gear.

The meeting was adjourned to complete the discussion.

FIRE-DAMP SAFETY CUT-OUT

MINING inspectors and others have repeatedly referred to the need for an automatic device to detect and indicate the presence of fire-damp and to cut off the current from electrical apparatus within the danger area before the percentage of fire-damp in the air reaches a dangerous amount. To supply this need an ingenious apparatus has been placed on the market by J. H. Holmes & Co. (Newcastle-upon-Tyne), under the name of the Holmes-Alderson fire-damp safety cut-out. The device will work with 2 per cent. of fire-damp, but can be adjusted to operate at any larger per-



FIRE-DAMP SAFETY CUT-OUT.

centage. The apparatus is contained in two separate cast-iron boxes as illustrated.

The detector itself consists of two compound metal strips, *E* and *F*, normally out of contact. Below these are coils of thin wire, of silver and platinum respectively. These coils are in series, and normally heat up both strips equally, so that they do not touch. Variations of temperature or voltage affect both strips equally. Should fire-damp be present,

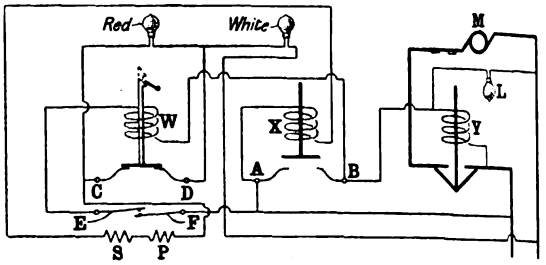


DIAGRAM OF CONNECTIONS OF FIRE-DAMP SAFETY CUT-OUT.

however, the platinum coil will increase in temperature due to catalytic action, and the strip *F* will bend up and close the circuit. This results in the solenoid switch, *W*, lifting and putting the red lamp in circuit by opening the short-circuit at *C*, *D*, and at the same time cutting down the current. Although the coils cool and the contact separates, the plunger of the solenoid *W* is held up by a catch. The air enters the detector box through openings covered with fine wire gauze as in a safety lamp.

In order that the device shall cut off the supply, a second solenoid switch, *X*, is provided. In its off position this closes two contacts, *A* and *B*, which are connected to the motor switch-gear in such manner that, when closed, they will cause the current to be cut off. This can be effected by connecting the two contacts, *A* and *B*, to the "no-voltage" release coil of the starting switch, but as it is possible for the attendant to switch current on again, it is recommended that a solenoid controlled main switch be employed, as shown in the diagram. If this solenoid switch be enclosed in a case, the attendant cannot switch on again until the solenoid *W* has been reset by the person having the key of the case. It will be seen that the solenoid *X* is in series with the heating coils and the two lamps. The core of this solenoid will remain lifted so long as there is any supply, and thus leave the two contacts, *A*, *B*, disconnected. Should gas be present and the strips come into contact, the reduction in the current due to the red lamp coming into circuit will cause the core of *X* to fall and make contact across *A*, *B*, and short-circuit the solenoid *Y* of the main switch. Although the strips separate, the main solenoid switch cannot be closed again until the red lamp has been short-circuited again by releasing the catch of the solenoid switch *W*. A switch is provided in the detector to short-circuit the heating coil under *E*, so that the apparatus may be tested periodically. The closing of this switch will cause strip *E* to cool, and come in contact with *F*, and thus operate the cut-out gear. If required, the apparatus can be supplied in a simpler form, for merely giving an indication that gas is present.

Miners and Electric Power.—At a representative meeting of the Federated Board of Miners, Enginemen and Firemen of Derbyshire and Nottinghamshire, held at Chesterfield on Nov. 5th, several speakers protested against inexperienced persons being in charge of electrical installations in mines, and suggestions were made that the electrical apparatus employed at some collieries was cheap and inefficient. A resolution pledging the Association to use its best endeavours to obtain proper safeguards in the new Miners' Act was passed. At a meeting of delegates from the Miners' Associations of South Yorkshire, resolutions were discussed, but not passed, relating to inspection and the use of electric power in mines. One resolution was against the supply of electric power beyond the safety zone in any mine.

Mining Patents.—The only patent specification published during the past month of particular interest to mining electrical engineers was No. 24,371 of 1909, by W. Alderson and J. H. Holmes, relating to the fire-damp detector and safety cut-out described on this page.

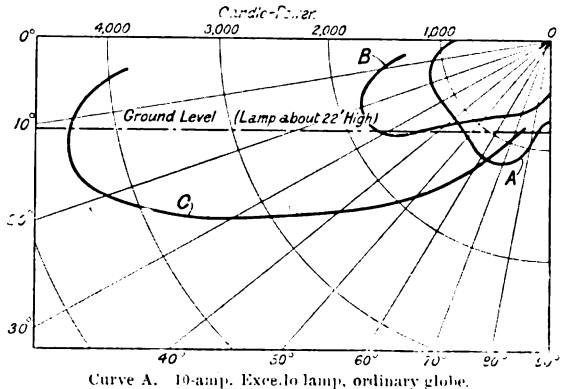
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STREET LIGHTING

MR. HAYDN T. HARRISON, in his Paper entitled "Street Lighting by Modern Electric Lamps," read before the Institution of Electrical Engineers in London on Thursday last, and in Manchester on the preceding Tuesday, remarked that the improvements connected with electric lamps which have taken place within the last two years have placed electrical engineers in a much improved position as regards competition with gas. Arc lamps were now available which give their maximum candle-power in the direction most suitable for street lighting, and for small units tungsten lamps were of great value, particularly where it was a question of replacing gas by lamps of about the same candle-power, and it was not advisable to scrap existing posts and lanterns. He instanced the case of Marylebone, where 1,964 gas lamps, most of them equipped with one or two mantles requiring 4¼ cu. ft. per hour, and giving about 45 and 76 c.p. respectively were replaced by Osram lamps of the following sizes :—

	Measured candle-power At 20°.	At 10
335 two 80-watt lamps	135	220
491 two 55- ,, ...	75	130
1,138 two 35- ,, ...	55	100

These were in special fittings designed by the author, involving the use of a white inverted wedge reflector with suitably curved sides, increasing the available candle-power near the horizontal to about double that of the lamps only, and to six times the vertical value. Other features of the fitting (see ELECTRICAL ENGINEERING, Aug. 25th, p. 547), were the placing of the large white surface of the reflector close up to the filaments, with no intervening lampholder, which reduced the effect on the eye of the high intrinsic brilliancy of the lamp, and the anti-vibration support. The conversion of the 1,964 lamps was carried out for £5,788, against estimates of £8,000, and the working expenses amounted to



Curve A. 10-amp. Excello lamp, ordinary globe.
B. 10-amp. Excello dioptric and opal globe.
C. 12-amp. Excello dioptric and clear globe.

FIG. 1.—CURVES FOR FLAME ARC LAMPS, SHOWING EFFECT OF DIOPTRIC AND OUTER GLOBES.

£7,350 per annum, or £3 15s. per post, made up as follows :—Electrical energy at 1·42d. per unit, £3,950; Lighting, extinguishing, cleaning, painting, &c., £1,570; lamp renewals, £1,230; repayment of cost of electric fittings in three years, £600.

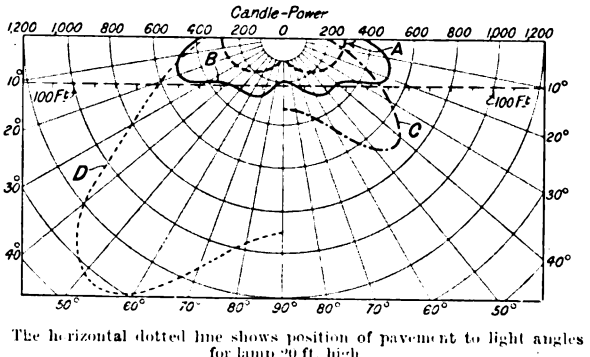
The total cost of lighting these lamps by gas had been £8,818 per annum. It must also be noted that the total candle-power of the gas lamps, viz., 109,000, was increased by the adoption of electric lamps to 146,000 at 20°, or 193,883 at 10°. The price of 1·4d. per unit was not based on costs of generation, but was arrived at in order to repay the cost of services at an early date. The cost per mile of street works out at £384 per mile for main thoroughfares, and £204 per mile for side streets. These figures, if energy is taken at 1d. per unit instead of 1·4d., reduce to £356 and £130 respectively.

The Paper then gives some details of the arc lighting in Oxford Street. At the time this street was changed from gas to electric lamps the most efficient lamp available for the purpose was the converging carbon flame arc lamp. This lamp was therefore used, the globes being of the opalescent type recommended by the makers at that time. Two such lamps were erected on centre poles where favourable, which were at distances of nearly 200 ft.; this resulted in a minimum horizontal illumination of 0·11 c. ft. The cost works out at £800 per mile per annum.

Since that time the arc lamp-makers have turned their attention to altering the distribution of light from flame lamps in order to make them more suitable for street lighting, and the excellent results obtained by the dioptric globes as employed in Regent Street and elsewhere are shown in Fig. 1, which is from tests by the author. Tests of other lamps, including the Crompton Blondel and the Jandus Regenerative, which also show good results at small angles of depression, taken by Mr. J. T. Morris, are also referred to in the Paper. The values of the candle-power per watt at 10° to 15° from the horizontal vary from 0·8 per tungsten lamp, up to 6·5 for an Excello lamp with dioptric and clear globe, and 5 to 8 for the Jandus regenerative lamp. In speaking of high-power gas lamps, it is mentioned that a nominal 1,500 c.p. Keith lamp, which gave 780 c.p., with 23 cu. ft. of gas per hour, on test, would require to be supplied with gas at 7d. per 1,000 cu. ft. in order to produce the same light at an equal cost as a flame arc lamp giving 5 c.p. per watt at 1d. per unit. Comparisons were then made between the cost of lighting by open arcs and by tungsten lamps. In a typical case of open-arc lighting the minimum illumination was 0·05 c. ft., and the cost per mile per annum £880, against the minimum illumination of 0·08 c. ft. obtained for £414 per mile with tungsten lamps in Marylebone. In Croydon groups of three 100-watt Osram lamps were adopted in special lanterns on existing arc lamp posts 20 to 22 ft. from the ground, 73 yards apart, and giving a distribution of light as shown in one of the curves in Fig. 2. The minimum direct illumination was found to be 0·041 c. ft., as against 0·024 with 10-amp. open arcs, and the cost per mile worked out at £200. The minimum illumination in the same streets when lighted by gas had been 0·0036 c. ft.

Series arc lamps could easily be replaced by groups of tungsten lamps, and for this purpose the author has devised a combined lantern and cut-out by the action of which a spare lamp placed in a conspicuous position in the globe comes into operation in the event of any of the other lamps failing. Mr. Harrison then briefly mentioned the case of Harrogate, where Mr. Wilkinson has replaced the arc lamps by four 100-c.p. tungsten lamps, arranged on spreading arms at a considerable height, the result being excellent, both as regards illumination and appearance.

Reverting to the subject of reflectors, the author again emphasises the importance of minimising the glare due to high intrinsic brilliancy. Mr. Pragnall had sought to diminish this by fixing thin sheets of metal with white surfaces, adjacent and radially to the light source, so that it is



The horizontal dotted line shows position of pavement to light angles for lamp 20 ft. high.
Curve A. 3 100-watt tungsten lamps without reflector or globe.
B. 3 100-watt tungsten lamps with reflector or globe.
C. 10-amp. open type arc lamp (d.c.) with opalescent globe.
D. 3-amp. magazine flame arc lamp with opalescent globe.

FIG. 2.—CURVES FROM STREET MEASUREMENTS OF VARIOUS LIGHT SOURCES.

seen in the midst of an illuminated white surface, and not against the dark sky or distant surroundings, while at the same time practically no light was lost owing to the surfaces being thin and radial to the lamp. Some curves showing the loss of light with the opalescent globes often used with arc lamps were also shown.

Mr. Harrison then commented on the specification for the Westminster Street Lighting, by which the rated candle-power of the lamps was the mean of that at 50° and 20°. The new gas lamps which had been put up gave about 1·5

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times more candle-power on the 20° ray than on the 50° ray, which was, of course, a ratio in the right direction, but not sufficiently so to prevent the illumination adjacent to the post being twenty times that of the minimum illumination, whereas with the small gas units displaced it was only 16 times as great, and if the height of the small units had been that of the present units it would only have been twice as great, which would have come under the head of even illumination.

The subject of cost of public lighting was then discussed at some length. All-night street lighting had a load factor of 40 per cent., and he argued that a remunerative price per unit may be taken as 1d. for large undertakings, and 1·5d. for small undertakings, which included, as in the case of consumers, the cost of service to the ordinary distributors, but not of fittings, &c. For the cost of lamp renewals and of lighting, cleaning, extinguishing and repairs, he gave the figures in the following table :—

Total c.-p. of unit.	Cost of renewals per c.-p. per annum. Without reflector. d.	Cost of renewals per c.-p. per annum. Special lantern. d.	Cost of lighting, extinguishing, repairs, &c., per annum. d.	Capital charges per annum. £	Total cost per candle-power per annum. Without reflector. d.	Total cost per candle-power per annum. Special lantern. d.
50 (Tungsten)	2·4	1·3	4·00	3	10·50	7·0
100 ,,	1·8	1·2	2·00	3	8·20	5·0
200 ,,	1·2	1·0	1·00	5	7·00	4·3
300 ,,	1·2	1·0	0·66	5	6·66	4·1
400 ,,	1·2	0·8	0·50	5	6·50	3·8
500 ,,	1·2	0·6	0·40	5	6·40	3·5

	Cost of carbons, trimming, &c. d.	£	d.	d.
300 open arc	3·6	20	10·20	—
1,000 flame arc	2·0	20	3·65	—
3,000 flame arc (dioptric and clear outer)	0·7	20	1·32	—
2,000 to 4,000 regenerative flame	0·3 to 0·15	20	1·0 to 0·8	—

A table follows of the candle-power necessary to obtain a minimum illumination of 0·1 c. ft. for various distances apart of posts from which the large reduction in total candle-power necessary to produce the same minimum degree of illumination with small units of light placed close together, and the effect of height of the lamps on horizontal illumination was very noticeable. Thus when the lamps were spaced at 30 yards only one-ninth of the total candle-power was necessary to give the same result as when they were placed 100 yards apart; therefore, unless a lamp giving a very high candle-power at low cost be used, the closer spacing would be the cheaper alternative. Again, converging flame lamps (unless provided with dioptric globes) when erected at 70 yards, give illumination at the same cost, equal to small units of light placed between 40 and 50 yards apart, provided, of course, the small units of light are fixed at the same height.

In this connection Mr. Harrison pointed out an objection to horizontal illumination as the gauge of street lighting in that the increase in the height of the lamps would not in any way increase the illumination of pedestrians and vehicles or other vertical objects; it was also misleading owing to the introduction of the cosine factor. On the other hand, the specifying of minimum horizontal illumination encouraged raising the height of the lamps, but the factor of direct illumination covered this point when the maximum and minimum are stated. The difference between the maximum and minimum illumination at any point of a street should be as small as possible. The importance of the diversity factor of illumination could not be overrated. Mr. A. J. Sweet, in his Paper read before the Franklin Institute of Philadelphia, stated that a ratio of maximum to minimum (illumination) of 4 to 1 was permissible, and pointed out that the present factor more frequently fell between 100 to 1, or even 500 to 1. For example, in Oxford Street, using flame arc lamps, it was 99 to 1; whereas in Regent Street, where the same type of lamp was used, but with a dioptric globe, this was reduced to 13 to 1. In Victoria Street, the latest example of gas lighting, it was 20 to 1, whereas in the important streets of Marylebone it was 6 to 1.

In conclusion, he wished to warn engineers that good illumination, though the prime object in street lighting, is not the only feature to be considered. Careful thought must be given to obtaining as even illumination as possible; and if high intrinsic brilliancy is carefully avoided the result would be in every way satisfactory, not only to the lighting authorities, but also to the general public.

Discussion in London.

Mr. Frank Bailey (City of London Electric Lighting Co.) expressed the opinion that most of our street lighting was very meagre and unsatisfactory, the standard of illumination under modern conditions of fast-moving traffic being very little better than it was many years ago. Electrical engineers had difficulty in obtaining the opportunity of showing what they could do; in the City of London he had had to beg to be allowed to demonstrate what was now possible with electric lighting. The absence of any intelligent specification was remarkable, and many borough engineers knew very little about lighting. It did not seem to be recognised that very much better results could be given with electric lighting now at the old prices, but at the same time he did not think the question of cost should be the predominant factor so much as the needs of the public. He put forward the new centrally hung arc lamps in Cheapside as a specimen of what a properly lighted thoroughfare should have. Whilst agreeing with the great advantages of metal filament lamps for side-street lighting, he preferred flame arc lamps of high candle-power for important thoroughfares.

Mr. C. P. Sparks (County of London Electric Supply Co.) suggested that the Institution would do a great deal of good if they appointed a committee to draw up a standard specification for street lighting, which, even if not adopted generally, could be taken as an authoritative basis. With the exception of a few isolated cases, street electric lighting had been mainly in the hands of municipalities, and most of it was still with open type arc lamps. On the prices of the old contracts there was ample margin to put in more modern lamps and give a standard of illumination which would compare with modern gas. The price of 1d. per unit mentioned in the Paper he thought was on the high side, and until supply undertakings were prepared to offer energy at a lower rate, there was not very much chance of wresting the bulk of public lighting from the gas companies.

Mr. A. H. Seabrook (Borough Electrical Engineer, Marylebone) disagreed with Mr. Sparks on the question of price, and mentioned that at this charge his Council were making a saving of £3,000 per annum in their street lighting bill. Mr. Harrison had mentioned £880 per mile for arc lighting as a good figure, but at Marylebone it was done for £800 on a scale that had been criticised. He thought that the glare caused by dioptric globes, such as had been used in Regent Street, made the system used in Oxford Street preferable. Where streets are wide enough he preferred centre columns to side columns for arc lamps, and would favour centrally hung lamps where he could get means for carrying this out. A good deal of the light from arc lamps on the footpaths was wasted on the buildings.

Mr. W. A. Vignoles (Borough Electrical Engineer, Grimsby), in reference to the Local Government Board and loans for street lighting, said he had found no difficulties put in the way if the whole scheme was worked out by the time the Inspector came down to hold the inquiry. He had received a loan for ten years for posts, fittings, and services, although the term of years for ordinary services was 15 years, and it used to be 25. He disagreed with the author in taking the minimum horizontal illumination as the standard, and thought the vertical would be better. He asked the author why two lamps were used in the Marylebone lanterns. Probably it was so that there would always be one lamp alight should there be a failure, but it surely increased the cost of renewals. Were there any fuses in the Marylebone lamps except those at the top of the posts, as this seemed to him an undesirable place to have them when he was considering the change over at Grimsby. He thought gas lanterns with a white reflector in the top were the very best form for street electric lighting. His figure for the change over at Grimsby was a little lower than that at Marylebone, and by charging one penny per unit he had a margin which was quite satisfactory for the department.

Mr. A. P. Trotter said that the diversity coefficient was an important matter, and referred to the form of dioptric globe that he had designed about 30 years ago, the effect of which was similar to the present holophane globe: it distributed the light both horizontally and vertically; but he had found that it was a mistake to distribute the light too uniformly, as people preferred a certain amount of variety in the illumination. Given a certain minimum and a certain diversity factor, there was a great deal to be worked out by the engineer, especially in the height of posts and size of lamps. The great problem now seemed to be the side streets, where a great deal more skill was required to get a good illumination.

Mr. L. Gaster supported the suggestion that a standard specification should be drawn up, and mentioned that a committee with this object in view had already been appointed by the Verband Deutsche Elektrotechniker.

Mr. W. R. Cooper asked what was the author's meaning when he used the term "candle-power," as sometimes he used it in relation to light from reflectors and dioptric globes (where the law of inverse squares did not hold). He rather deprecated the use of the term "diversity factor," as there was the possibility of confusion with other kinds of diversity factors.

Mr. C. M. Shaw (Borough Electrical Engineer, Worcester) said he was not satisfied with the use of old gas lanterns in

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Worcester, and designed others when he changed over from gas to electric lighting. He thought they would have to offer very much lower prices than the present suggestions to make any considerable progress in replacing gas. He was satisfied with the £120 per mile that he got for side-street lighting, against the £204 mentioned in the Paper. In Worcester he got out a scheme for lighting streets from the tramway posts, and was able to do it for £116 per mile, or £195 including all capital charges. They did it all out of revenue, and did not trouble the Local Government Board about it.

Prof. J. T. MORRIS (East London Technical College) spoke of some interesting experiments confirming the author's view that illuminated white surfaces near the lamp diminished glare by actual measurements of the contraction of the retina.

Mr. C. NEWTON RUSSELL (Chief Electrical Engineer, Shoreditch) briefly referred to the street lighting which is being carried out in that borough, where some 400 Osram lamps had been installed.

Mr. K. EDGCUMBE thought it would hardly be possible for the Institution to take in hand the drafting of a standard specification without calling in representatives from the gas industry and also the surveyors.

Mr. H. BOOT advocated the use of centrally hung lamps for side-street lighting. In his opinion the price put down for electrical energy for street lighting was much too high, and from figures that he had worked out he was of the opinion that it could be supplied at very little more than ½d. per unit. In one town with which he was connected they had taken on a contract to light the whole place for five years, and although this involved laying new mains, the policy was justified by the number of new consumers obtained.

Mr. J. S. DOW spoke as to the desirability of recognising the avoidance of glare with the production of uniform illumination.

Mr. HARRISON replied briefly to some of the points raised. He thought that centre lighting was bad for drivers, who frequently had the lamps in their line of vision. The standard specification was an important matter, but he did not think electrical engineers could work alone in connection with it. They could not ignore the gas interests nor the borough surveyors. Unfortunately the latter had a very imperfect knowledge of illumination. The Marylebone lamps were introduced at a time when they had to put two lamps in series, but the pairs of lamps undoubtedly gave a better effect.

DISCUSSION IN MANCHESTER.

Mr. S. L. PEARCE (Chief Electrical Engineer, Manchester Corporation) thought that in Marylebone pairs of 230-volt lamps in parallel would have been preferable to lamps in series. He did not see why there should be any difficulty in allocating capital charges or mains, and he wanted a little more explanation of the way the Marylebone costs were worked out. The dioptric globe had further advantages to the improved distribution of light, in the better ventilation and the avoidance of etching the outer globe by the chlorine liberated. The price they were getting in Manchester was 1¼d. per unit, including capital charges, maintenance, and current. He rather objected to the use of the term "diversity factor" for the ratio of maximum to minimum illumination.

Mr. H. W. ANGUS (Borough Electrical Engineer, Eccles) said that in Eccles they had about 300 posts, each fitted with a 55-watt 100-volts tungsten lamp in a well-glass fitting, with inverted reflector, mounted upon a swan-neck bracket. The approximate cost of the post, fitting, and lamp, erected, was £2 12s., and the approximate cost of the service, including the tee joint, was £1 5s. 6d. There were 40 posts per mile, and the cost per mile was approximately £100 per annum. They got a price of £2 8s. 6d. per post per annum, which includes the electrical energy supplied, lamp renewals, and attendance. This sum was based on the cost of energy at 1·92d. per B.T.U., but it also provides for four lamp renewals. Actual results obtained have shown that the average life of these tungsten lamps is over 2,000 hours. The lamp renewals per annum have therefore worked out at a little over 1½ lamps per post.

Mr. A. G. COOPER (Borough Electrical Engineer, Colne) made some remarks upon the burning hours of enclosed lamps, and Mr. J. Frith referred to the relative penetration of fog by different illuminants.

Mr. F. SELLS (General Electric Co.) was very appreciative of the Paper, but wished there had been more in it about the smaller towns. With regard to the relative life of high- and low-voltage tungsten lamps, his personal experience was that whilst low-voltage tungsten lamps might have a longer average life than high-voltage tungsten lamps, the series lamps certainly had not got a longer life than the parallel lamps, the most apparent reason being the difficulty of matching the series numbers.

Mr. H. C. CREWS and Mr. MOON also spoke, and Mr. J. S. PECK (British Westinghouse Co.) made some remarks from the chair, pointing out that the light from two adjacent lamps should be taken in account in working out the minimum illumination. He thought, however, that this was an unsatisfactory criterion. He had worked out that with tungsten lamps 1·4d. per unit was equivalent to gas at 10d. per thousand cu. ft.

Mr. HARRISON replied briefly. He had omitted to include enclosed arc lamps in the Paper because as made at present their light distribution curves do not give high efficiency for the purpose. He agreed that horizontal illumination was not everything, but as it embodied all the other factors it was the most convenient unit for comparison. The reason the Marylebone lamps were put in series was because at the time they were put in, 240-volt lamps of small enough size to be used in parallel could not be obtained.

THE PRICE OF ELECTRICAL ENERGY FOR TRAMWAYS

MR. ROBERT HAMMOND has now issued his award determining the price which the Paisley District Tramways Co. is to pay the Corporation for electrical energy for working the tramways. Under the Paisley District Tramways Order of 1901, the following schedule of prices was fixed for the following seven years, but this period was subsequently extended to nine years :—

2d. per unit for the first 200,000 units per annum.
1¾d. per unit for the next 100,000 units per annum.
1½d. per unit for the next 100,000 units per annum.
1¼d. per unit for all additional energy.

The period of nine years expired on August 16th, 1910, and as the Corporation and Company could not agree to a new scale of charges, the matter was referred to Mr. Robert Hammond as arbitrator to determine, it being agreed that the expenses of the arbitration should be shared equally. The arbitration proceedings were reported in our issues of October 13th and 27th, and November 3rd, 1910.

Mr. Hammond's award is that the rates to be paid by the Company to the Corporation for a period of seven years from August 16th, 1910, shall be *a fixed sum of £4 15s. per kw. per annum of the maximum power delivered to the tramway feeders, and, in addition, the sum of 0·475d. per unit for all units delivered to the tramway feeders and metered at the generating station.* The maximum power delivered to the tramway feeders during the year shall be taken to be the average power delivered to the tramway feeders during the period of thirty consecutive minutes in which the electrical energy supplied to the Company is a maximum for the year.

Mr. Hammond states that in fixing the above prices he has been guided, among other things, by the cost of fuel for the year ended May 15th, 1910. During that year, according to the accounts of the Corporation, the cost of "coal and other fuel" was £3,294 15s. 3d.; the number of units generated was 3,035,698; the quantity used on the works, 408,936 units; and the quantity delivered to the feeders [or the whole Corporation supply, including that delivered to the tramway company] was 2,626,762 units, the resultant cost per unit delivered to the feeders being 0·301d. He decides, therefore, that the 0·475d. per unit mentioned above is to be increased or decreased, as the case may be, by an amount equal to the difference between the actual cost per unit delivered to the feeders of "coal and other fuel" to the Corporation in any year, and 0·301d. Pending the determination of the amount of the maximum power and of the coal cost each year, monthly payments are to be made by the Company of £275 in respect of the kilowatt charge, and 0·475d. per unit for all units supplied, the necessary adjustments of the accounts being made at the end of each complete year.

For the determination of the power he assumes that an integrating wattmeter will be employed, so arranged with auxiliary mechanism that it will automatically record the maximum consumption of the electrical energy during periods of thirty consecutive minutes, the number of kilowatts of average power being twice the number of units so recorded.

As the Company have been taking about 1,300,000 units from the Corporation, and the maximum load for the tramways has been about 575 kw., it will be seen that the capital charge to be made by the Corporation works out on this basis to 0·504d. per unit, and the total charge therefore at 0·979d. per unit. The Company have been paying an average price of 1·4d. per unit, which the Corporation claimed should be continued, and the Company asked for a reduction to 0·56d. per unit, and it is an interesting coincidence that the result of the award worked out on the new basis should have come out almost exactly the mean of these two prices.

Reviewing Mr. Hammond's decision, it is certainly the correct method to base the payment on a more or less fixed charge, *plus* a sum per unit. As, however, the capital cost to the Corporation should depend entirely on the cost of the extra plant they must reasonably put down to meet the tramway load, from information given by the Company in advance of the load itself, and not on the actual maximum load supplied,

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published November 24th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

22,234/09. **Electric Driving of Planing Machines.** LANCASHIRE DYNAMO & MOTOR CO., LTD., and G. E. MASON. The armature of the driving motor is in series with the armature of the generator of a small motor-generator. The field of the driving motor is connected direct to the supply, while the field of the generator is connected to the supply through a tappet switch operated by the planing-machine table. This switch reverses the generator field at the end of the stroke and increases the field on the return stroke so as to increase the speed. Four figures.

25,296/09. **Water Heater.** C. KRATT (Glasgow). The water is passed through one or more tubes of insulating material filled with balls or granules of carbon or other suitable resistance material through which the current is passed. The passage of the water through the carbon both heats and filters it. A heater with a vacuum jacket to prevent loss by radiation is also described. Eight figures.

25,407/09. **Induction Telephone System for Trains.** H. VON KRAMER (Erdington, nr. Birmingham.) This patent relates to the system of train telephony described in ELECTRICAL ENGINEERING, Aug. 4th., p. 513, and Sept. 15th, p. 590, and gives some particulars as to dimensions of wires and coils required. Three figures.

25,889/09. **Manufacture of Metal Filament Lamps.** H. KUZEL (Vienna). To improve the vacuum obtained during exhaustion of lamp bulbs, the mercury vapour from the air pump is prevented from entering the bulbs by placing between the pump and the bulb a large area of metal such as gold or silver leaf, zinc or copper filings, which absorbs the vapour. In addition, the mercury in the pump is cooled to a temperature of about 1° C.

29,200/09. **Motor Controllers.** ELECTRIC CONSTRUCTION CO., LTD., and F. W. CLOSE. In order to make the contact brush yield in all directions, it is mounted on an arm through the medium of an elliptic spring, the length of which runs in the direction in which rubbing takes place. Two figures.

1,597/10. **Lamp Holders.** SIEMENS BROS. & CO., LTD., and J. S. HUDDLESTON. To prevent lamps of too high candle-power being inserted in lamp holders, the contact pins of the holder have extensions of insulating material which enter recesses in the lamp cap. If the recesses are not of a certain depth, the contact pin proper will not come in contact with the lamp contacts. Four figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: FINETTI and TISCHER [Light-projecting apparatus] 27,742/09; KÖLLER [Automatic safety-catches for arc lamps] 9,888/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MALCOLM and APPLEYARD [A.-C. conductors] 9,647/10.

Dynamos, Motors, and Transformers: ELLISTON and MARRYAT [Electric driving] 25,586/09; PARSONS and LAW [Alternators] 25,785/09; FERGUSON [Train-lighting system] 26,289/09; HEYS [Commutator bars] 26,943/09; KEITCHUM [Machines] 13,330/10.

Electric Ignition: PODSZUS [Sparking plug] 7,617/10; BARTLETT [Automatic ignition and control of gas] 11,479/10; R. BOSCH [Sparking plugs] 15,901/10; WRIGHT (*Veifa-Werke Vereinigte Elektrotechnische Institute Frankfurt Aschaffenburg*) [Induction coil interrupter] 20,872/10.

Electrometallurgy and Electrochemistry: JENSEN (*Spitz*) [Recovery of tin from waste metal] 25,915/09; JOHNSON (*Badische Anilin & Soda Fabrik*) [Manufacture of nitrates] 30,502/09; THOMSON [Electric furnaces] 11,716/10.

Incandescent Lamps: HAILWOOD [Miners' safety lamp] 26,524/09; STOPFORD [Miners' safety lamps] 29,707/09.

Instruments and Meters: MCNAB [Revolution counter] 25,899/09; COWBURN [Depth indicator for tanks] 25,902/09; REITH and FLADE [Coin selectors for prepayment apparatus] 28,562/09.

Switchgear, Fuses, and Fittings: LIDDLE [Liquid controllers and starters] 21,595/09; WILSON [Switches] 23,224/09; FERNIE [Operating switches on three-wire systems] 25,668/09; HARRISON [Conduit fastenings] 25,994/09; NOBLE [Support for cables or conductors] 26,099/09; COX [Switches] 26,422/09; BRITISH THOMSON-HOUSTON CO. and YOUNG [Automatic regulators] 27,827/09; RAILING and GARRARD [Switches] 5,085/10; RAWLINS [Earthing device for switches] 8,858/10; BEARD and TOWNSEND [Lamp shades] 9,547/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Switches] 9,890/10, and [Electromagnetically operated switch] 18,443/10; RYAN and HENGERER [Lamp socket] 13,165/10; SIEMENS SCHUCKERTWERKE GES. [Fuses] 17,047/10.

Telephony and Telegraphy: QUINN [Telephone memorandum] 25,757/09; CHISHOLM-ELLAMS [Telephone call recorder] 3,756/10; SIEMENS BROS. & CO. (*Siemens & Halske A.G.*) [Automatic telephone exchanges] 7,093/10, and 9,634/10; GOLDSTEIN [Central battery signalling systems] 16,331/10.

Traction: KRUMSCHMIDT [Compensating wear of brake-shoes] 29,602/09; HENRARD and LÉVÊQUE [Controlling tramway and railway points] 2,810/10; FRAZER & CHALMERS, LTD., WHITMORE, CHAPMAN and KÜBLER [Control of compressed air systems] 9,958/10; SIEMENS BROS. & CO. and FERREIRA [Electrically detecting railway points] 19,970/10.

Miscellaneous: BOULT (*Electric Meat Curing Co.*) [Electromagnetic apparatus] 23,040/09; MARKS (*Soc. Anon. Italiana Gio. Ansaldo Armstrong & Co.*) [Electrical ship's steering gear] 25,365/09; FAIRWEATHER (*Huff Electrostatic Separator Co.*) [Separators] 25,768/09; ROHDE [Feeding and reversing gear for electric rock drills] 26,051/09; JUNGHANS [Illuminating clock dials] 18,784/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: A.-G. BROWN, BOVERI, ET CIE. [Excitation of induction machines] 25,397/10.

Electric Ignition: R. BOSCH, 20,968/10; MACQUAIRE [Sparking plugs] 23,577/10.

Electrochemistry: CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE GES. [Manufacture of persulphuric acid] 23,548/10.

Incandescent Lamps: KNIGHT [Manufacture of lamps] 24,810/10.

Telegraphy: CARPENTIER [Printing telegraphs] 20,111/10.

Traction: MASLIN AND DE CHAVANNES [Signalling] 25,578/10.

Miscellaneous: FELTEN & GUILLEAUME LAHMEYERWERKE A.-G. [Cable tensioning and slipping devices] 21,335/10; ARIETS, WRIGHT AND CALDWELL [Tubing and joints] 22,310/10; HOUSEKEEPER [Contact devices for moving conductors] 24,911/10; ALCOCK & CO. PROPRIETARY [Electric process for drying timber] 25,175/10; ALLGEMEINE ELEKTRICITÄTS-GES. [Emergency braking] 25,589/10.

Opposition to Grant of Patents

20,639/09. **Heating and Cooking Apparatus.** A. F. BERRY. Opposition has been entered to the grant of this patent. The specification (abstracted in ELECTRICAL ENGINEERING, Oct. 6th, 1910, p. 636) relates to the continuous heating up of a large mass of metal from which the heat is extracted by conduction when required.

22,997/09. **Heating Apparatus.** H. A. KENT. This patent is opposed. The specification describes heating elements consisting of granular tungsten enclosed in silica glass tubes, and was abstracted in ELECTRICAL ENGINEERING, Oct. 6th, 1910, p. 636.

Amendment

5,081/09. **Current Rectifier.** T. J. MURPHY. A disclaiming note has been added to this specification, which relates to a vibratory rectifier for producing a pulsating D.-C. current from an A.-C. supply.

Surrender of Patent

18,328/09. **Flame Arc Lamp.** SIEMENS-SCHUCKERTWERKE GES. have offered to surrender this patent. It covers a flame arc lamp with three converging carbons, in which the two carbons of like polarity supporting each other contain the chemical salts for producing the flame, while the third electrode is of practically pure carbon. Persons interested should communicate with the Comptroller General at the Patent Office.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: G. C. MARKS (*General Electric Co., U.S.A.*) [Mercury vapour lamps with starting and colouring arrangements] 14,121/00; A. BLONDEL [Lamp mechanism] 16,357/03.

Dynamos, &c.: J. S. PECK and C. LE G. FORTESCUE [Transformers] 16,179/04.

Electrometallurgy, &c.: M. OTTO [Purification of liquids by ozone] 17,257/98; S. O. COWPER-COLES [Electrolytic manufacture of metal tubes and sheet] 16,210/99.

Switchgear, &c.: A. MORRISON and J. W. BUTTERWORTH [Lamp-shade holders] 17,633/02.

Traction: H. TRAUN [Trolley-line insulator] 14,164/00; ESEMANN [Tramcar life-guard] 28,922/04.

Miscellaneous: EDISON ORE MILLING SYNDICATE (*T. A. Edison U.S.A.*) [Magnetic separators] 14,355/00.

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we cannot but think that, in future cases, an equitable way of arriving at the price will be to fix a definite total *sum*—not a price per kw.—as the capital charge, representing the annual sum payable for interest, depreciation and redemption on the whole of the cost of this extra plant. Similarly, we think that the charge per unit to be added to this for the works costs, &c., should be based on an estimate of the total costs of generating the traction units and not of the whole of the units supplied from the station, making this up in two items, one representing the fuel costs, which should be made to vary with the price of coal, as Mr. Hammond has decided. We trust that the final decision of the joint Committee of the Incorporated Municipal Electrical Association and the Municipal Tramways Association will advocate this method of computation.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

GENERATORS AND MOTORS.—We have received from the General Electric Co. four new lists relating to electrical plant manufactured at their Witton works near Birmingham. These deal respectively with continuous- and alternating-current generators and motors, and are attractively printed in two colours with covers each on a distinctive colour scheme. The continuous-current dynamo list contains full specifications with illustrations of detail, and lists high- and low-speed machines separately in sizes from 0·5 to 300 kw. Independent lists are also given of machines suitable for low-voltage Osram lamp installations. Balancers and boosters are also dealt with, and full details of weights and dimensions are given. The continuous-current motor list is equally well arranged, and includes constant- and variable-speed machines, as well as crane rated motors of the semi-enclosed, enclosed ventilated, totally enclosed and dustproof, water and gas tight, and pipe ventilated patterns. Useful tables of the power taken by different classes of machinery are included. In the alternating-current generator list a wealth of technical detail is given, and machines for single-, two-, and three-phase working are included for engine and steam turbine drive up to 1,000 kw. The alternating current motor list deals with single and polyphase induction motors up to 100 h.p., and some illustrations of larger machines are also given. The technical information is fuller than is usual in this class of list, and the completeness of the range of spare parts, accessories, and extras, together with the fact that dimensions and weights are given throughout in meters as well as English units greatly enhances their utility.

CABLES AND WIRES.—Messrs. Siemens Brothers and Co., Ltd. (Caxton House, Westminster, S.W.), have now issued their complete new catalogue of vulcanised india-rubber wires and cables, which supersedes the provisional catalogue of the same title, published at the commencement of October. The catalogue contains, besides the usual association and non-association wires and cables, a special section dealing with bell wires and flexibles, &c. Amongst the latter, special attention should be drawn to the new "Besto" fire resisting flexible twin wires, which have been put on the market to meet the demand for special twin flexibles for shop-window lighting. These wires have a layer of asbestos spun over the ordinary rubber insulation, under the outer cotton or silk braiding, by a special patented process. The catalogue contains, in addition, some practical tables for the use of those engaged in wiring work, and illustrations of the Woolwich works, where all the wires and cables are made.

CHRISTMAS TREE LIGHTING.—A leaflet from the General Electric Co. gives particulars of miniature Robertson lamps for running in series for Christmas tree and other temporary decorative work. The company request us to state that in order to assist contractors they are prepared to print and supply these leaflets with their name and address upon learning what quantity they can distribute with advantage.

OSRAM LAMPS.—A further addition to the series of Osram lamp posters issued by the General Electric Co., Ltd. (67 Queen Victoria Street) is a reproduction of the well-known large poster in double-crown size. The company are willing to supply copies to the trade free of cost.

ALUMINIUM.—A leaflet from the British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.), calls attention to the use of aluminium granules in iron and steel works and foundries as a deoxidising agent and for keeping large melts of metal fluid, by means of the heat generated by the reaction caused by the addition of aluminium to the melt. If small portions of aluminium are added to molten iron or steel, it combines with the oxygen and other gases absorbed by the metal in the furnaces, and rises to the top in the form of slag, which can be skimmed off. It is the presence of these gases in the metal which causes blow holes and imperfect castings, and the addition of aluminium therefore reduces the number of "wasters" to a minimum.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

PRIMARY BATTERIES.—A new and very complete catalogue of the primary cells manufactured by the General Electric Co., Ltd., at their works at Witton, Birmingham, is now ready. All the usual forms of wet Leclanché cell are included, and also the company's special "carporous" cell with the zinc in the centre, and the "carsak" type of very low internal resistance. The latest forms of G.E.C. dry Leclanché cells are also dealt with as well as the "extra sec" cell, suitable for export, which is quite inactive until water is added. Other batteries are the Edison-Lalande alkaline cells and various forms of Daniell cells. The lists of spare parts, &c., are particularly complete, and very full electrical and other data are given as to each form of cell listed. Attention should be drawn to the fact that each G.E.C. dry cell bears a label guaranteeing to replace it should exhaustion take place in stock within six months from the date stamped thereon, provided, of course, that the label is unbroken at time of return.

METAL FILAMENT LAMPS.—Messrs. Siemens Brothers' Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.), have issued a new list of "one-watt" lamps, including the new 200-c.p. size mentioned in another column. Quantities of this list can be obtained overprinted with contractors' names and addresses.

SUPPLY ADVERTISING.—The Electric Supply Publicity Committee are making a further issue of supply advertising literature, consisting of a leaflet on the use of electric radiators, as suitable for being enclosed with correspondence; an electric radiator leaflet; a radiator post-card, and a series of adhesive labels, illustrating electric heating, electric ironing, and electric power, in colours, suitable for attaching to letters, accounts, &c., other publications, including a cooking leaflet, showing illustrations of up-to-date cooking apparatus and detailing advantages, a leaflet entitled "Electric Light and Health," and a coloured calendar.

LOCAL NOTES

Beckenham: *Council and L.G.B. Inspector.*—At the last meeting of the Council the Electricity Committee reported their dissatisfaction with the manner in which Mr. H. R. Hooper recently conducted an inquiry into a loan for electrical extensions (Electrical Engineering, November 10th, p. 719) and recommended that a letter of complaint be addressed to the Local Government Board. Mr. A. H. Dykes protested against any such letter being sent, but his motion was not seconded.

Blackpool: *Public Time Service.*—It is stated that a scheme for the installation of 100 public clocks to be electrically controlled by a master clock at the Town Hall is under consideration.

Cleethorpes: *Electric Lighting.*—A conference is to take place between the Council and the Grimsby Tramways Co. to discuss terms for the supply of electricity in bulk.

Cornwall: *Overhead Wires.*—The Cornwall Electric Power Co. have applied to the Board of Trade for sanction to erect a number of overhead wires.

Darlington: *Electricity Undertaking.*—At the last meeting of the Town Council some criticisms were passed upon the management of the Electricity Department, and in order to meet this a statement has been prepared showing the full financial results of the undertaking. The works have been in existence for nine years, and the total capital expenditure is £80,000. The profits, after providing for interest and depreciation, have amounted to £11,323, of which £4,882 has been devoted to relief of rates; £5,261 to reserve; and £1,180 expended on capital account. Nearly £20,000 capital has been repaid. It is claimed that last year the gross profit was higher than that earned by any electric supply company in the country, and higher than the gross profit earned by 93 per cent. of the municipal undertakings of the kingdom.

Hornsey: *Power Charges.*—New power tariffs have been framed as follows: For certain approved classes of load, 1d. per unit, supplies being cut off at peak load; for domestic purposes, a rate of £3 15s. per kilowatt per annum, plus ¾d. per unit, has been fixed. If the kilowatt charge is paid in advance for a whole year, it is reduced to £3.

Haddington: *Electric Lighting.*—A contract has been entered into with Messrs. Crompton and Co., for an electric lighting scheme.

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Leeds: *Electric Lighting Accounts.*—The accounts of the electricity undertaking for last year show a deficit of £8,980 after paying £30,882 in capital charges.

Leicester: *Supply Outside Borough.*—The Lighting Committee propose to apply to the Board of Trade for an order authorising the supply of electricity in certain districts adjacent to the Borough.

London: *County Council: Coronation Illumination.*—The Fire Brigade Committee of the L.C.C. have drawn up a suggested list of precautions in order to prevent accidents from electrical illuminations during the Coronation of His Majesty the King next year.

Stepney: Tramways.—The Council have refused to consent to the proposal of the L.C.C. to adopt the overhead system along Burdett and Grove Roads, and insist upon the conduit system.

Loughborough: *Street Electric Lighting.*—The Tramways Committee have recommended the conversion to electric lighting of the existing gas lamps along all the routes of electric mains. The charge is to be £2 18s. 6d. for the first three years per lamp, to include the cost of conversion, and £2 15s. per lamp per annum afterwards. When the proposal was considered by the Council an amendment referring the matter back was carried.

Morley: *Tramway Purchase.*—The Council have decided to purchase so much of the undertaking of the Tramways Company as is within their district. An application is to be made by the Light Railway Commissioners for the construction of further lines.

Potteries: *Abandonment of Tramways.*—Lieut.-Colonel Druitt, of the Board of Trade, held an inquiry at Stoke-on-Trent on Thursday into an application by the Potteries Electric Traction Co. to abandon certain light railways authorised in 1897 and 1902, at an estimated cost of £43,000. The reason for the request to abandon these lines is that the Company's investigations go to show that they will not be remunerative. Opposition to the proposal came from all the districts concerned, and the inquiry was closed.

Scarborough: *Winter Tramway Service.*—The Scarborough Electric Tramways Co. has not yet complied with the order of the Board of Trade to commence a winter service. Messrs. Edmundsons' Electricity Corporation has secured the appointment of a secretary as receiver of the Tramways Company in respect of a claim for £515, arrears of interest under a mortgage of £25,000 dated February last.

Southampton: *Motor Hiring.*—It has been decided to hire out motors at a rental of not less than 20 per cent. per annum of the cost, and radiators at 10s. per annum. For motors costing more than £100, special arrangements are to be made. The Chairman of the Committee, in putting this proposal forward, stated that with regard to wiring it was proposed to charge cost, plus 10 per cent., to be paid in 12 quarterly instalments. It was the desire of the Committee to help the contractors in the town. Therefore they did not propose to sell fittings, but there will be a schedule of prices, and it will be to the benefit of the contractors that the scheme should proceed, as the work would go through their hands. This was why the charge for radiators had been fixed at the somewhat prohibitive price of 10s. per year.

Torquay: *Tramways.*—The Mayor of Torquay made a statement regarding the surface-contact tramways at the annual dinner of the Torquay Chamber of Commerce last week. He complained that the Board of Trade should have condemned the system, whilst all the inhabitants were in favour of its retention, and said that until the end of his days he would maintain that the town had not had fair play in the matter. It seemed to him that the Council had had to fight the Tramways Company, the arbitrator, and the Board of Trade.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—The Melbourne Council require six single-phase transformers. Particulars from Messrs. McIlwraith, McEacharn & Co. Propty., Ltd., Billiter Square Buildings, London, E.C. The Council also require six tons of bare hard-drawn copper cables.

Barking.—Tenders are invited by December 20th for a 400-kw. Diesel engine set; 250-kw. motor-generator; traction battery, and reversible booster; main switchboard and mains; and overhead travelling cranes. Particulars from the Borough Electrical Engineer.

Ealing.—An expenditure of £20,000 is recommended for mains, extensions, and meters.

Edinburgh.—A loan of £37,000 is to be applied for in connection with the scheme of cooling towers at Dewar Place, and the replacement of certain plant to be scrapped.

Finchley.—A loan of £10,000 has been applied for, for prospective expenditure on mains, services, and meters.

Heckmondwike.—A Local Government Board inquiry was held last week concerning a loan of £24,159 for electrical extensions. According to a remark made by Mr. H. R. Hooper, £20,000 have been expended on the electricity undertaking without sanction, and he commented somewhat severely upon this method of carrying on the undertaking.

Leicester.—The Tramways Committee recommend the borrowing of £12,000 for cables and works in connection with the supply of electrical energy for power purposes in the tramway station.

Leyton.—The Council require a 600 kw. mixed pressure turbo-generator. Particulars from the Borough Electrical Engineer, and tenders by December 29th.

Llandudno.—A loan of £2,322 is to be taken up for electrical extensions. Mr. H. R. Hopper, the Local Government Board Inspector, who conducted the inquiry, suggested that services should be paid for out of revenue.

London: *London County Council.*—The Council require 5,000 tons of steel girder rails and fastenings, and about 700 tons of conductor tees. Particulars from the Chief Engineer, and tenders by December 6th.

Islington.—The Electricity Committee require a high tension switchboard. Particulars from the Electrical Engineer, and tenders by January 12th.

Southwark.—A loan of £6,909 has been granted for electric lighting purposes.

Newport (Mon.).—A loan of £31,000 has been sanctioned by the Local Government Board.

New Zealand.—The Taihape Council require a generating plant in connection with a water-power scheme. Tenders to the Town Clerk by January 11th. The *Board of Trade Journal* says that specifications can be seen at 73 Basinghall Street, London, E.C.

South Africa.—A loan of £2,450 is to be taken up by the Standerton Council for electric lighting purpose.

Wilts.—A generator, motors and wiring are required for a private installation in Wilts. (See an advertisement on another page.)

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Proposed new baths at Ealing.

Alterations to schools in Old Kent Road and Drury Lane for physically defective children.

New school for physically defective children in Lewisham.

PROVINCES.

Bath.—Receiving Home for Children. The Guardians.

Birmingham.—Enlargement of Smethwick Branch Post Office. Smethwick Postmaster or H.M. Office of Works.

Bishop Auckland.—Extensions to Workhouse.

Bristol.—Cinematograph hall in Clare Street.

Derby.—Improvements at Brighton Road School.

Dundee.—New Mechanical Engineering Laboratory at University College.

Durham.—New school at Trimdon, and alterations to Cross School.

Edinburgh.—Electric theatre at rear of Miln's Hotel, Lauriston Street.

Church in memory of the late Professor Charteris. Architect, Mr. J. B. Dunn.

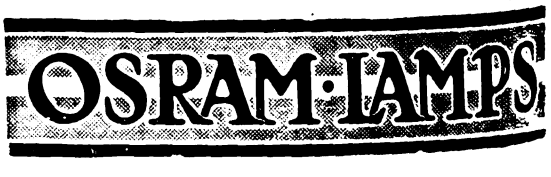
Farnworth.—New Council school.

Faversham.—Rebuilding of Lord Sondes' residence, recently destroyed by fire.

Glasgow.—Block of buildings in Jail Square.

Keighley.—Extensions to Workhouse.

Kidderminster.—New secondary school. Builder, J. Brickwater, Cradley Heath.



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Leicester.—Public Hall and Concert Pavilion. Town Clerk.
Maidstone.—Drill hall in Union Street.
Morley.—Extensions to Parkfield Mills. Architect, T. A. Buttery, Queen Street, Morley.
Norfolk.—Cottage hospital at Wells. Architect, Mr. Leslie T. Moore.
Oxford.—Swimming baths in High Street. Extension to Sanatorium.
Salford.—A secondary school for boys in Leaf Square.
Walton-on-Naze.—New elementary schools.
Warrington.—New schools.

MISCELLANEOUS

Australia.—Tender forms for the supply of insulators, wires, &c., have now been received at the offices of the Commonwealth for Australia, 72 Victoria Street, London.
Birmingham.—The Tramways Committee require 400 tramway poles. Particulars from the General Manager, and tenders by December 12th.

TENDERS RECEIVED AND ACCEPTED

Hull.—The tender of Messrs. C. Greenwood, of Hull, has been accepted at £3,676, for the building of the extension to the car shed at Anlaby Road.
London: *County Council.*—Tenders have been received from the following firms for the electric lighting of the fire station in Parnell Road, Bow:—Tilley Brothers (recommended), £167; Johnson & Phillips, Ltd., £190; Malcolm & Allen, Ltd., £198; W. J. Fryer & Co., £233 13s.
The Stores and Contracts Committee have accepted a tender of Messrs. John Pickles & Sons to supply and fix an electrically-driven cross-cut bench saw at the Clerkenwell Furniture Stores at a cost of £53 10s.
Marylebone.—The Electricity Committee recommend the acceptance of a tender by the Tudor Accumulator Co. for a new battery at Manchester Square station at £2,795 10s., with maintenance contract for 20 years at £220 per annum.

Workmen's Compensation.—A brass worker named Arthur Mason, in the employ of the Electrical Power Storage Co. was awarded 13s. 9d. a week compensation at Birmingham last week through injuries received from sulphuric acid. It was stated that one finger on the left hand has been amputated, and that another operation is necessary.
At Woolwich County Court last week a machine attendant named Vincent Barber in the employ of the Western Electric Co., Ltd., was awarded £7 16s. 8d. damages for the loss of two finger-tips whilst attending a press punch which it was alleged had not been properly fenced. The company was summoned by the Home Office Factory Inspector a short time ago in respect of the fencing.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—*Members:* W. B. Boyd, D. Murray, R. P. Sloan. *Associate Members:* C. W. Appleby, G. Archer, A. T. Arnall, H. E. Blake, W. H. Bradbury, J. Brownell, P. H. Buzza, W. A. Christianson, C. H. Cox, G. P. Dennis, L. C. Desbruslais, N. Donkersley, R. N. Eaton, T Ellis, A. L. Johnson, D. Kerridge, A. Kirk, H. R. McClymont, W. E. Morby, W. Napier, G. Paton, T. E. Robertson, M. Rosenbaum, J. H. Ryder, J. V. Stanton, W. J. Wayte. *Students:* H. Algar, A. Arnold, H. A. Browett, B. A. Churcher, B. Jain, D. N. Jenkins, E. A. Martin, H. N. Munro, J. S. Navarra, H. Papazian, W. Parry, L. C. Pocock, J. T. Radcliffe, J. F. Riley, B. A. Robinson, J. P. Rowell, H. E. Sanders, B. K. Sibou, H. W. Trefusis, D. H. Umrigar, H. K. Whitehorn, W. E. Woodward, E. Wyatt.

Recent Installation Work.—Messrs. Siemens Brothers Dynamo Works, Ltd. (Caxton House, Westminster), inform us that they and Messrs. Siemens Brothers & Co., Ltd., have recently obtained a large number of orders which they have sublet to local contractors, as they themselves do not do actual wiring work. For example, Messrs. J. H. Harpin, electrical contractors, of Birmingham, are now carrying out an installation of 450 lights at the Hawkesyard Priory, Rugeley, with "Stannos" wires, using the sheathing as the return conductor, and "Zed" fuses are used throughout. The power is supplied by a Siemens generator driven from an Austin petrol engine. The switchboard is being made by Siemens Brothers Dynamo Works, Limited. A 60-cell battery by Pritchetts & Gold is being installed. The generating plant is provided with Walker, Horrocks & Co.'s system of automatic control, whereby the generating set starts itself as soon as the battery voltage falls below a certain value. Siemens cables are used throughout. Messrs. S. Gillett are carrying out the wiring with "Stannos" at the Church at Whitley Bay, Northumberland, and that firm is also carrying out for Siemens Brothers the complete electric installation, including 10 h.p. generating plant with battery and switchboard of a private house at Haydon Bridge, Northumberland.

APPOINTMENTS AND PERSONAL NOTES

Mr. H. N. Sporborg, chief engineer, and Mr. W. C. Lusk, manager of Export Department of the British Thomson-Houston Co., Ltd., have been appointed members of the Board of Directors.

Mr. W. H. Sayers informs us that his office at 39 Victoria Street, where he has been continuing the consulting practice carried on by Mr. H. M. Sayers before his departure abroad, is now closed. Telephone messages may, however, be sent to the office of Messrs. Sayers & Wesson, 19 Hanover Square (Gerrard 4787), and letters may be addressed to 11 Knollys Road, Streatham, S.W.

Salesman wanted for wholesale electrical fittings showrooms in Manchester district. (See an advertisement on another page.)

Supply Company has vacancy for Improver. (See an advertisement on another page.)

Messrs. H. A. Neale and G. J. Freund, who have for some years been in prominent positions in the Contract Department of Messrs. Crompton & Co., have severed their connection with the company and started business under the name of Neale & Freund, Ltd. (31 Budge Row, Cannon Street, E.C.). They will undertake the electrical equipment of factories, workshops, country houses, &c., and the export of machinery and plant to foreign markets.

Mr. C. Lakin-Smith, the retiring local Engineer and Manager of the Guernsey Electric Light & Power Co., has been presented with an oak smoking cabinet. Mr. A. N. Rye succeeds Mr. Lakin-Smith.

The salary of Mr. F. H. Edwards, Deputy Electrical Engineer, Erith, has been increased from £180 to £200 per annum.

Mr. W. A. Valon has been appointed Engineer and Manager of the Stafford Electricity & Gas Works. Mr. Valon has been Chief Assistant Engineer at the South Shields Gas Works, and it is stated that although he will have the general management of the two undertakings, the direct management of the electricity works will be in the hands of the Resident Engineer, Mr. Mead.

The Union Cable Co. require a Works Manager for their new factory. (See an advertisement on another page.)

Mr. T. A. Nunwick, for many years chief representative for Messrs. Dorman & Smith, has resigned that position to take up a similar appointment on the staff of Messrs. Parmiter, Hope & Sugden, Hulme Electrical Works, Manchester. This necessitates his relinquishing the various agencies which he has held during the past two or three years; but as Messrs. Parmiter, Hope & Sugden are the selling agents in Lancashire, Yorkshire, Cheshire, and North Wales, for the Gilbert Arc Lamp Co. and Metalite, Ltd., he will represent these firms also.

Railway Rates for Electrical Goods.—At Aston last week the General Electric Co., Ltd., of Witton, were summoned for consigning two parts of a stator, which they despatched by the Midland Railway, as two cases of "bearers." The charge was that the employees of the company in so consigning the goods had in view the object of securing a lower rate, namely, 9s. 2d. per ton instead of 22s. 9d. per ton, had the goods been sent as stator parts. The company contended that it was right to describe the goods as bearers, and that they had been despatched under that description previously. The Bench found that the description of the goods was false, and imposed a fine of £20 and costs, with £10 special costs.

Northern Telephone Exchange, Birmingham.—On Saturday last, at 2 p.m., the National Telephone Company transferred the subscribers connected to its Northern Exchange to a new central battery equipment installed in a building suitably altered to accommodate a telephone equipment at Villa Road, Handsworth. The new equipment has been manufactured and installed by the Western Electric Co., Ltd., of North Woolwich, and is of the No. 1 C.B. type, consisting of six subscribers' positions, giving accommodation for 690 lines, and two incoming junction positions. The equipment is of similar design to those previously described in ELECTRICAL ENGINEERING.



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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Co., of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 to £59 10s. per ton (last week, £59 15s. to £60).

Liquidations.—A meeting of the Polesworth Electric Appliance Co., Ltd., will be held at the offices of Messrs. H. Hackett and Co., 36, Cannon Street, Birmingham, on December 20th, to hear the liquidator's account of the winding up.

Bankruptcies.—The discharge of Frank Shepherd, Electrician, of 4 Haslett Road, Kensington, London, has been suspended for two years from October 18th last.

The trustee in the bankruptcy of J. Platt and R. Bleasdale, trading as Platt & Bleasdale, electrical engineers, Victoria Square, Bolton, has been released.

The discharge of Arnold Roberts, electrical engineer, 21 North Parade, Bradford, has been suspended for two years as from October 18th, 1912.

Plant for Sale.—The Wolverhampton Electricity Department have a 500 kw. generating set for sale. (See an advertisement on another page.)

Exhibition Award.—A gold medal has been awarded to the United States Metallic Packing Co., Ltd., for their exhibit at the Buenos Aires Exhibition.

British Agency.—The firm of G. Schniewindt, of Neuenrade (Germany), have appointed Mr. H. W. Cressall (13 Sumner Row, Birmingham) sole agent for their resistance nets and other manufactures in this country, to whom all inquiries should be addressed.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Douglas Southern Tramways.—The net profit for the past year was £1,636, and after meeting 5 per cent. preference dividend a balance of £338 is carried forward.

Oxford & District Tramways Co.—The report for the past year states that the directors are not able to say when the conversion of the lines to electric traction will take place, owing to the condition of the money market and other circumstances. It will be remembered that the final arrangement was to have the conduit system in the centre of the town, and the overhead system elsewhere, and this combination is put forward as an obstacle in the way of securing the necessary finance within a reasonable period.

Isle of Thanet Electric Tramways & Lighting Co.—There was a profit of £18,242 for the year to September 30th, compared with £15,053 in the previous year. After paying 2½ per cent. on the preference shares it is proposed to place £2,500 to reserve, £2,500 to maintenance and permanent way, and to carry forward £2,277.

Aron Electricity Meter.—Transfer books will be closed from December 7th to 14th inclusive.

Adelaide Electric Supply Co.—The report for the year to August 31st shows a credit balance of £42,239, and a dividend of 7 per cent. is paid on the ordinary shares after meeting the 6 per cent. preference share dividend. A bonus of 2s. per share is also paid upon the ordinary shares. Dividend equalisation fund is credited with £15,000, and depreciation account with £1,000, the carry forward being £4,551.

Electrical Bills in Parliament.—We give below further particulars of those private Bills of electrical interest which are to be promoted in the next session of Parliament, in addition to those given in our last issue :—

Electric Lighting Orders will be applied for in respect of Wycombe (extension), Ashford, Portishead and district, Sevenoaks, Budleigh Salterton, Truro, Coombe, Aldeburgh, Goole, Bognor, Gloucester Corporation (exemption of generating stations from nuisance).

Tramway Bills are being promoted by the Newcastle-upon-Tyne Corporation (use of trolley omnibuses, &c.), Chiswick Urban District Council (lines to be transferred to London United Tramways Co), Caterham and district (trolley omnibuses), Belfast, Aberdare (trolley omnibuses), Halifax, London County Council, Manchester, Middlesborough, Stockton, Thornaby, Northampton, Paignton, Southampton, South Lancashire Tramways, Mansfield (trolley omnibuses and electric lighting), and Brighton, Worthing.

It is proposed to incorporate the Greater London Railway Co. for constructing railways in the Counties of Middlesex and Essex to make junctions with all the main-line railways serving London. Liverpool Overhead Railway Bill will deal with the capital of the company.

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NOTICE is hereby given that the transfer books and register of members of ARON ELECTRICITY METER, LTD., will be closed from Wednesday, December 7th, to Wednesday, December 14th, 1910, both days inclusive.

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ELECTRICAL ENGINEERING

No. 206 [Vol. VI., No. 491 THURSDAY, DECEMBER 8, 1910. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price 1d.

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 208-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

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SUMMARY

Public demonstrations of street lighting are to be made in Gower Street, London, by the Gas Light & Coke Co. and the Metropolitan Electric Supply Co. respectively. The specification prepared by the Holborn Borough Surveyor is open to the objection that the lamps may have a most unsuitable light distribution curve and yet satisfy the conditions. (Page 772.)

A 160 kw. Diesel engine set has been added at the Felixstowe electricity works. The reception tests gave results corresponding to fuel costs of 0·18d. per unit at full load, and 0·22d. at one-third load. (Page 773.)

Mr. W. Tatlow's inaugural address to the Dublin Section of the Institution of Electrical Engineers dealt with the subject of measuring and testing apparatus. (Page 774.)

We publish a detailed description of the electrical installation at Messrs. Arding & Hobbs' new premises, which have been rebuilt since the fire of last year, and represent the largest London drapery establishment south of the Thames. The ground floor is lighted by 60 enclosed arcs, and 900 metal-filament lamps are employed in other parts of the building. Flame lamps hung outside are relied upon entirely for the window lighting. (Page 775.)

In our monthly article on new electrical supplies and accessories we describe some new designs of shades, an improved pattern of electric iron, a cheap form of radiator, a new ampere-hour meter, a portable electrically-driven vacuum cleaner, and a convenient tool for removing shade rings from lampholders. (Page 777.)

A brief illustrated description of Messrs. F. & C. Osler's showrooms appears on page 779.

Among the specifications published by the Patent Office on Thursday last was one by J. J. Rawlings for an earthing device for tumbler switches and other wiring fittings. H. A. Beard and T. W. Townsend describe a shade holder comprising a resilient sleeve fitting over the lamp cap and resting on the pins. In spite of opposition, a patent has been granted to G. Schauli for a dry-cell paste consisting of flaked rice, and zinc and ammonium chlorides. The patent by L. D. Cibie for arc lamp mechanism of the supported carbon pattern is opposed. A patent relating to inter-communication telephones expires during the current week after the full life of fourteen years. (Page 780.)

"The Wiring Contractors' Point of View" deals with the suggestions which have been issued by the London Fire Brigade on the subject of the Coronation illuminations, and also reviews the present position with regard to the proposed Municipal Wiring Bill, which, it is expected, will not be introduced this session. (Page 781.)

The action against Sir John Benn for libel in respect of the experiment with the G.B. surface-contact system in the Mile End Road, ended on Thursday with a verdict in favour of Messrs. Griffiths & Bedell. Damages were assessed at £12,000, but a stay of execution was granted with a view to an appeal. (Page 782.)

Sir Francis Oppenheimer's annual Consular Report upon the trade of Frankfort contains some interesting notes on the German electrical industry. Conflicting statements have been made as to the revenue from the new lamp tax. (Page 782.)

In view of the probable compulsory electrification of the main line sections within the metropolitan district of Boston, Massachusetts, the railway companies concerned have submitted reports and estimates to a specially appointed Commission. The New York, New Haven & Hartford Railroad proposes the single-phase system for its lines, and estimates the cost for these and the Boston & Maine Railroad lines at £6,550,000. The Boston & Albany Railroad chooses the direct-current system with third-rail and 1,200 volts pressure, and estimates the cost of its equipment at £1,282,000. Objections are made to the proposals, and the necessity of higher rates if the work is done is pointed out. (Page 783.)

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A DESCRIPTION is given of the electric driving at the works of Messrs. Thomas Smith, Ltd., of Saltley. (Page 783.)

MR. F. BROADBENT replies to a letter in our last issue regarding connection of overload devices to motor-starters, and a correspondent states that the device described has already been adopted by a well-known firm. Another letter calls the attention of our readers to the Electrical Trades Benevolent Institution. (Page 779.)

A NEW device for removing scale from boilers has been introduced. It consists of three steel discs similar to milling cutters mounted in a holder, and driven from an electric motor by means of a flexible shaft. (Page 784.)

IN Sir J. J. Thomson's presidential address to the Junior Institution of Engineers, a plea was made for a closer connection between pure science and engineering. (Page 784.)

AT an inquiry regarding overhead electric lighting wires at Dawlish, Mr. Trotter, of the Board of Trade, said that he had to think of the public safety, and not of unsightliness.—The London County Council proposes to purchase its large supplies of coal direct from collieries, and to appoint a chemist in this connection.—The Islington Council are installing 16 additional arc lamps, which will replace 40 gas lamps.—A large water power scheme is about to be developed on the west coast of Mexico.—The New Zealand Government also propose to develop their sources of water power in connection with railway electrification. (Page 785.)

BOURNEMOUTH CORPORATION require tenders for 1½ miles of overhead trolley tramways; Eccles Corporation propose to expend £1,000 on motors for hiring; an additional 200 kw. of generating plant is required at Loughborough; extensions are contemplated at Carnarvon, £1,911; Stepney, £10,000; Haslingden, £5,000. Cables are required at Todmorden, and a testing set by the Australian Postmaster General's Department. (Page 785.)

EXPERIMENTAL LIGHTING IN HOLBORN

AS the result of a protest by a large body of ratepayers in the borough of Holborn against a proposal of the Council to hand over the street lighting to the Gas Light & Coke Co., without inviting tenders from the three electricity supply companies in the borough, the Council have invited the companies concerned to give a public demonstration in order that the two methods may be compared. The following notes from the specification of Mr. E. F. Spurrell, the Borough Surveyor of Holborn, kindly lent us by Mr. H. B. Renwick, of the County of London Electric Supply Co., are of interest.

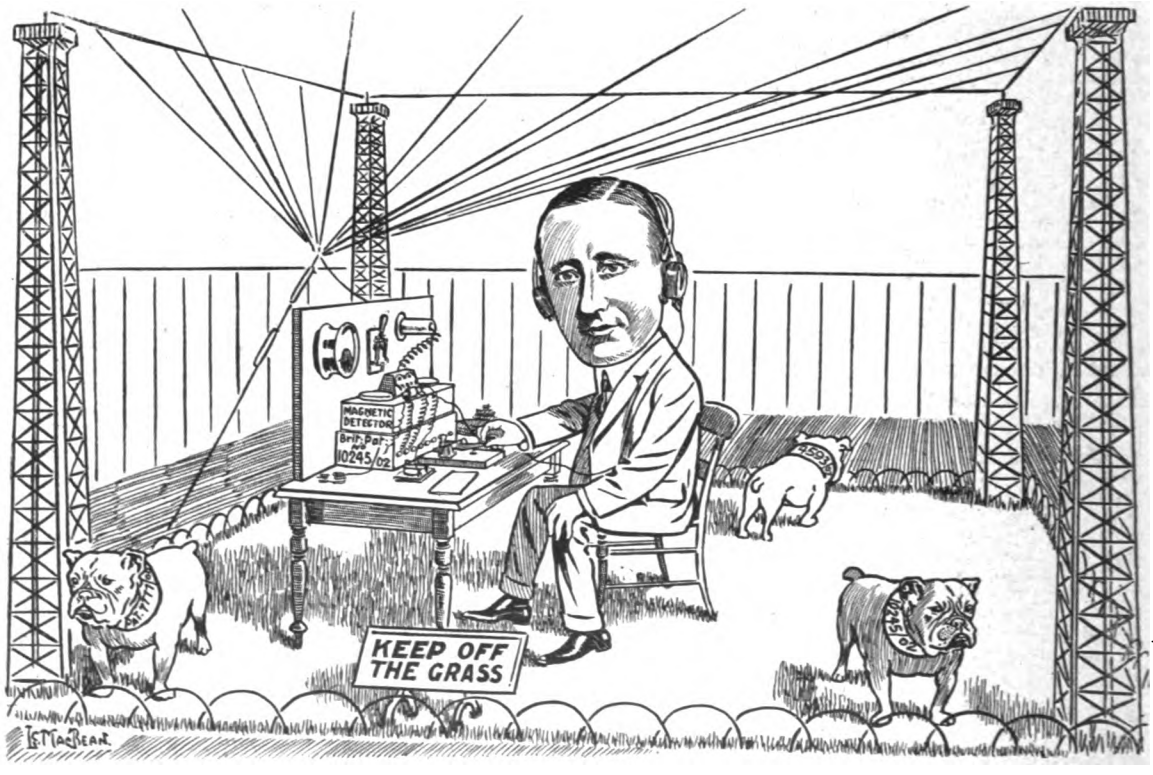
The experimental lighting is to be arranged in Gower Street, which is 397 yards in length and about 47 ft. wide, and is now lit by 16 gas lamps. The northern half of the street, 198 yards long, is to be placed in the hands of the Gas Light & Coke Co., and the southern half will be dealt with by the Metropolitan Electric Supply Co. as representing the three electricity supply companies, the other two being the County of London Electric Supply Co. and the Charing Cross, West End & City Electricity Supply Co. The companies are to take over the lighting for not less than one month, supply all the fittings required, to obtain the necessary wayleaves, &c., and to be responsible for maintenance and repair during that period. Each fitting is to be provided with lamps or burners, giving a minimum of 300 candle-power as measured directly by the Council's portable photometer at ground level. Reflectors will be used to diffuse the rays, and these are to be horizontal and with either flat or convex surface.

The specification continues:—"The candle-power shall be arrived at by taking the average of two sets of readings in any position with regard to the light under test—one set at an angle of 20°, and a second set at an agle of 50°, to the horizontal. The test shall be taken in such a manner as to ensure that glazing bars shall not interfere with results. The photometer shall be the 'Trotter' photometer."

The tests are to be made in clear weather, and in the presence of representatives of the companies. It is also stated that the light shall be a steady white or yellowish-white.

It will be noticed that the part of the specification relating to the method of determining the effectiveness of the lighting is exactly the same as that adopted in the much-discussed Westminster specification. As has already been pointed out, this is open to the objection that the candle-power of the lamp measured at either angle may be quite inadequate provided that the figure at the other angle is sufficient to bring up the average to 300 candle-power.

[*For* ARRANGEMENTS FOR THE WEEK *see page* 781.]



An important patent action will commence next week.

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DIESEL ENGINE PLANT AT FELIXSTOWE

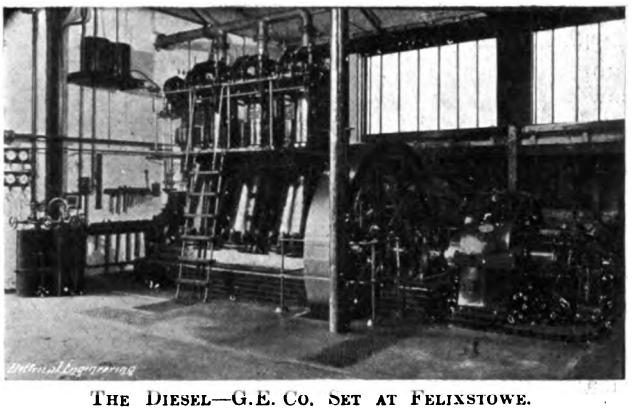
AN interesting little ceremony took place at Felixstowe on Saturday, when a new 150-kw. set at the electricity works was started up by the Chairman of the Urban District Council. Although this represented an increase of over 50 per cent. in the plant capacity of the station, the event would not be worthy of more than passing mention were it not for the fact that the local circumstances would in the ordinary course necessitate high works costs, whereas, by the employment of a Diesel engine for this extension, extremely low fuel costs may be expected. The guaranteed full load consumption is 0·702 lbs. of fuel per kw.-hour, and the result on test was 0·68 lbs.; at two-thirds load the guarantee was 0·768 lbs. and the test 0·671; and at one-third load the guarantee 1·029 and the test 0·828 lbs. per kw.-hour. The fuel employed is a crude oil, costing at Felixstowe 50s. per ton on a contract, so that the fuel costs per unit generated, calculated from the test figures, will be about 0·18d. per unit at full load and 0·22d. at one-third load. The Diesel Engine Co., Ltd. (179 Queen Victoria Street, E.C.), who supplied the engine, are to be congratulated upon these extremely good results. The high efficiency at light loads is particularly interesting and valuable in a small station. It may be added that the cooling water tests were also satisfactory, the guarantee being 4 gals. of water per b.h.p.-hour, with water entering at 60° F. and leaving at 120° F., while the test showed that only 2·85 gals. of water were required. The water is cooled by a small natural draught cooling tower placed on the roof.

The electricity works at Felixstowe occupy rather an unfortunate position; they are well in the centre of their load, but they are surrounded by houses. Although for the most part, at any rate, these houses have sprung up since the works were erected, yet it is, nevertheless, necessary that the works should run practically noiselessly and without serious vibration; moreover, the cost of coal at the works would be fairly high. It is seen, therefore, that the Diesel engine is an almost ideal one for these conditions.

Felixstowe is the largest of three stations run by the Suffolk Electricity Supply Co., the other two are at Stowmarket and Diss. The undertaking was founded by Mr. Napier Prentice, who is the chief engineer to the company. At Felixstowe, after the works had been running for some time, the Urban District Council obtained a Provisional Order, and by subsequent arrangement they acquired the electricity works from the company, who now lease them from the Council by paying the annual capital charges, and run the station. Mr. R. P. Wilson acts as Consulting Electrical Engineer to the Council, and all extensions are carried out under his and Mr. Prentice's joint supervision. The system is at present a 2-wire 200-volt system. There are about 480 consumers, and an equivalent of about 12,000 30-watt lamps. Overhead wires are employed, except in the case of two feeders, which are underground. Bare copper is used, chiefly fixed on ceiling brackets. The consumer has to lead in from the terminal insulator from the chimney. The previous plant consists of two 20-kw. and two 65-kw. sets, driven by horizontal gas engines, and an 80-kw. set driven by a vertical gas engine; the two smaller sets are run with town gas and the others with producer gas.

The new set, as already stated, has a 150-kw. Diesel engine, and it will take the whole load of the station except during the summer peak which is the characteristic of seaside towns. The engine was made to the designs and inspection of the Diesel Engine Co., by Willans & Robinson, Ltd. It drives a 6-pole General Electric Co.'s shunt-wound dynamo rated at 640 amperes, with a maximum pressure of 235 volts at 195 revs. per minute, and has a 9-ton flywheel. There is a D.P. battery with 11,000 ampere-hour capacity at the ten-hour rate, and a reversible booster. At night the engine plant can be shut down, and the cells take the comparatively small all-night load. The old switchboard was of Whipp & Bourne's manufacture, and the new panel for the Diesel-G.E.C. set is being supplied by Bertram Thomas.

The principle of the Diesel engine is probably known to the majority of our readers. It has a 4-stroke cycle. On the first downward stroke air is admitted, on the upward stroke all the valves are closed and the charge of air is highly compressed until about three degrees before the top dead centre, when the fuel valve is opened and the oil is injected against the compression pressure by still more highly compressed air from separate reservoirs. The high compression causes instant combustion without any other ignition device,



THE DIESEL—G.E. CO. SET AT FELIXSTOWE.

and this partakes more of the nature of a slow burning as the fuel is sprayed in than of a sudden explosion. When the combustion is complete, during the next downward stroke the gases expand in the ordinary manner, and in the last upward stroke they are exhausted. There are three cranks at 120°. The air pressure is produced by a Reavell compressor of the quadruplex type directly coupled to the crank shaft; it works without suction valves, the gudgeon pins uncovering the ports. Atmospheric air is compressed up to about 700 lbs. pressure, and is then led to three "bottles" for the compressed air storage. One of these only is employed for the injection of the fuel, and the other two are bye-passed so that they are charged while the engine is running, and they are also used at starting. To start the engine the three "bottles" are connected to one of the cylinders of the engine, so that it starts by atmospheric pressure alone, and after two revolutions the fuel is admitted and the compressed air cut off. One of the tests was ten successive starts, which reduced the pressure in the bottles from 60 down to only 35 atmospheres.

The fuel is stored in a tank in the yard of the station, whence it is pumped by a hand-pump to an overhead reservoir in the station, from which it drops by gravity to a feed-tank. A pump on the top of the engine feeds the fuel in the cylinder in proper quantities for the load, and it is controlled by the governor of the engine, which regulates the time of closing the suction-valve of the pump.

After the starting-up ceremony, the guests were entertained at dinner by the Directors of the Diesel Engine Co. and the Suffolk Electricity Supply Co. Mr. P. C. N. Peddar, Chairman of the latter company, presided. Mr. E. H. Woodmancy, Chairman of the Urban District Council, in responding to the toast of the Felixstowe U.D.C., said that he occupied a unique posi-

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tion, as he is the Vice-Chairman of the gas company, and had had to start up the electric lighting plant. He endeavoured to keep an open mind, and had years ago advocated that the electric lighting should be in the hands of the Council. He had been one of a deputation of three who had inspected Diesel-engine plants before deciding upon the adoption of this one, and was satisfied with the noiselessness and efficiency of the Diesel engine. Had they not adopted this type it would have been necessary to move the works owing to complaints of noise and smell. Moreover, the cost of generation would be considerably reduced, and he hoped they would soon have an all-round price of 6½d. per unit, at Felixstowe [at present the price is raised to 8d. per unit during the summer season]. Mr. C. A. Baker (representing Mr. R. P. Wilson, the Consulting Engineer) wished success to the Diesel Co. He referred to the smoothness with which the contract had been carried out, and also to the satisfactory reception tests. The low-load tests had so far exceeded the guarantees that he had at first thought that the Diesel Co.'s Resident Engineer was carrying out an elongation test on his leg. Mr. W. T. Batho, replying for the Diesel Co., read out the test results, which we have given earlier in this article. He also quoted from the report of Mr. Milton, of the Maidenhead Electricity Works, in which he stated that although the output for the second quarter this year was 18,000 units in excess of that of the corresponding quarter last year, the cost of fuel had been £71 less on account of the saving by using the Diesel engine. Out of 11,311 units generated in one week, 4,798 units generated by the steam engine had cost £13 4s., while the 6,518 units generated by the Diesel had only cost £5 11s. To illustrate the efficiency at light loads, he instanced the case of Leatherhead, in which, with a 51 per cent. load factor in the winter, the fuel costs were 0·21d. per kw.-hour, while with a 13 per cent. load factor in the summer they only rose to 0·217d. At Letchworth [a 150-kw. set which is fully loaded for ten hours daily and then shut down] the costs had been 0·34d. per unit with suction gas, but were now only 0·165d. with a Diesel engine. Mr. Humphrey, the Town Clerk, proposed the toast of the General Electric Co., who had supplied the dynamo, and Mr. Anderson returned thanks on behalf of the company. He said that during the last few years his company had supplied five sets for coupling to Diesel engines, which had given every satisfaction. Mr. Batho then proposed the health of Mr. Napier Prentice, who, in replying, referred to the question of the high price of current which had been mentioned by one or two speakers. He explained that during the greater part of the year only half the plant was required for the load, but that during one and a half months of the summer season the whole plant was fully loaded.

PRACTICAL ELECTRICAL MEASUREMENTS

AT the opening meeting of the Dublin Local Section of the Institution of Electrical Engineers, the Chairman, Mr. W. Tatlow delivered his inaugural address, which had the above title. He attributed much of the rapid progress made in electrical engineering during the past 30 years largely to the facility and accuracy with which it has been possible to measure the electrical quantities involved. Considerable benefits had also accrued to mechanical engineers, owing to the accuracy with which electrical power supplied to machinery could be measured. In the case of large generating stations it was the systematic measurement of the electrical output that had led to the measurement of various quantities involved in its production with a view to checking the cost at every stage.

The lecturer then referred to the various units involved in the measurements of electrical quantities, and the earlier forms of instruments used. Speaking of modern instruments he referred to the well known balances of Lord Kelvin, in which the forces brought into play are counterpoised by standard weights with almost the accuracy of a chemical balance.

For the purpose of checking a current balance, probably the best method is by means of a certified standard cell, and one or more certified resistances capable of carrying the required current without undue heating. An accuracy of at least ⅛ per cent. can be obtained. Two values for each resistance can be obtained if both a Clarke and a cadmium cell are available. Speaking of standard cells, Mr. Tatlow referred to the zinc chloride cell with a mercury cathode depolarised with mercurous chloride. In such a cell the pressure can be set by altering the density of the zinc chloride solution, which should have a s.g. of close on 1·38 to give one volt. The temperature coefficient determined by Hibbert is 0·000073 volt per degree centigrade, and is therefore negligible for all ordinary work. He had constructed several such cells. One made in January, 1905, and tested in February, 1905, had an E.M.F. of 0·9987 volt, and retested August, 1909, at the same temperature, gave 0·9986 volt

The choice of apparatus for the measurement of direct current in the test room of an engineering works or power station practically lies between such instruments as Kelvin balances and some form of potentiometer. The potentiometer has some decided advantages, not only in the way in which its range can be extended by the use of suitable resistances, but also in the fact that the standard cells and resistances upon which the accuracy of the measurements depend can readily be carried to other laboratories for comparison.

Regarding the measurement of resistance, the lecturer described the Lorenz apparatus. In practice resistances are usually measured by some of the well known Bridge methods, or by comparing the pressure falls over the known and unknown resistances, when traversed by the same current, by the potentiometer. The accuracy attainable is really limited by our knowledge of the temperature of the resistances under comparison. In this connection he drew attention to Prof. Callender's statement that Maxwell's rule for connecting up a bridge for maximum sensibility was often undesirable, as it involved more heating of the conductors by the current than other methods. This remark applies especially to platinum thermometry.

In the case of alternating current measurement, the difficulty is greatly enhanced by the absence of anything equivalent to the storage battery. Other complications due to eddy currents or capacity have to be guarded against, so that on the whole it is not reasonable to expect the same precision in alternating as in direct current measurements.

Mr. Tatlow recommended an alternator driven by a direct current motor, the fields of which are controlled by a resistance, as the most suitable source of current. He described a method which has been devised to control the speed of alternators used for wireless telegraphy. The turbine driving the alternator has its throttle valve controlled electrically through a contact made by the needle of a hot-wire ammeter. The speed increases until a frequency is reached at which a circuit containing capacity and self-induction, and including the hot-wire ammeter resonates, when perfect synchronism is approached, the current rises rapidly, and the needle makes contact and operates the throttle: the frequency is thus maintained within very close limits.

Mr. Tatlow concluded his address by referring to modern types of wattmeters for power measurement, and referred in appreciative terms to the Duddell oscillograph, which had played an important part in the investigation of alternating current phenomena.

Royal Institution.—Among the forthcoming lectures at the Royal Institution will be a course of six lectures by Prof. Sir J. J. Thomson on "Radiant Energy and Matter." Prof. Thomson will also give one of the Friday evening lectures.

Osram Lamps for Motor-car Lighting.—The General Electric Co., Ltd., call our attention to the following remarkable testimonial of the strength of the filaments of the small battery Osram lamps used for motor-car lighting: A well-known central station engineer, whilst motoring, recently experienced a side-slip which caused his car to charge a bank and turn over. The first thing to strike the ground was the off-headlamp, which was recovered from the wreck in a very battered condition without a particle of the front glass remaining. Out of curiosity the engineer in question switched on the lamps after the smash, and was surprised to see the Osram lamp light up amid the remains of the lantern. The lamp in question had been in service since June, 1909.

Wireless Telegraph Notes.—The Austrian Minister of Commerce has issued an order that Austrian passenger ships trading beyond Gibraltar or Aden must be fitted with wireless telegraph apparatus. The apparatus must have a range of 100 nautical miles. After November 8th, 1911, when the order comes into force, ships not equipped will not be allowed to carry passengers.

A further wireless telegraph station is to be established in the Cape Peninsula at Slangkop.

According to the *Daily Mirror*, Marconi's Wireless Telegraph Co. have offered to equip Capt. Scott's Antarctic ship, the *Terra Nova*, with wireless apparatus. If the offer is accepted, Capt. Scott would be enabled to communicate with New Zealand from King Edward VII. Land *via* two or three ships stationed at intermediate points, if this were practicable. A new wireless station is now being erected at The Bluff, New Zealand. A telephone equipment will be carried by the sledge party, who hope to keep in touch with the base by laying an aluminium wire as they proceed. (See ELECTRICAL ENGINEERING, June 30th, 1910, p. 427.)

Lieutenant Watkins, who will shortly attempt to win Baron de Forest's prize of £4,000 for a flight across the Channel on an all-British aeroplane, will carry with him a wireless apparatus developed by the Marconi Co. and Mr. T. Thorne Baker, of the *Daily Mirror* staff. The preliminary experiments of Mr. Thorne Baker were described in ELECTRICAL ENGINEERING, October 6th, 1910, p. 632.

According to the *Daily Telegraph*, Capt. E. S. Grogan, the unsuccessful candidate for the Parliamentary election in Newcastle, Staffs, commenced his election campaign on his way home from East Africa by sending wireless messages from the ship in which he was travelling.

It is announced that H.M. hired transports *Soudan*, *Bebille*, *Dongola*, *Rewa*, and *Plassey* have been fitted with wireless telegraph apparatus, and that arrangements are being made for these vessels to be kept in touch with throughout the whole of their voyage.

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ELECTRIC LIGHTING OF A LARGE DRAPERY ESTABLISHMENT

PARTICULAR interest attaches to the electric lighting of Messrs. Arding & Hobbs' new premises at Clapham Junction for two reasons. First, because it is, we believe, the largest drapery establishment in London south of the Thames, and secondly, because it was in these premises that a disastrous "electrically caused" fire occurred about a year ago. In the rebuilding and in the new installation, therefore, the most approved precautions have been made to eliminate fire risk. Before proceeding to describe the electrical installation itself, one significant fact may be mentioned. The old premises which were burnt down were lighted chiefly with gas, but electric light had been employed for lighting up the Christmas show in one of the windows, and the cause of the fire was traced to the cotton-wool decorations being in too close proximity to some of the electric lamps temporarily installed in this window; yet in rebuilding it was realised that no form

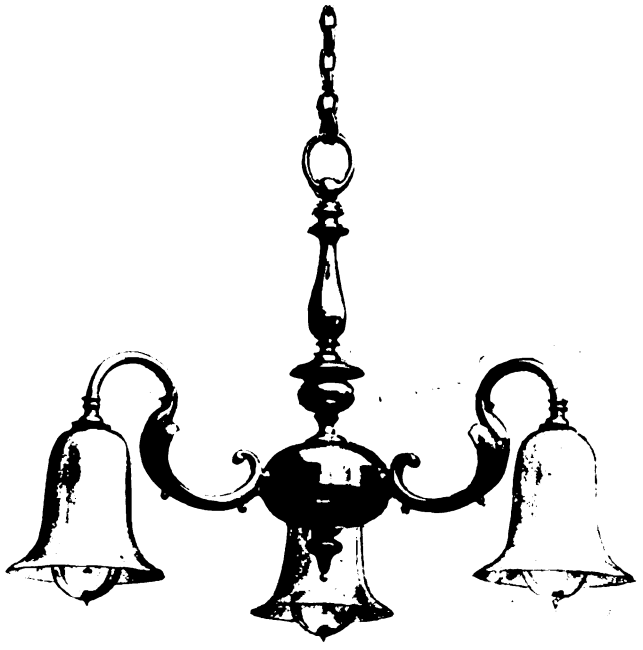


Fig. 1.—Three-lamp Pendant Fitting.

of illumination could be so safe as electric light if permanently and properly installed.

The work has been carried out by Messrs. Belshaw & Co. (53 Victoria Street, Westminster) to the specifications of Mr. S. G. Castle Russell, of 19 Lombard Street, E.C., and supply is taken from the Electricity Supply Department of the Battersea Corporation.

The building is constructed in steel and brickwork, and is divided into four sections separated by heavy brick party walls, with openings which can be closed by steel fire-proof sliding doors. There are no partition walls. One service is brought in at about the middle of the building and is divided just inside, a three-wire cable running in each direction to the two main distribution centres in the basement, situated at opposite ends of the building. The mains pressure is 460 volts, three-wire, continuous current. There is one power board at each centre, and two lighting boards, one on either side of the three-wire system. Fifteen sub-boards for lighting are controlled from one centre, and ten from the other, while each motor has a separate circuit direct from one of the main power boards.

The connections from the main boards to the twenty-five sub-boards have been made with Henley's steel-armoured lead-covered paper-insulated cables, the average size being 19/18s. These are provided with sealing boxes at each end, short lengths of C.M.A. vulcanised-rubber cable leading from the sealing boxes into the iron-clad boards through holes bushed with brass rings. The sealing boxes are provided with special bonding clamps over the armouring of the cables, and are carefully bonded to the iron-clad boards and earth. All the cables from the sub-boards to the switch centres and points are in E.S.C. solid-drawn heavy-gauge enamelled screwed conduit, with the exception of a small amount of galvanised tubing. The armoured cables and all the conduits are laid in the coke breeze under the cement covering of the ground and first floors, and under the boarding of the upper floors. From floor to floor they run in chases in the brick party walls. The conduit is not screwed into the boxes and fittings, but passes in through close-fitting holes. Brass collars are screwed over the ends to prevent chafing of the cable, and a water-tight fit and electrical continuity are secured by means of a back nut screwed on to the conduit outside the fitting.

All the main and sub-boards were constructed by Messrs.

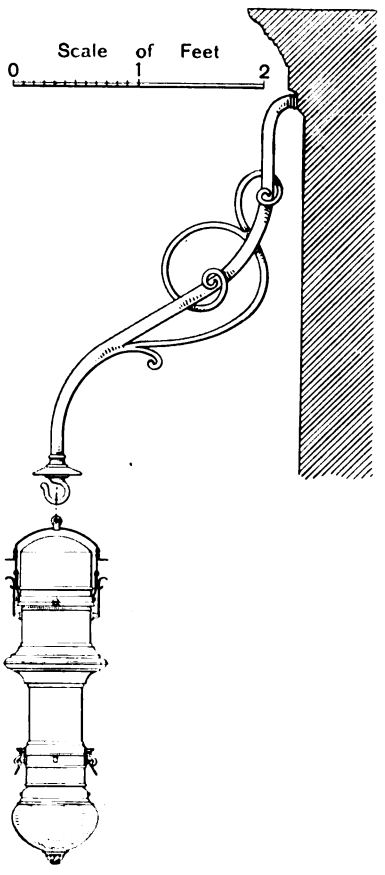


Fig. 2.—Flame Arc Lamp Bracket for Window Lighting.

Belshaw, and are of cast-iron with glass-fronted covers, and lined with uralite. The marble slabs are mounted 2 in. clear of the back of the box with ample space all round. All have face connections by means of lugs sweated on the cables. The 460-volt power boards have double fool-proof doors, giving access to only one side of the three-wire system at a time. All the larger motors are run off the outers, but five small ones are supplied at 230 volts. The main fuses for both lighting and power circuits consist of a strip of fusible metal sandwiched between two wider strips of mica to prevent splashing on blowing. The fuse is fixed between heavy terminals on a marble base enclosed in an iron box. The three-pole power switches and the two-pole lighting switches are of the Cantie quick make and break pattern enclosed in similar boxes. Porcelain tubular fuse carriers are employed on the main boards, and all the circuits are labelled. The boxes and apparatus at each of the two main distribution centres are enclosed by a fire-proof partition.

The sub-boards for arc and incandescent lighting respectively are separate. Each contains one double-pole link switch and the usual porcelain clip fuses. The incandescent lamp circuits are limited to 2½ amperes per circuit, and each arc circuit consists of two enclosed 5-ampere lamps in series. Tumbler switches are employed in all cases, and these are

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grouped together wherever possible and enclosed in a light iron box with glass-fronted cover. In many cases these boxes are mounted flush with the wall, and provided with a fancy metal front through which the dolly-heads of the switches project. As many as eighteen switches are thus grouped together in some cases.

All the wiring is by vulcanised C.M.A. cable, which is drawn in from point to point. There are no elbows or T-joints, but the runs are so arranged that practically all are straight from point to point, there being only a very few drawing-in boxes. An interesting feature in connection with the wiring is the deep pattern of box used for the wall-plugs. This goes far back into the wall, and gives plenty of room for the connection of the incoming leads to the back of the socket.

The main interior lighting on the ground and first floors is by Foster "B.E." pattern enclosed arc lamps adjusted for 5½ amperes, and giving over 50 burning hours on one trim. There are about 60 lamps, connected two in series. On the first floor there are 139 three-lamp pendant fittings of the pattern illustrated in Fig. 1. These were designed and manufactured especially for the present installation by Messrs. Best & Lloyd, Ltd. (Cambray Works, Handsworth, Birmingham). Somewhat simpler fittings are employed on the other floors. Nearly 900 Mazda lamps are in use, and some 300 holophane shades. The flexible that is used for the pendants is C.M.A. 23/36 wire. The exterior lighting is by flame arc lamps. These are of the "Excello" pattern, and some 50 are in use. Fig. 2 shows the form of bracket employed. The lamps are connected five in series across the 230-volt circuits. At present the flame lamps outside are relied upon entirely for the window lighting, but in each window there are three or more wall plugs, and it is very probable that concealed window lighting by reflector lamps will be employed in some windows at a later date.

The power installation includes six lifts by Messrs. Archibald Smith & Stevens (Janus Works, Queen's Road, Battersea). The two goods lifts are of one ton and fifteen cwt. capacity respectively. These and the two service lifts are fitted with push-button control. The two passenger lifts are provided with switch control from the cages. The other power applications comprise a pneumatic cash service, ventilating fans, and several small motor-driven appliances in the catering, hairdressing, and other departments.

Before closing this article, we think that it will not be out of place to give a general idea of the extent and arrangement of the building itself and of the business carried on there. Messrs. Arding & Hobbs's business is one of those which have grown from small beginnings, having originally been established as one small shop in High Street, Wandsworth, thirty years ago. In 1885 new buildings were erected on the present site nearly opposite Clapham Junction Station, and the business has gradually been extended in character so as to embrace not only drapery, millinery and outfitting, but also furniture, household ironmongery, china and glass, jewellery, cutlery, toys, cut flowers, and in fact almost every branch of retail trade; there is even a restaurant, and a post office with full postal facilities. It has been found that a far wider *clientèle* is obtained than is represented by the local residents, as the large and well-stocked establishment by Clapham Junction Station attracts a shopping public from other parts of London, and from practically the whole of the districts on the London & South-Western and London, Brighton & South Coast Railways. The size of the new building is seen in Fig. 3: and a further idea of its extent will be derived from the fact that the shop-window frontage is 650 ft. long, that 300 men were employed night and day for three months to clear the site after the fire, and 500 have been working continuously during the subsequent nine months on the rebuilding work.

The General Manager, Mr. F. W. Lloyd, showed our representative over the building just before the reopening, which took place on Tuesday, and we were much impressed with the completeness and the practical nature of the arrangements. The fire-proof construction has even been carried out to the extent of employing a metal handrail instead of a wooden one on the main staircase, and the avoidance of wooden skirting at the bottom of its walls. The general construction of the building has already been indicated. No less than 1,595 Grinnell sprinklers have been fitted, which are put into action automatically from the heat of a fire, and the sides of the building facing other buildings are provided with "drenchers," which will drench the wall in the event of fire occurring opposite, and so prevent its spreading across.



Fig. 3.—General View of Messrs. Arding and Hobbs' Establishment at Clapham Junction.

In the general decoration of the rooms, the Georgian and Adam styles have been followed, and the electric light fittings illustrated, which were selected by the members of the firm themselves after an inspection of many alternative designs, are in keeping with this style. The enclosed arcs on the ground floor give a good diffused light, and are excellent for colour-matching, and the pleasing diffusion afforded by the holophane shades on the metallic filament lamps will also be appreciated.

On the second floor, a number of rooms are being furnished in different styles, to represent rooms in flats, &c., and a selection of suitable electric lighting fittings will be used in them, as Messrs. Arding and Hobbs find it advisable to include the sale of these so as to be able to undertake the whole furnishing and fitting of houses and flats.

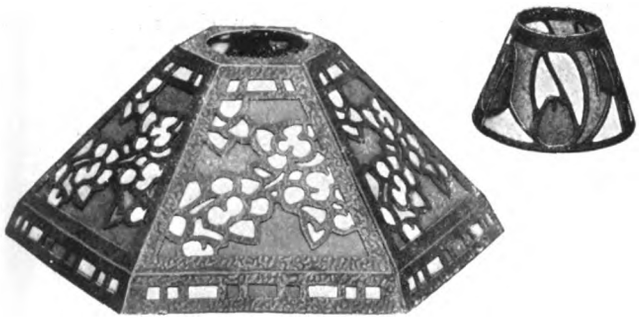
Obituary.—The death is announced of Mr. J. H. Wray, who was for five years Borough Electrical Engineer at West Bromwich. Ill-health during the past few years had prevented Mr. Wray from following his calling as an electrical engineer.

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Switches, Fittings and Accessories.

A NUMBER of new and effective designs of their well-known "Spookie" shades have been prepared for the present season by Simplex Conduits, Ltd. (113-117 Charing Cross Road, W.C.). Some of the new designs are very attractive, and considerable general improvements have been made in these shades. They are more strongly made, and by the use

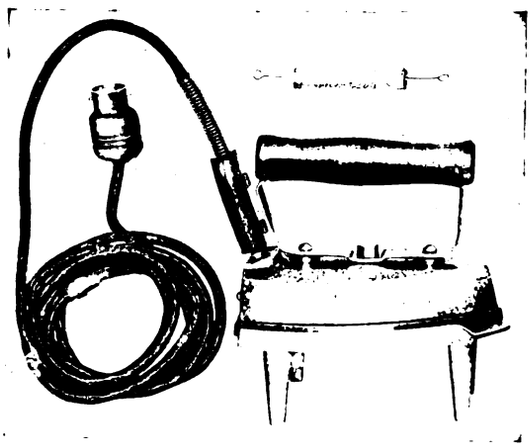


New Simplex "Spookie" Shades.

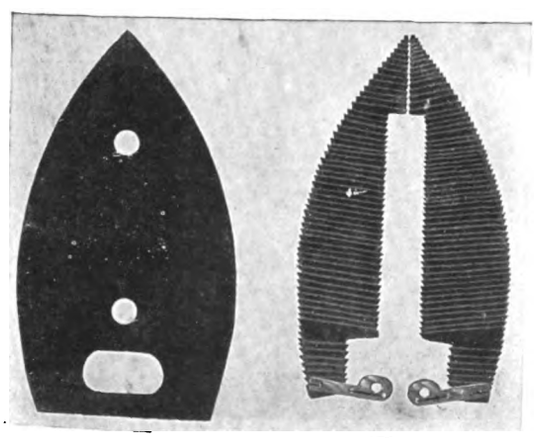
of a special new form of linen paper, added richness in colouring effect has been obtained. All the new "Spookie" shades supplied have an imitation metal framing, and this is supplied in three finishes:—brown or antique green, and silver. Two of the new designs are illustrated herewith.

Heating and Cooking Apparatus.

The British Thomson-Houston Co., Ltd., have brought out an entirely new series of electric flat irons, which



"Calorite" Iron, complete with Adaptor and Lead on Stand.



Heating Element.

nbody considerable improvements on the earlier patterns. he heating unit is of an alloy named "calorite," which ey state is capable of withstanding oxidation to a point several hundred degrees higher than any metal previously used in heating devices, and has a melting-point of 2,370° F. Indeed, they inform us that one of these has been in circuit continuously day and night for nearly four weeks, and although the wooden handle has entirely disappeared, the heating unit is still intact. These irons are made in various sizes, suitable for all kinds of light or heavy ironing, from delicate embroideries to leather and tailoring work. The parts are fully interchangeable, and high efficiency is secured by the heat-insulating air-jacket over the top, and the close thermal contact between the heating unit and the sole of the iron. An illustration of the complete iron and of its heating unit are given here. It will be seen that the heat is supplied where it is most required, at the point, heel, and sides. The body is of two hard grey cast-iron plates, which clamp the leaf unit between them, and are held by two heavy steel bolts.

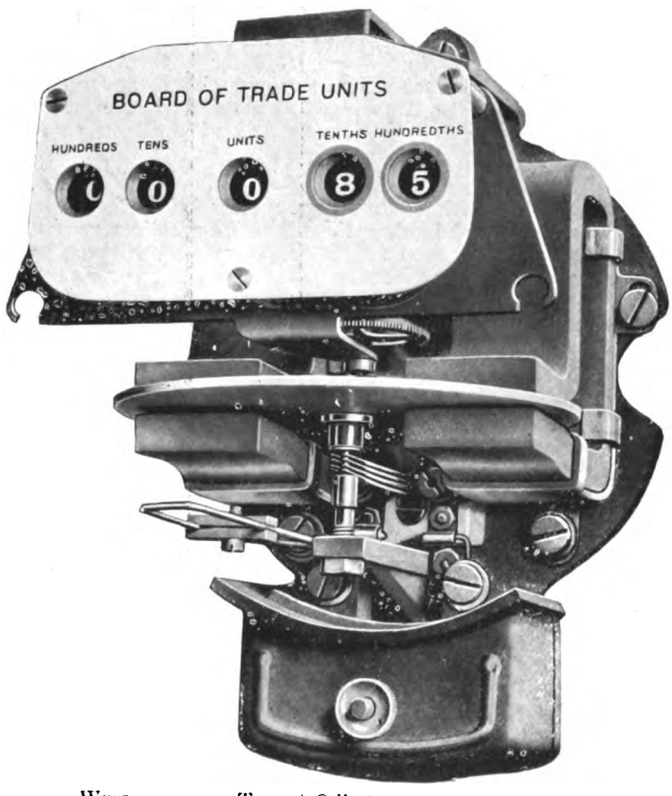


Simplex Radiator.

We illustrate herewith a simple form of four-lamp radiator, which is very moderate in price, and is one of a number of new designs contained in a new list just issued by Simplex Conduits, Ltd. (Garrison Lane, Birmingham). The list includes a variety of patterns of two-, three-, and four-lamp radiators, as well as convecters, in sizes up to those with a consumption of 2½ kw.

Miscellaneous.

The accompanying illustration represents a new pattern of ampere-hour meter which the British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), have recently placed upon the market, and is known as type "O." The meter, which is shown here with the case



Westinghouse Type "O" Ampere-hour Meter.

off, is particularly designed for use on small consumers' circuits, and is of very simple construction. It is a motor-meter driven by the drop across a low-resistance shunt, which carries the main current. The armature is connected in parallel with this shunt, thus only a small proportion of the total current is carried by the commutator and brushes. An adjustable resistance gives a suitable range of speed adjustment. The armature consists of three coils of enamelled

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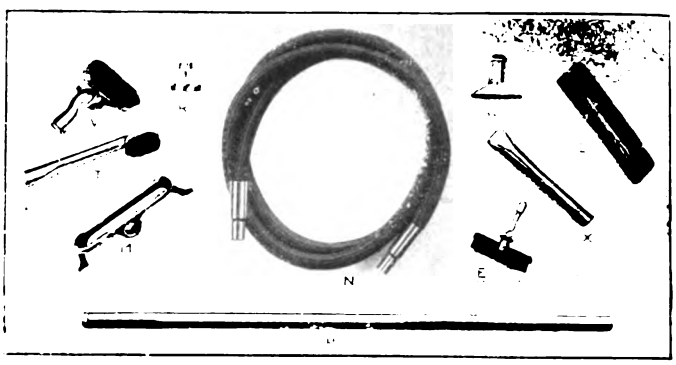
strip, wound and arranged in an improved patented method to give a maximum torque for a minimum weight, and totally enclosed between aluminium discs. The commutator is of 18-carat gold on ivory bushes, and is of extremely small diameter. The full-load torque is 14 cm. gms., and the weight of moving element is only 20 gms. The full-load speed is 100 r.p.m. for sizes below 30 amps., above 30 amps it is 75 r.p.m. The jewel bearing is of best sapphire, and, if desired, can be supplied with a spring support. The case as well as the cover are of iron highly finished in either black or French grey stove enamel. Clock-face or cyclometer dials are supplied as desired, which can be arranged to read either ampere-hours or B.O.T. units. The cyclometer dial is of



Electric "Kleenall."
(General Electric Co., Ltd.)

special construction with a novel springing device which prevents the halving of figures when turning over. The meter is extremely small and light, and an efficient washer renders it completely proof against damp, dust, or dirt. All these meters can be supplied for use on two-wire circuits up to 500 volts, and for capacities from 1 to 200 amps. inclusive. The degree of accuracy obtained is guaranteed within 2 per cent. from 25 per cent. overload to 1/20 of full load. Switchboard as well as house-service patterns are made.

The General Electric Co. are now putting before the trade an improved form of light, self-contained domestic vacuum-cleaner, which has several points to recommend it, both to the consumer as an efficient means of dust removal, and to the supply authority as a current-consuming device. The apparatus is now known as the electric "Kleenall," and embodies improvements on the similar type of apparatus introduced some months ago. The appliance consists of a vertical spindle motor driving a centrifugal exhausting fan immediately over the wide nozzle, and a bag is provided for the reception of the dust. The whole is attached to a long handle, and is light enough to be used as a broom for carpet cleaning. When employed in this way a brush can be fitted inside the nozzle, so that it is vibrated by the motor, and assists the disengagement of the dust. In addition to being used in this way, a series of attachments are provided, by which cleaning of objects, hangings, and decorations in any part of a room can be carried out by simply clipping on the shoe *M* to the wide nozzle, and laying the apparatus down on the floor. A flexible hose, with any one of the numerous forms of nozzle illustrated, can then be attached, and the apparatus used as a stationary suction cleaner. Again, for



Spare Attachments for Electric "Kleenall."



Broadbent Patent Shade Remover. (Sun Electric Co., Ltd.)
(Scale, one-third full size.)

some purposes the hose may be attached to the delivery side of the pump, and used as a blower for removing dust from surfaces difficult to reach with a suction nozzle.

Among the novelties recently introduced by the Sun Electrical Co., Ltd. (118-120 Charing Cross Road), is a very convenient special tool for removing shade rings in cases where the shade is too narrow for the hand to reach the ring. The tool is illustrated above. The ring is held by a number of spring jaws, which are attached to a metal disc free to slide within the external brass tube mounted on the handle. These springs are so shaped that they close tightly on the ring as the outer tube is pressed over them. Thus to pick up a ring from a flat surface, the jaws are first shut or pulled out and placed over the ring, and the handle pressed down, when the ring is tightly gripped and can be slipped into place. Pulling the handle will, of course, disengage the jaws. A shade ring can be laid hold of for removal in a similar way.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ILLUMINATION.—Holophane, Ltd. (12 Carteret Street, Queen Anne's Gate, S.W.) have produced the first issue of a monthly publication entitled "Holophane Illumination." This will contain particulars of the latest patterns of Holophane globes and reflectors and methods of using them. The present issue includes photographs of Holophane installations; some notes on Holophane reflectors for church lighting, and a description of the new "Stiletto" type reflectors. Particulars and illustrations of Holophane fittings were given in a special article on lighting in Electrical Engineering, Oct. 20th, 1910, p. 657. Any of our readers who desire to have information with regard to the principle of light distribution by holophane shades should apply to the company for a copy of this publication, which, we understand, is being circulated free of charge.

METAL FILAMENT LAMPS.—Mr. G. Braulik (8 Lambeth Hill, Queen Victoria Street, E.C.) sends us lists of "Eclipse" colloid-tungsten metal filament lamps, which are made in sizes from 9 to 1,000 c.p., and for various voltages from 25 to 260.

SMALL MOTORS, COILS, BELLS, &c.—Another list from the same firm deals with toy and other miniature motors, cheap induction coils, bells, and novelties.

RESISTANCE NETS. A large sheet mounted for hanging on the wall is being issued by H. H. Cressall, 13 Summer Row, Birmingham, who, as announced in our last issue, has taken up the British agency of Schniewindt's patent asbestos woven resistance nets. Illustrations are given of various forms, suitable for motor starters, heating, and other purposes, and tables of technical data and prices are given.

DYNAMOS.—A new list of continuous current generators has been issued by Crompton and Co., Ltd. (Salisbury House, London Wall, E.C.). Open type machines are only listed from 5 to 250 kw., but the firm are, of course, prepared to quote for machines of larger size. The machines listed are manufactured from seventeen standard sizes of frame, and for each size a large number of windings have been standardised, which give a complete range of outputs and speeds for all ordinary work.

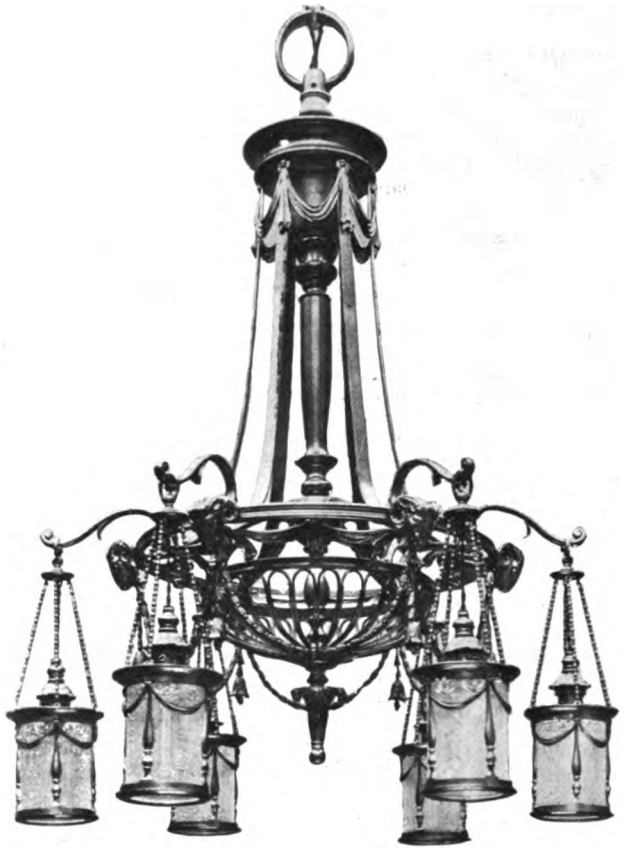
SIGN FLASHERS.—A new leaflet from the Sun Electrical Co., 118-120 Charing Cross Road, describes the automatic clock-controlled mercury contact magnetic sign-flashing switches the company have recently introduced. This excellent piece of apparatus was illustrated and full particulars of its working were given in the special article on electric signs in Electrical Engineering, October 20th.

SWITCHGEAR.—A set of leaflets in a convenient cover is to hand from the Switchgear Company, Ltd. (Newhall Street, Birmingham). Among the apparatus dealt with are quick-break blow-out fuses for continuous current, Statter's patent quick-break blow-out and other circuit-breakers, switch fuses, quick-break knife switches, and the latest forms of the Statter discriminative lag apparatus, which can be applied to all forms of circuit-breaker, relays for generator and feeder protection, &c. This presents great advantages owing to the relation between the lag and overload that can be obtained. Further leaflets describe many oil switches and oil-immersed star-delta starting switches.

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OSLER'S NEW SHOWROOMS

WE recently had an opportunity of inspecting the showrooms of Messrs. F. & C. Osler, Ltd. (100 Oxford Street, London), which have been considerably extended, and we are enabled to illustrate one of the



A Fine Adam-style Electrolier.

new rooms and also two of the many pleasing designs of fittings which are adequately displayed there. The reputation of this firm for cut glass is a very high one, and the array of beautiful glassware of all classes in their establishment is probably second to none in



A Two-light Bracket.

London; it is not so well known, however, that the firm manufacture at their works in Birmingham not only glass but also metal fittings of an equally high quality and finish, and that, besides the more elaborate and costly ones, they stock a number of less expensive patterns, some of them quite equal in artistic merit and all equal in workmanship and finish to the class of fittings which has made their name.

The extension of the showrooms consists mainly of six smaller rooms opening out of the large gallery in Oxford Street. Each room is devoted to a particular style. In one some really beautiful electroliers and brackets in the Adam style are shown, and we illustrate one of the most prominent of these. Another room is devoted to Georgian and Tudor. In the "pillared hall," which we illustrate, some extremely pleasing patterns are shown, in which Sheraton, Chippendale, and Grinling Gibbons designs are embodied. There is a panelled room for miscellaneous fittings, including the various French styles, and a "Gothic" room, with stone walls, is employed to display church fittings and those of similar character.

We illustrated in our issue of November 17th the cut glass dish fittings chosen for the Institution of Electrical Engineers Building, and various sizes and patterns of these are shown, as this design will always remain one of the most popular. In some of the dish or bowl



The "Pillared Hall."

pattern fittings a modification of the design has been introduced to soften the glare. The glass is cut in pillars and "acided" inside so that each pillar acts as a lens, and while the light is softened there is no undue loss of illumination.

A feature that we greatly appreciated in the Osler fittings is the selection of the shades. Many fittings which one sees in houses are spoilt by the use in them of ordinary stock shades which are not in keeping with the character of the fittings, but as Messrs. Osler manufacture their own shades, every one of them is selected to harmonise perfectly with the general scheme.

Serious Fire at Derby.—The Derby Electricity Works had a very narrow escape from being involved in a fire which broke out in the early hours of Monday morning at Messrs. Sowter & Co.'s flour mills, almost adjoining the station. The fire was one of the most serious that has been known in Derby, and both the flour mills and the major portion of the building known as the old silk mill were entirely gutted, the flames being favoured by the high wind prevailing. The Derby Fire Brigade, with assistance from the Midland Railway Brigade and that of Messrs. Bemrose & Co., succeeded in preventing the fire spreading to other buildings, but it was not until six o'clock in the evening that the engines stopped playing. Fortunately no damage was done to the electricity works; and although Mr. T. P. Wilmshurst (Borough Electrical Engineer), who was himself called to the scene in the night, informs us that the heat in the station was terrific, there was no interruption of the supply.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published December 1st, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

5,035/10. **Knife Switch.** M. J. Railing and C. C. Garrard. (General Electric Co., Witton.) This specification describes a quick-break switch provided with a double-acting spring for preventing the closing of the switch by vibration or when inverted. Closing the switch puts one half of the spring under tension, and in opening the switch the other half is put under tension, so that a very quick break is effected. Three figures.

8,858/10. **Earthing of Wiring Fittings.** J. J. Rawlings (London). The insulating base of a tumbler switch or other fitting is recessed to receive a strip metal spring which is forced into contact with the cover when the latter is screwed on. The strip is connected to the conduit or other earthing system. Four figures.

9,547/10. **Shade Holder.** H. A. Beard and J. W. Townsend (Banbury, Oxon.). The shade is supported by a sleeve, which is placed over the lamp cap before inserting the lamp in the socket. The sleeve has a grooved flange at the bottom which rests on the bayonet pins, and a spring flange at the top to grip the shade and prevent it rattling. Nine figures.

18,443/10. **Electrically-controlled Switch.** Adams Manufacturing Co., Ltd. (*Cutler Hammer Manufacturing Co., U.S.A.*). The switch is provided with links forming a self-locking toggle for holding the switch closed after the temporary energising of the operating solenoid. In the closed position a weighted lever bears against the toggle to lock it, but on energising the tripping solenoid, the lever delivers a hammer blow to the toggle and releases it. Seven figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Ingle [Insulating materials] 1,021/10; Haefely [Winding apparatus for coils] 18,151/10.

Dynamos, Motors, and Transformers: Siemens Bros. Dynamo Works and Holmes [Electrical marine propulsion] 28,804/09.

Electric Ignition: Turner and Fenwick [Magneto machine] 27,624/09; Etablissements de Dion Bouton (Soc. Anon.), 5,510/10; Haddan (*Lesperance*), 6,650/10.

Electrometallurgy and Electrochemistry: Preston [Primary cells] 26,683/09; Soc. Anon. Electrométallurgique (Procédés Paul Girod) [Three-phase furnaces] 3,421/10; Frost [Galvanising process] 9,352/10; Thomson and FitzGerald [Electric furnaces] 11,717/10.

Incandescent Lamps: Wolfram Lampen A.-G. [Process for decarbonising metal filaments] 14,116/10.

Storage Batteries: Tate [Regenerating batteries] 2,513/10.

Switchgear, Fuses, and Fittings: Cowper-Coles [Lamps] 26,888/09; Bourne [Four-way switch] 26,899/09; Bonella [Wall plugs] 29,506/09; Nash and Western Electric Co. [Relays] 752/10; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co., U.S.A.*) [Rheostats] 2,749/10; Wolf, Bambury and Bernardy [Lamp brackets and pendants] 3,822/10; Henkel [Motor controllers] 3,847/10; Electric & Ordnance Accessories Co. and Collins [Time limit devices for circuit-breakers] 12,708/10; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Circuit-breakers] 13,520/10; Sweetser and Electric Sign & General Advertising Co. [Switch] 15,037/10.

Telephony and Telegraphy: Goldschmidt [High-frequency generator for wireless telegraphy and telephony] 11,294/10; Eisenstein [High-frequency impulse generator for wireless telegraphy and telephony] 16,354/10.

Traction: Marks (*California Valve and Air Brake Co.*) [Air brakes] 10,826/10; Schaeffer [Operation of tramway points] 18,513/10; Siemens Bros. & Co. and Ferreira [Operation of railway points] 19,969/10.

Miscellaneous: Schwarz [Heat accumulators] 26,376/09; Macfarlane [Electrically-driven centrifugal machines] 26,406/09; Mavor & Coulson, Ltd., and Mavor [Coal conveyers] 26,531/09; A.-G. Brown, Boveri & Cie [Gas turbine] 26,712/09, 27,217/09, 27,219/09, and 27,220/09; Taylor [Hand tool for grinding commutators] 4,724/10; Bourck [Temperature and fire alarm] 9,364/10; Melling [Winding and hauling engines] 13,152/10; Shaw [Prevention of overwinding] 14,927/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: A.-G. Brown, Boveri & Cie [Repulsion motor generators] 25,473/10.

Electric Ignition: Herz [Sparking plugs] 25,539/10.

Electrochemistry, &c.: Langbein Pfanhauser-Werke A.-G. [Manufacture of electrolytic iron] 25,092/10, and 25,969/10; Consortium für Elektrochemische Industrie Ges. [Production of acetylene tetrachloride] 25,967/10.

Incandescent Lamps: Westinghouse Metallfaden Glühlampenfabrik Ges. [Process for decarbonising metal filaments] 24,637/10.

Switchgear, &c.: Lange [Electrical remote control system] 26,268/10; Reiniger Gebbert & Schall A.-G. [Mercury contact breakers] 26,341/10.

Telephony: Telephon Apparat Fabrik E. Zwietusch & Co. [Automatic telephone exchanges] 26,079/10.

Miscellaneous: Scherl [Gyroscopic stability mechanism] 27,838/09; Aktiebolaget Ljungströns Angturbin [Gas turbine] 24,137/10.

Opposition to Grant of Patents

2,215/09. **Steam Turbines.** G. Belluzzo. This patent has been granted in spite of opposition. It covers the balancing of the axial thrust by the admission of steam at an intermediate pressure to special chambers situated at both ends of the turbine.

10,791/09. **Battery Electrolyte.** G. Schauli. This patent has also been granted. The specification, abstracted in Electrical Engineering, June 2nd, 1910, p. 364, relates to a mixture of flaked rice, zinc chloride, and ammonium chloride.

21,008/09. **Arc Lamp.** L. D. Cibie. Opposition has been entered to the grant of this patent. The specification, abstracted in Electrical Engineering, Oct. 13th, p. 648, describes a lamp in which one carbon is guided in a socket having a spherical bearing and rests on a stop attached to this socket.

Restoration of Patent

14,851/06. **Telephone Exchanges.** Kjöbenhavns Telefon Aktieselskab. This patent, which expired in 1909 owing to non-payment of the renewal fee, has been restored to Aktiebolaget L. M. Ericsson & Co. It covers apparatus for the automatic distribution of the operating service in telephone exchanges.

Amendments

15,802/09. **Ignition Apparatus.** B. Brooks and F. H. Alston. A disclaiming note has been inserted in this specification. The patent covers the use of the induction coil itself as the revolving part of the H.-T. distributor, thus eliminating some of the rubbing contacts.

16,405/09. **Combined Massaging and Magneto Machine.** F. Burks. A statutory reference to Specification No. 12,844 of 1909 has been inserted in this specification, which describes a massaging machine with a metal roller for conveying a current to the body from a magneto geared to the roller.

5,043/10. **Bicycle Lamp Dynamo.** C. Schlick. A disclaiming note has been added to this specification, which describes a permanent magnet generator with a spring holder for bringing the armature pulley into contact with the tyre.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

28,612 of 1896. **Intercommunication Telephones.** A. J. Boult (*Soc. Anon. de Téléphonie Privée, Brussels*). This patent covers telephone apparatus for use in private installations in which the stations are connected with each other by means of multiple contact switches. Separate batteries are employed, and only that of the station required for conversation is put in circuit, thus avoiding interference due to the other currents in the common return conductor. A special Hunnings transmitter is also described.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: H. Leitner and R. N. Lucas [Train-lighting dynamo and system] 17,601/03; H. Hill [Storage-battery train-lighting system] 17,602/03 and [Train-lighting system with dynamo] 17,764/04.

Instruments, &c.: H. T. Harrison [Electrolytic meter] 17,632/03.

Switchgear, &c.: F. W. Manley [Reversing switch for train-lighting dynamo] 17,603/03.

Telephony, &c.: W. L. Wise (*C. L. Buckingham, U.S.A.*) [Telegraphic tape perforator] 14,637/00; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Group-calling system for telephone exchanges] 16,484/05.

Miscellaneous: E. G. Hoffmann [Ball thrust bearings] 16,517/99; G. C. Marks (*M. B. Church, U.S.A.*) [Bevel gears for automobile motors] 16,577/05.

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ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, DECEMBER 8TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. "The Magnetic Properties of Iron and its Alloys in Intense Fields," by Sir Robert Hadfield, F.R.S., and Prof. B. Hopkinson, F.R.S.

Institution of Electrical Engineers: Dublin Section.

8.20 p.m. At Royal College of Science.

Rugby Engineering Society.

8 p.m. At 29 Regent Street, Rugby. "Electricity in the Himalayas," by B. F. McMurtrie.

FRIDAY, DECEMBER 9TH.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. "Recent Progress in Electric Lighting," by Prof. E. W. Marchant.

SATURDAY, DECEMBER 10TH.

Birmingham and District Electric Club.

7 p.m. Annual General Meeting at Colonnade Hotel, New Street.

MONDAY, DECEMBER 12TH.

Institution of Electrical Engineers: Newcastle Section.

8 p.m. At Armstrong College. Discussion on "Electric Winders."

Royal Society of Arts.

8 p.m. Cantor Lecture IV. "Industrial Pyrometry," by C. R. Darling.

TUESDAY, DECEMBER 13TH.

National Electrical Manufacturers' Association.

2.30 p.m. Special General Meeting at Balfour House, Finsbury Pavement, London.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At School of Technology. "Organisation and the Reduction of Manufacturing Costs," by A. R. Stelling.

Institution of Electrical Engineers: Yorkshire Section.

7.45 p.m. Reception and Smoking Concert, Hotel Metropole, Leeds.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street.

Faraday Society.

8 p.m. At Institution of Electrical Engineers, Victoria Embankment. (1) "New Apparatus for the Rapid Electro-Analytical Determination of Metals," by H. J. S. Sand and W. M. Smalley. (2) Mr. R. W. Paul will exhibit some new pyrometers and resistance thermometers, and some low and high reading amperemeters, &c.

WEDNESDAY, DECEMBER 14TH.

Institution of Electrical Engineers: Glasgow Section.

Annual Dinner.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. At the University. "Street Lighting by Modern Electric Lamps," by H. T. Harrison.

Institution of Electrical Engineers: Students' Section.

7.30 p.m. At Victoria Embankment. "Progress in Arc Lamps," by J. F. Shipley.

Junior Institution of Engineers.

7.30 p.m. At Royal United Service Institution, London. "Some Recent Developments in Condensing Plant," by G. L. Kothny.

THURSDAY, DECEMBER 15TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. "Submarine Cables for Long-Distance Telephone Circuits," by Major W. A. J. O'Meara.

FRIDAY, DECEMBER 16TH.

Electro Harmonic Society.

8 p.m. Smoking Concert, at Holborn Restaurant.

SATURDAY, DECEMBER 17TH.

Junior Institution of Engineers.

3 p.m. Visit to G.P.O. Power Station, Blackfriars.

FROM THE WIRING CONTRACTORS' POINT OF VIEW

IT will not be long before preparations are in hand for street illumination and other temporary lighting for the Coronation. The matter has already been under the consideration of the Fire Brigade Committee of the London County Council, and, as we have already announced, a short series of seven recommendations has been drawn up by the chief officer pointing out such precautions as are advisable from the fire risk point of view. The Council have, of course, no power to impose compliance with any actual regulations, and these rules are more of the nature of advice. They contain much that is universally admitted to be essential to good practice, but the importance of sound work on temporary installations can never be repeated too often.

The Fire Brigade would have every installation tested and approved by the supply authority before connecting up, but we should imagine that, unless the companies are prepared to enlarge their staffs considerably, this will be difficult of universal accomplishment. Adequate fusing of both poles of all circuits and sub-circuits is required, and the latter are limited to 2 kw.—by no means too low a figure. Bare conductors are rightly entirely tabooed, and the importance of earthing of all metal conduits and coverings is emphasised. Festoons, garlands, &c., must have supports independent from the conductors, and an important hint is given that the effect of wind must not be overlooked in their design, and another rule reads as follows:—All shades and decorations of combustible materials in proximity to lamps should be rendered non-inflammable by a process which will withstand the action of rain for several days, and no shades or decorations of celluloid or similar substance should be used. It is also recommended that the installations should be connected, where practicable, at the main intake, or at the main distribution boards, so as to avoid the possible overloading of the house wiring, advice which the careful wiring contractor will hardly require, but which it is desirable to publish for the benefit of the consumer, who might be tempted to try his hand at amateur work. Illuminations are in use for several hours at a stretch, and therefore the overloading of the house circuits might lead to disastrous results. Copies of these recommendations are being sent to all the supply authorities in the London district.

The Conference between representatives of the Incorporated Municipal Electrical Association and the Electrical Contractors' Association will be resumed on Friday. In the meantime it may be noted that the Municipal Wiring Bill is not among the private Bills deposited for the coming session of Parliament in the ordinary course. If, therefore, it is still deemed advisable by the I.M.E.A. to proceed with a Bill after the Conference, the only course left is a "late Bill," a Private Member's Bill, or a Government Bill. The first of these procedures is not likely to be followed, as there is no intention to push forward a Bill hurriedly, and procedure by Private Bill would be complicated, as it would probably necessitate every Corporation included in the Bill being one of the promoters, or at any rate assenting to it in all its clauses. It must also not be forgotten that several corporations already possess the powers sought. A Private Member's Bill of so controversial a nature would stand practically no chance of passing into law, and the possibilities of a Government measure being introduced can hardly be discussed with any degree of assurance at the present time. Failing compromise between the two sides to the Conference, we anticipate that the ultimate result will be that those Corporations desiring wiring powers will proceed each with their own Bill as heretofore. The requisite clauses would then either be embodied in omnibus Bills, as has been the usual course, or would form short Bills. In the latter case it might certainly be found possible to have all the Bills considered simultaneously, and to have joint representation by counsel to save expense. The Electrical Contractors' Association, however, should not rely upon the technical obstacles we have named, and take up an absolutely irreconcilable attitude, as, if the breach is widened, hostilities might be opened very effectively from the municipal side by those Corporations who have wiring powers which they have not yet exercised, deciding to test their efficacy. In the meantime there is an enormous amount of wiring work ready for useful canvassing all over the country.

Loom Motors.—A new leaflet from the Electric Construction Co., Ltd. (Wolverhampton), describes a special form of spring-mounted enclosed squirrel-cage induction motor with high starting torque, good efficiency over a wide range of load, and small drop of speed on full load, which the company have specially developed for use in textile factories.

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THE G.B. SYSTEM IN THE MILE END ROAD

£12,000 Damages against Sir John Benn

THE libel action by Messrs. Griffiths & Bedell against Sir John Benn in respect of certain statements made by him relating to the G.B. surface contact system in the Mile End Road, concluded on Thursday with a verdict for the plaintiffs on all the questions put to the jury except one, general damages being assessed at £12,000.

On Wednesday last week the final speeches to the jury and the judge's summing-up took place. Mr. Greer, K.C., for Messrs. Griffiths & Bedell, said he had been thinking over the suggestion made by Mr. Justice Ridley that the alleged libels at the London County Council were privileged and might be ignored, but thought he could hardly agree with the suggestion. Mr. Justice Ridley said he also had come to the same conclusion after thinking the matter over.

Sir EDWARD CLARKE contended that the system had proved inefficient in the Mile End Road, and that as Sir John Benn's statements referred only to that system, they were true, and perfectly justified by the position that he held in relation to London government. Even had the system proved successful after further trials, it would still have been an inefficient system rendered efficient by the application of Mr. Mordey's patent. During the course of this speech, Mr. Justice Ridley interposed with the remark that he did not consider the London County Council came into the question at all, nor that their officials were on their defence. It was simply a question of libel or not.

Sir Edward Clarke, in dealing with the question of special damages, contended that there was no evidence of this, as it had not been proved that contracts had been lost at any of the places mentioned in the evidence through the result of the Mile End Road experiment. He also drew attention to the fact that Sir John Benn had made no statements until after the Highways Committee had recommended that the system should be abandoned, and consequently any statement he might have made subsequently could not have influenced their decision.

Mr. GREER said that his case was that Sir John Benn had gone out of his way to attack the system as a system. He did not allege that the Moderate party had improperly used the system, but he had called it a mischievous and impossible system which had imperilled the lives of man and beast, and that had received the condemnation of all competent experts. Anything more likely to hamper and injure the business prospects of the inventor, and the gentleman who had spent his money in an effort to develop the system, he could not imagine. This was the reason why it had been necessary to go into the merits of the system, but he wished to say that he raised no question as to the *bona fides* or competence of the L.C.C. officials. He was quite aware that comments upon the officials had been made by Mr. Smith in his opening speech, but that was before the facts were developed. He must say, however, that having passed their judgment upon the system, the officials of the London County Council could not, in the nature of things, possess that open mind to judge the results of the experiments carried out by Mr. Mordey. It could not be disputed that the system had had a bad start in the Mile End Road, from which it never recovered.

Mr. Greer then reviewed the evidence at some length.

Mr. JUSTICE RIDLEY, in summing-up, put nine questions for the jury to answer. On the question of malice he said this did not necessarily mean spite against the person, but could be the suggestion of corrupt or wrong motives. Statements recklessly made would come within this meaning, but it was necessary for the plaintiffs to show evidence of malice. In order that special damages could be recovered it would have to be shown that injury had been directly caused by the statements made, such as the loss of customers. The jury returned a verdict for the plaintiffs on the grounds that the words complained of were defamatory; that they were statements of fact, and not opinion; many of the statements were untrue; that they referred to the G.B. system in the Mile End Road, and also generally; and that, except in the L.C.C. speeches, malice was proved. The jury disagreed on the question of special damage, but gave general damages of £12,000, to be divided equally between Mr. Griffiths and Mr. Bedell.

A stay of execution was granted with a view to an appeal, security being given for £5,000 within ten days.

Fire.—The works of Messrs. Taylor, Tunnicliff & Co., makers of porcelain insulating materials, Hanley, were considerably damaged by fire on Friday. Fortunately most of the machinery destroyed is duplicated in other parts of the works.

Obituary.—We regret to have to record the death, on November 20th last, of Herr Rudolf Wolf, the founder of the well-known works at Magdeburg, Buckau (Germany), for the manufacture of locomobiles, or semi-portable self-contained engine and boiler sets. Herr Wolf, who had reached the age of seventy-nine, had, during his career, achieved remarkable success in the development of the superheated steam locomobile into an economical and convenient form of steam power plant.

THE GERMAN ELECTRICAL INDUSTRY IN 1909-10

IN his annual report upon the trade and commerce of Frankfort for the year to April, 1910, Sir Francis Oppenheimer makes a few references to the electrical industry. The new tax on electric lamps and burners came into operation on October 1st, 1909. The factories producing these articles during the months preceding the introduction of the tax were occupied to the extent of four or five times their normal occupation, and the demand was so keen that prices were raised, and new orders only accepted at an average increase of 25 per cent. An additional revenue of twenty million marks is expected from this new tax, and early in 1910 it has brought a surplus of 1,300,000 marks over the estimated yield for the period. (According to the *Elektrotechnischer Anzeiger*, however, the revenue for the first eleven months from the date of the imposition of the tax was only 9,730,000 marks, or about half of what was expected. Further details from this source are given below.)

Dealing with the industrial position during the year, Sir Francis Oppenheimer states that the shares of the electrical manufacturing companies were popular throughout the year, and, even in the slump early in the year, proved favourites for speculative and investing purposes. When increased dividends were declared in the autumn, the quotations of the shares in the two leading concerns were found to have risen 50 and 40 per cent. respectively compared with the beginning of the year. The Felten-Guilleaume-Lahmeyer Works did not share in the general electrical boom, and their shares declined in 1909.

It is also pointed out that electric power stations to supply certain districts are being erected in increasing numbers close to the coal mines. Such stations exist already at Weissenfels, Helmstadt, Schwandorf (Oberpfalz). The latest addition is at Zittau, to supply the Oberlausitz with electricity. A very vast scheme of this kind is at present being discussed, namely, a central power station established in the Halle district for supplying Berlin with electricity.

Systematic experiments are being carried on in an experimental station near Berlin to ascertain the effect of electric currents upon the growth of various kinds of plants. It is hoped that eventually the experiments may lead to practical results, and thus a very important use may be devised for the numerous power stations which are being established in agricultural districts, thus far chiefly for the working of agricultural machinery.

According to the *Elektrotechnischer Anzeiger*, an official report states that the revenue from the German tax on illuminating apparatus for the quarter, October 1st, 1909, to March 31st, 1910, has been much less than that estimated by the Government. Particulars of the tax were given in ELECTRICAL ENGINEERING, July 29th, 1909, Vol. V., p. 693. The number of articles on which the tax was imposed during the quarter were as follows:—10,250,000 electric incandescent lamps, 1,600,000 kg. of arc lamp carbons, and 14,850,000 gas mantles. The estimated figures were 15,000,000, 3,500,000, and 50,000,000 respectively. The revenue for the eleven months from October 1st, 1909 (when the tax came into force), to August 31st, 1910, was 9,730,000 marks (approximately £486,000); while, according to the estimates of the Government, it should have been 21,500,000 marks (approximately £1,075,000). This result cannot be due to the laying in of large stocks by big consumers, as the tax was applied to these stocks also. It is stated that one result of the tax has been that consumers have not renewed their lamps and mantles so often.

Telegraph Traffic.—It is officially announced that telegrams for Uruguay are no longer subject to censorship. The submarine cable between Obock and Djibouti was restored to working order on November 30th. On November 15th the British Administration will open telegraphic communication with Berbera, in British Somaliland, by means of wireless stations at this place and at Aden; the installation is to be regarded as an extension of the ordinary telegraph system.

An Edison Storage Battery Tramcar.—The *Electric Railway Journal* (New York) contains a description of a double-truck tramcar driven by Edison batteries, destined for one of the New York lines. The car is somewhat larger than the Edison battery car described in ELECTRICAL ENGINEERING of May 19th (p. 515), and is also designed by Mr. R. Beach. The battery consists of 190 type A8 cells. The car is 23 ft. long, seats 40 passengers, and is of the single-deck pattern on two maximum traction trucks of very novel design. These have fixed axles upon which the wheels run on roller bearings. The driving wheels are 30 in. in diameter, and each is driven through a Morse silent chain by an 85-volt G.E. 1022 automobile type motor. The speed reduction is 3½ to 1. The weight of the car complete is 15 tons. The maximum speed is 35 m.p.h. The average power consumption is given as 650-watt hours per car mile, and an acceleration of 1 m.p.h. per sec. is said to be obtainable on level track.

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MAIN LINE ELECTRIFICATION PROPOSALS IN BOSTON, U.S.A.

In accordance with a resolution of the Massachusetts Legislature, the railway companies having lines terminating in Boston, namely, the New York, New Haven & Hartford, the Boston & Maine, and the Boston & Albany Railroads, have submitted reports on the electrification of their lines within the metropolitan district of Boston to a Commission which is to prepare a Bill to place before the next Legislature providing for the compulsory electrification of all standard gauge lines in the district within a stated time. The zone in question reaches about 15 miles from Boston, and on a few branches to 20 miles. The estimated cost of the equipment for the New York, New Haven & Hartford lines is approximately £2,772,000; for the Boston & Maine, £3,778,000; and for the Boston & Albany, £1,282,000, or a total of nearly eight million, exclusive of the capital to be written off in respect of the displaced steam rolling-stock.

In a joint report for the first two railways, Mr. E. H. McHenry, Vice-President of the New York, New Haven & Hartford Railroad, gives full estimates for the cost of the scheme, based on the single-phase system as adopted on the New York end of his company's line with a trolley-wire pressure of 11,000 volts and a frequency of 25 cycles. He points out that electrification of all the sections within the district of Boston only is not the method of development which would be chosen by the companies concerned, as it will involve the erection of costly intermediate stations at some thirteen points on the district boundaries for effecting the change-over from steam to electric locomotives and *vice versa*. The companies would rather at first restrict the replacement of steam by electric traction to a few of the more important routes, subsequently extending the system as rapidly as consistent with the financial conditions and the development of the traffic. The estimates for the two railways cover the requirements of the passenger traffic only, and include some £1,200,000 for a power station, and £770,000 for the distribution system and overhead equipment. A total length of 461 miles of single track would have to be equipped, but no sub-stations would be required. A sum of about £363,000 is estimated for the suburban terminal stations and repair shops. 162 electric locomotives, 232 multiple-unit motor coaches, and 377 trailer cars are provided for. This equipment provides for a traffic of 17,286 train-miles per day, according to the time-tables, and an additional 50 per cent. for holiday service. It is stated that, notwithstanding the greater traffic density at New York, the electric service of the New York, New Haven & Hartford Railroad not only fails to earn any interest upon the extra capital invested, but that it has also increased the cost of working. This is partly explained by the fact that the steam service is still retained to a considerable extent, and that the capacity of the power stations between the peaks of passenger traffic is not utilised for goods traffic. Mr. McHenry concludes that no general substitution of electric for steam traction should be made unless it includes both passenger and goods traffic and shunting, and also extends to the full length of run or engine district in order to avoid intermediate engine change-over stations.

The report for the Boston & Albany Railroad was submitted by Mr. A. H. Smith, Vice-President of the New York Central & Hudson River Railroad, who are lessees of this line. The estimates cover the equipment of 128 miles of track, or somewhat over 20 miles of route, including four miles outside the Boston district boundary in order to reach a station suitable as a change-over point. The system chosen is a third-rail equipment with continuous current at 1,200 volts, and rolling stock similar to that employed on the New York Central & Hudson River line in New York. The present service would require 16 locomotives, 62 motor coaches, and 31 trailer cars. It is pointed out that the present working expenses are already in excess of the gross receipts, and that the additional annual charge for electrical equipment would necessitate increased fares.

AN ELECTRICALLY-DRIVEN TOOL WORKS

A TRIAL of the electric motor on one or two machines resulted recently in the partial electrical equipment of the works of the well-known firm of Thomas Smith & Sons, of Saltley, where stampings and drop forgings for various classes of work are made, as well as all kinds of edged tools, hammers, &c. The plant displaced by the new method of driving consisted of one 100-h.p., 40-r.p.m. beam engine, with a Lancashire boiler, and three gas engines. These were replaced by 11 motors, varying in capacity between 3½ and 45 h.p., all running at 710 r.p.m., together with the necessary cables, switchboard, &c. Two further gas engines and two steam engines are still in use for the present.

The supply is obtained from both the Bordesley and Saltley sub-stations of the Birmingham Corporation Electric Supply Department, and is fed into the works at 5,000 volts, three-phase, 25 cycles, through three-core, paper-insulated, lead-covered cables, laid underground in earthenware troughs, to a high-tension, three-panel, iron-clad switchboard in the works sub-station, covering the small space of 15 ft. by 12 ft., and shut off by expanded metal screens. The switchboard is of the standard type used by the Birmingham Corporation Electric Supply Department, the outside panels being connected to the incoming feeders and the central one to the customers' circuits, arrangements being made for running off either supply. On each of the incoming feeder panels are two potential indicators and an oil switch. On the outgoing panel are fitted an ammeter, two potential indicators, a wattmeter, and an oil switch. From this panel the supply is taken by three single-core, rubber-insulated, lead-covered cables to the main oil-switch, mounted in a stone cubicle, from which it is led by three single, rubber-insulated cables to a 200-k.v.a., 5,000/440-volt, oil-cooled transformer, and then by three rubber-insulated, single-wire armoured cables supported on porcelain insulators to the low-tension panel containing ammeter, voltmeter, and porcelain fuses for each of the five outgoing circuits which are fed to the distribution boxes in different parts of the works.

In one of the tool shops is a battery of 4- to 7-cwt. stamps, which is driven by a 45-h.p. motor belted to line shafting along the top of the stamps. A band is attached to the weight (*i.e.*, to the top half of the die), passes over a pulley, and is joined to a rope of sufficient length to allow the man operating the stamp to catch hold easily. By pulling the rope the friction between the band and the pulley lifts the weight, and the rope being released the weight falls on the heated metal. This operation is repeated a number of times, depending on the weight of the top die, and the distance it falls. The furnace fires used for heating the metal before it is taken to the stamps are blown by a 10-h.p. motor-driven fan, and a second 45-h.p. motor drives a further group of three stamps, the furnaces in connection with which are blown by a fan driven by a 7½-h.p. motor. A motor of 20 h.p. is mounted on the framework of another set of stamps, which it drives through belting. A fly-wheel is placed on the countershaft in a portion of the space which formerly contained the displaced large boiler. There is also a 24 h.p. motor driving two large American board stamps, and two power presses.

From the stamps the forgings are taken to the emery wheels driven by a 7½-h.p. motor. The edged and other tools are taken to the grinding mill, containing six large wet running stones driven by a 15-h.p. motor. The 7½-h.p. motor which drives the emery wheels also drives the exhaust fan used to carry the dust from the wheels to the dust settling tanks. The shop in which the polishing of the tools is carried out is operated by a 10-h.p. motor, mounted on the ceiling. This motor drives seven polishing machines, the exhaust fans used in connection with these being operated by a 4-h.p. motor. The handles for the different tools, such as hammers, &c., are made on the premises in the wood-working department, which is sectionised and is driven by two 5-h.p. motors. The whole of the electrification of these works has been carried out by the British Westinghouse Electric & Manufacturing Co., Ltd., to whom we are indebted for the above particulars.

Joint Conference of London Electric Supply Authorities.—The Joint Conference of London Electric Supply Authorities held a meeting at Cannon Street Hotel on Thursday last. Mr. E. Debenham was in the chair, in the absence, through illness, of Mr. W. F. Fladgate. An interim report of the Executive Committee of the Conference was submitted, approved, and adopted. This dealt with the extensive work which has been carried out during the past year by the Executive Committee, assisted by the Joint Engineers' Committee in setting out the bases of a linking-up scheme under the London Electric Supply Act, 1908. Reference was made to the valuable information of a confidential character which had been collated by the Joint Engineers' Committee, bearing on the question of supply of London, and upon which the Engineers are still engaged. The Executive Committee were unanimously reappointed. A resolution was passed expressing appreciation of the work of the Electric Supply Publicity Committee, and it was unanimously decided that the members of the Conference should subscribe a substantial amount to the funds of the Publicity Committee, on a revenue basis, for the purpose of their developing a still more vigorous advertising programme.

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CORRESPONDENCE

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

To the Editor of Electrical Engineering.

Sir,—About this time of the year it is not uncommon to make subscriptions and give donations to charitable objects, and I therefore venture again to remind you of the existence of the Electrical Trades' Benevolent Institution, and to beg you to bring it to the notice of your readers, many of whom on previous occasions have taken note in a very effective manner of the kindly reminders you have given them. Thanking you in anticipation, I am, yours truly,

Ridler Place, Holland Street, Blackfriars, S.E., Dec. 5th, 1910. W. Davenport, *Secretary*.

STARTING OF INDUCTION MOTORS.

To the Editor of Electrical Engineering.

Sir,—In reply to the query by "A. C." in your last issue, I have not actually had any occasion to fit an overload device in the manner shown in my sketch to an induction motor having slip-rings on the rotor. In such cases the starting current does not obtain the same proportions as is the case with squirrel-cage machines, and it is therefore not usually necessary to cut out the overload device during the starting periods. But I do not think there would be any difficulty in meeting such a case as your correspondent raises, and if he is an engineer it would not take him many minutes to scheme out something suitable. One way that readily suggests itself is to connect the ends of the overload-coil in the stator circuit to a pair of terminals on the rotor rheostat. During starting-up periods these terminals could be short-circuited by means of a link which is lifted by the rheostat arm when in the full "on" position. The overload coil in the stator circuit would by this means be short-circuited during such times as the motor was taking a heavy starting current. There are no doubt other ways of accomplishing the object in view which would readily suggest themselves to anyone having such a problem to solve.

Yours faithfully,

4 Queen Street Place, E.C., Dec. 5, 1910. Frank Broadbent.

To the Editor of Electrical Engineering.

Sir,—I have read with interest the correspondence in your columns *re* the above, and would like to point out that the method of protection as submitted by Mr. Frank Broadbent, for rheostatic type starters, has been used in a simplified form on A.C. double automatic starters, designed and manufactured by Mr. George Ellison, for the past three years. These starters control the stator as well as the rotor circuit, and where the motor is not fitted with short-circuiting and brush-lifting device, the overload coil is put in the rotor circuit and connected to the resistance and the last contact. Where it is necessary to have the overload coil in the stator circuit, similar protection is given by splitting the stator contact and connecting to the coil. As these starters are fitted with a spring, it is impossible to leave the arm in any intermediate position.

Yours faithfully,

Birmingham, Dec. 6th, 1910. D. G. Robertson.

BOILER CLEANING APPARATUS

A DEMONSTRATION was given on Friday afternoon last at the Hotel Metropole, London, of a new device for removing scale from the interior of boilers. The apparatus has been devised by Mr. A. Schror, and is being introduced by the Electric Safety Boiler Cleaner, Ltd. (6 Lloyd's Avenue, Fenchurch Street, E.C.). It consists of three steel discs, similar in appearance to milling cutters, with the teeth staggered relatively to one another and keyed side by side on to a spindle mounted in a holder which can be conveniently held in the hand. The cutters are driven at a comparatively high speed by means of a flexible shaft from a ½-h.p. electric motor. When held against the scale the rapid succession of blows by the chisel points of the cutters scrapes away the scale. It is claimed that no damage is done when the cutters reach the steel, as the pressure on the tool is not sufficient. The tool is so small as to enable corners and narrow parts to be got at, and it is stated that it is possible to clean any type of boiler in from three to five days. For water-tube boilers, a different form of tool is used, but this was not exhibited. It was stated, however, that a rotary cutter on the end of a flexible shaft is introduced into the tubes *in situ*, and can be used conveniently whatever the shape of the tubes.

SCIENCE AND ENGINEERING

THE presidential address which Sir J. J. Thomson delivered to the Junior Institution of Engineers on November 15th was entitled "The Influence of Pure Science in Engineering." The distinction, he said, between pure science and engineering was one, not of method, but of aim. The physicist endeavoured to discover new facts without any thought as to their utility, but it was a striking feature in the history of science that almost every advance in pure physics had been turned to account by the engineer, the manufacturer, or the doctor. The province of applied science, of engineering, was to survey the facts known to science, and to select those which seem to have in them the possibilities of industrial application. This development, he thought, could generally best be done in laboratories or research workshops attached to works. Here there were opportunities of testing results on a commercial scale, and that technical knowledge of detail which often means the difference between success and failure, and here, too, were probably available greater supplies of money and greater incentives to success than are at the disposal of Government, municipal, or university bodies. The success of works' laboratories in Germany and the United States, and to a growing extent in this country, was one of the most striking features in modern industrial development. He thought that a closer connection with science would be of great service to engineering and commerce in this country. Practice, however, sometimes outstripped theory, and progress had to be made by trying one thing after another. There were, for example, many phenomena in wireless telegraphy which had not yet received any adequate explanation. It was the object of applied science to keep theory and practice at the same level, by raising the one underneath, not by pulling down the other.

It appeared to him that faith in the results of pure science was more robust in Germany and the United States than in this country. Here we cultivated more exclusively things which ripened quickly and yielded an immediate return upon the capital invested, and were inclined to turn aside from projects which, though more profitable in the long run, would take a long time before they came into bearing.

It was not that we had lacked pioneers in this country, but it could not be maintained that science played as large a part in engineering and industry on a whole here as it did in Germany. One reason for the comparative neglect of pure science in engineering was that the training in that subject given in our engineering and technical colleges was not that best adapted to develop any great interest or enthusiasm for it. Economy of time was so important that attention was paid only to those parts of science which had direct application to practice. The results are especially conspicuous in mathematics. The language of mathematics, he said, should be as familiar to the engineer as his mother tongue; his mathematics should be as a part of himself, and he should be able to use them with the confidence with which a good workman uses his tools. It might be urged that the curriculum for engineering students was already so overloaded that it was impossible to find time for a fuller study of science and mathematics. That was only true because that curriculum was founded on the truly British idea that boys are not expected to learn anything at school. Most of the work in the courses for students in their first year, and some of that in the second, in all engineering schools was of a kind that a boy might well be expected to have done at school. Though he regretted the predominance of classics in our public schools, he would regret still more any system which allowed boys to restrict their studies entirely to scientific subjects, in fact, to any system which involved premature specialisation. The education of the engineer ought to be framed so as to develop those qualities which make him, in the best sense of the word, a man of the world. These were much more likely to develop by a training which included a considerable study of literature than one which was severely restricted to scientific or technical subjects.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to the Editor, Electrical Engineering, *205–6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

J. D.—Send us the details of your particular case. To answer your question in general terms would fill a book.

W. M. Ferber.—Application for membership of the Institution of Electrical Engineers, London, should be made to the Secretary, Mr. P. F. Rowell, at the offices of the Institution, Victoria Embankment, W.C., from whom can be obtained the qualifications necessary for the various classes of membership.

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LOCAL NOTES

Axminster: *Electric Lighting.*—A company is being promoted to carry out an electric lighting scheme for the town.

Brazil: *Electric Railways.*—A British Consular report states that the Victoria-Minas Railway, which has a length of 312½ miles, is to be converted to electric traction.

Bristol: *New Offices.*—The Engineer's Offices at Temple Back and the showrooms in Colston Street have been removed to The Exchange, Corn Street.

Canada: *Electric Traction.*—The *Board of Trade Journal,* quoting from the *Canadian Gazette,* states that applications are being made for the incorporation of the Pacific & Peace Railway Co. and Saskatoon & Hudson Bay Railway Co., both of which propose to construct electric railways.

Dawlish: *Overhead Wires.*—Mr. A. P. Trotter, Electrical Adviser to the Board of Trade, held an inquiry last week respecting an application by the Dawlish Electric Supply Co., Ltd., for permission to erect overhead wires in connection with the power station which they are constructing in Brook Street. A number of objections were made by individual ratepayers, mainly on the ground of disfigurement of the town. Mr. Trotter stated that the Board of Trade had to consider the protection of the public and not the appearance of the place. There was no opposition by the Town Council, whose surveyor has to approve the position of the wires, and Mr. Trotter will report in due course.

Dundee: *Tramway Extensions.*—Mr. Peter Fisher, the Tramway Manager, is reporting upon some extensions of the tramways.

Gloucester: *Generator Foundations.*—Rubber foundations are to be fitted to one of the generating sets in order to avoid the vibration which at present exists. The foundations to be fitted are a patent of M. Prache, who has offered to fit them free of charge.

India: *Bulk Supply.*—The Tata Hydro Electric Power Supply Co., which proposes to supply electrical energy in bulk in the Bombay district, has now been registered. Preliminary work has been commenced.

Leeds: *Electric Lighting Accounts.*—We regret that in a short note dealing with the Leeds accounts last week, we stated that the loss of £8,980 was for the past year. It should have been stated that this figure relates to the half-year to Sept. 30th. The accounts for the last completed year, that is, to March 31st, 1910, showed a surplus of £8,931, although the accounts for the first half of that year showed a deficit of £12,322.

London: *County Council: Supply of Coal.*—Owing to the large quantity of coal consumed by the different departments of the London County Council and the difficulties of thoroughly testing the samples, the Stores and Contracts Committee recommend the appointment of a coal officer, who shall have passed the Home Office examination for colliery managers, to buy direct from collieries in future. This officer will give assistance in testing various samples, but the chief officer of the tramways will still remain responsible for the coal for the Greenwich power house, and will be able to call upon the coal officer for assistance.

Islington: Street Lighting.—The Borough Council have decided to put up 16 additional arc lamps, which will displace 40 gas lamps, and result in a saving of £34 10s. per annum in the lighting bill. At the last meeting of the Council this question was discussed, and Alderman Vorley, the Chairman of the Electricity Committee, stated that electricity for public lighting in Islington was five times cheaper than gas, candle-power for candle-power. He added that there is no intention on the part of the Lighting Committee to go back to gas.

Liverpool Road: Tramways.—The proposal of the London County Council not to reconstruct the Liverpool Road horse tramways for electric traction, but to abandon the lines altogether, has been referred back to the Highways Committee for further consideration.

Mexico: *Water Power Utilisation.*—It is stated that an electric power scheme is about to be developed on the west coast of Mexico, which involves the erection of three power plants on the Mayo, Humaya, and Santiago Rivers, at an estimated cost of over £1,000,000. Some 1,200 miles of transmission lines will be erected, and the area includes about 20 towns with which negotiations are to be opened up for a supply of electrical energy. A large number of horse tramways and steam railways are also within the sphere of the company's operations.

New Zealand: *Water Power Development.*—According to the *Board of Trade Journal,* a Bill has been introduced into the New Zealand Government providing for an expenditure this year of £500,000 in the development by State enterprise of the chief sources of water power in New Zealand. In connection with this proposal it is proposed to electrify the railway through the Lyttleton-Christchurch tunnel.

Pickering: *Provisional Order Revoked.*—The Board of Trade have revoked the Pickering Electric Lighting Order granted in 1901.

Spain: *Electrical Imports.*—The imports of dynamos and motors into Spain for the year 1909 only amounted to 9,000 kilos, compared with 37,000 kilos in 1908. The decline is attributed to the great strides made in the electrical industry in the province of Barcelona.

Sweden: *Water Power.*—According to the *Board of Trade Journal* a measure is to be submitted to the Riksdag for sufficient funds to make a complete survey of all the waterfalls in Sweden, with a view to considering the best method of exploiting them.

Transvaal: *Storage Battery Tramcars.*—According to the *British and South African Export Gazette,* Krugersdorp, in the Transvaal, is to be provided with a tramway system, with cars of the Edison-Beach storage-battery type. (See Electrical Engineering, May 19th, p. 319.)

Winchester: *Purchase of Electric Light Co.*—Arbitration as to the purchase of the Winchester Electric Light Co.'s undertaking has been avoided, the Council and the Company having come to terms as to the price to be paid. The terms agreed upon have not yet been made public.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—The Sydney Deputy Postmaster-General requires a testing equipment, consisting of a rotary converter, transformer, switchboard, &c., to work at 240 volts D.C. Tenders by Feb. 1st. Tender forms, &c., at 72 Victoria Street, London, S.W.

Canada.—The Calgary City Commissioners require a 1,500-h.p. synchronous motor generator, exciter set, switchboard, instruments, &c. Tenders by Dec. 22nd. Copies of specifications may be seen at 73 Basinghall Street, London, E.C.

Carnarvon.—A loan of £1,911 is to be taken up for electric lighting extensions.

Chili.—The *Board of Trade Journal* announces that a concession has been granted to Messrs. Rafael Ovalle and Gilbert Hodgkinson for installing electric light in the town of Rancagua.

Haslingden.—An expenditure of £5,000 is contemplated in connection with the distribution of electricity which the Accrington Council is supplying in bulk. Mr. J. S. Watson, Electrical Engineer to the Bury Corporation, is advising the Council.

London: *Stepney.*—A loan of £10,000 is to be taken up for additional plant at the Limehouse generating station.

Loughborough.—Additional 200 kw. of generating plant is to be installed.

New Zealand.—The Thames Council are considering a scheme of electric lighting and tramways.

Paraguay.—The *Review of the River Plate* states that three applications have been made for a concession for electric lighting and tramways in Asuncion, and that a "battle royal" is raging in connection with the matter. The applicants are Mr. Carosio, of Buenos Aires, Mr. Manues Rodriguez, chairman of the Central Paraguay Railway Co., and Mr. Muller.

Roumania.—According to the *Board of Trade Journal,* the municipal authorities of Botoschan invite tenders by Dec. 31st for an electric lighting installation. Particulars from Herr Bürgermeister, Bürgermeisteramt, Botoschan.

Todmorden.—Extensions of cables are contemplated.

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Transvaal.—A scheme for the electrification of Henderson's Transvaal Estates, Ltd., is in hand, a licence for the erection of a power station having been obtained from the South African Government.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Accommodation for mentally defective children in various parts of London. L.C.C. Education Committee.

Adaptation of Alexander Institute, Carter Street, Walworth, as Cinematograph Hall.

Alterations to electric lighting installation at Deptford Public Baths, Laurie Grove, New Cross.

Electrical installation at Skating Rink, Brook Green Road, Hammersmith.

Alterations to electrical installation at Wesleyan Central Hall, High Street, Plumstead.

New school in North St. Pancras.

PROVINCES.

Aberdeen.—Extension of Ferryhill School.

Amble.—Extensions at the Gibson Street Schools.

Bockenham.—Proposed enlargement of Workhouse.

Belfast.—Shops and warehouse in Castle Street. Architect, Mr. A. Seaver, 16 Donegall Square South.

Birmingham.—Public baths in King's Norton.

Bournemouth.—Sessions House, Police Court, and Police Station.

Canterbury.—New schools.

Carnarvon.—Completion of Institute buildings.

Doncaster.—New Postal Sorting Office. Builders, Messrs. D. Gill & Sons, Doncaster.

Palace of Varieties in Silson Street.

Dundee.—Electric Theatre. J. Bannister Howard, 112 Nethergate.

Edinburgh.—Additions to Small-pox Hospital.

Gateshead.—New Lunatic Asylum.

Glasgow.—Additions to Ruchill Hospital and Belvedere Hospital. Conversion of workshop, 61 St. George's Road, to theatre.

Grimsby.—Extensions to Free Library, Victoria Street.

Hamilton.—Elementary school in Hope Street.

Hebden Bridge.—Proposed sanatorium.

Lancaster.—St. John's Church, Great Harwood. Architects, Austin & Paley.

Limerick.—Tenders are invited for the wiring and fitting of electric lighting, internal bells, and telephones at the Technical Schools, Military Road. Architect, W. P. Ryan. Particulars from the Secretary or Mr. J. Mackey, 58 Dame Street, Dublin.

Manchester.—New church in Winton, Patricroft.

Morecambe.—Ballroom, Theatre, and Music Hall. Morecambe Tower Co.

Reading.—Additions to Workhouse.

Retford.—New girls' school. Notts Education Committee.

St. Albans.—Infectious Diseases Hospital. Joint Hospitals' Committee.

Southampton.—New buildings for Hartley College.

Wolverhampton.—Eight dwelling houses, Bruford Road. L. Clarke, Norfolk Road.—Four dwelling houses, Bruford Road. Miss N. Shaw.

MISCELLANEOUS

Argentine.—Surveying operations are to be carried out with a view to the establishment of a national system of telephonic communication.

Negotiations are being carried on between the Rosario City Council and the Rosario Electric Tramways Co. for extensions of their system. The company, whose concession is for 55 years, have now asked, says the *Review of the River Plate*, for a further extension of 25 years as a condition of carrying out extensions. On the other hand, the Council suggest a uniform tariff of 10 cents.

Beckenham.—A special report is being prepared in connection with improved lighting in the Anerley, Beckenham, and Croydon Roads.

Bournemouth.—Tenders are invited by Dec. 22nd for the construction of 1¼ miles of tramways on the overhead trolley system.

Eccles.—A loan of £1,000 is to be applied for, for the purchase of motors for hire.

Egypt.—A proposal to reconstruct the Egyptian State Railways for electric traction, and to use the outflow of the Assouan reservoir for generating electrical energy, is under consideration.

London: *County Council.*—The Highways Committee recommend the reconstruction to electric traction of the horse tramways running from Finsbury Park *via* Southgate Road to the City Road, at an estimated cost of £123,880.

Spain.—The Compania del Tranvia Urbano del Bilbao has applied for a concession for the construction of a number of electric tramway lines.

War Office.—Tenders for various stores are required, including cables, electrical stores, and scientific instruments. Director of Army Contracts, War Office, London.

TENDERS RECEIVED AND ACCEPTED

Birmingham.—The tender of Messrs. W. Griffiths & Co. has been accepted for relaying certain tramway tracks.

Bolton.—The tender of the British Insulated & Helsby Cables, Ltd., has been accepted for the supply of cables for 12 months.

Brighton.—A tender of Messrs. Chamberlain and Hookham to supply meters for the tramcars at £3 5s. each has been accepted. The contractors have agreed that if after six months a saving of at least 5 per cent. in current consumption is not shown, the meters are to be taken back and the money refunded.

The tender of the Stanton Iron Works Co., of Nottingham, has been accepted at £1,145 10s. for the piping arrangements in connection with the new water-circulating system at the Southwick Electricity Works.

Croydon.—The tender of Messrs. Ferranti, Ltd., has been accepted for a supply of meters.

Dundee.—The supply of cables for the Electricity Department's requirements during the next year, for which the committee recommended placing an order with the Union Cable Co. at last meeting, has been remitted back for further consideration by Council, there being a general opinion that the work ought not to go to a foreign company on such a small difference in price, especially as British manufacturers are handicapped by having to work under a special trades' union clause.

Messrs. Siemens Bros. Dynamo Works, Ltd., have, we are informed, obtained the largest contract for metal filament lamps for ship lighting which has ever been placed. The order comes from one of the largest shipbuilders in the United Kingdom.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 5s. to £59 10s. per ton (last week, £59 to £59 10s.).

Dissolution of Partnership.—F. Simpkin and C. Gibson, electrical engineers, 66 Kirkstall Road, Leeds, have dissolved partnership. Debts all to F. Simpkin.

Liquidations.—The Chichester & District Electric Supply Co., Ltd., is to be wound up voluntarily. Mr. H. A. Stagg is liquidator, and a meeting of creditors will be held tomorrow, Friday, at 1 Kingsway, London, W.C.

Concert.—The staff and fire brigade of Messrs. Siemens Brothers Dynamo Works, Ltd., Incandescent Lamp and Fittings Department, Tyssen Street, Dalston, held their annual supper and concert at the "Crown and Castle" Hotel, Dalston, on Friday last, Mr. J. S. Huddleston in the chair. An excellent variety programme was provided by kind permission of Mr. W. Gibbons, of the London Theatre of Varieties.

Synchronome Clocks.—The Synchronome Co. inform us that, in addition to the diploma of honour gained at Brussels, their system of electric clocks was used extensively in the Centenary Exhibition at Buenos Aires, and was awarded a gold medal.

Bankruptcy.—C. H. Pearson, electrical and mechanical engineer, 37 Park Street, Greenhays, Manchester, has been adjudicated bankrupt.

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APPOINTMENTS AND PERSONAL NOTES

Mr. C. M. Davis, of the Tynemouth Electricity Department, has been appointed engineer and canvasser in the Bristol Electricity Department at a salary of £156 per annum, and Mr. T. B. Stoddart, at present with Messrs. Wm. Drysdale & Co., Barrow-in-Furness, and formerly of the Edison & Swan United Electric Light Co., Newcastle-upon-Tyne, has been appointed showroom attendant at Bristol, at a salary of £91 per annum.

An assistant electrical engineer is required for a leading railway company abroad. Salary, about £750 per annum. (See an advertisement on another page.)

Manager wanted for metallic battery lamp department. (See an advertisement on another page.)

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

British Electric Traction Co.—The receipts of the British Electric Traction Co. and its associated concerns, from the commencement of the present year to November 18th, show an increase of £63,900 compared with the corresponding period of 1909.

Blackpool, St. Anne's & Lytham Tramways Co.—The report for the year to October 31st shows a net profit of £8,523 against £6,640 in the previous year. A dividend of 2½ per cent. on account of arrears of debenture interest was recommended. The arrears of debenture interest now amount to £25,625.

Electrical Securities Trust.—The accounts for the year to November 14th show a loss of £4,706. This does not include the book loss on the South Western Traction Co. bonds amounting to £24,507. The accounts take no credit for interest or dividends due during the year, but which have not yet been paid.

Cleveland & Durham Electric Power Co.—A petition for confirming the reduction of the capital of the Cleveland & Durham Electric Power Co., Ltd., from £1,000,000 to £700,000 was heard before Mr. Justice Neville on Tuesday.

Dividends.—Sao Paulo Tramway, Light & Power Co., quarterly dividend of 2½ per cent.

Manx Electric Railway Co.—Dividend on the preference shares, making 5½ per cent. for the year, carrying forward £236.

British Columbia Electric Railway Co.—Dividend at the rate of 8 per cent. per annum on the deferred ordinary stock for the June half year.

Adelaide Electric Supply Co.—At the annual meeting of Monday it was stated that at the end of 1911 the Local Authorities have the option of purchasing the Company's business, and that inquiries are now being made as to the details.

Companies to be Struck Off Register.—The names of the following will be struck off the register of joint stock companies within three months unless cause is shown to the contrary: Accessible Battery & Engineering Co., British Accumulator Co., British Arc Lamps, Crawford Electric Lamp Syndicate, Electrical Mining Co., Electric Loco-Motor Propulsion Co., Farnham & District Electric Supply Co., Gould Storage Battery Co., London & Provincial Illuminated Advertising Column Co., Mercédès Petrol-Electric Co., Nottingham Electrical Co., and Traction Corporation, Mercédès Electric Manufacturing Co., and Traction Batteries, Sir Hiram Maxim Electrical & Engineering Co., and Telescriptor Co.

Siemens-Schuckert Werke Ges., Berlin.—The report for the year ending July, 1910, shows a net profit of approximately £530,000, permitting a 10 per cent. dividend, as in the previous year.

Siemens & Halske A.-G., Berlin.—A 12 per cent. dividend is proposed for the year ending July, 1910. The report shows a net profit of approximately £575,000.

NEW COMPANIES

E. HILDEBRANDT.—44, Croft Street, Lower Road, Deptford. Capital £5,000. Manufacturers of accessories used in electrical and gas industries.

MATTAGAMI RIVER FALLS SYNDICATE.—Registered by Spyer and Sons, 65 London Wall, London, E.C. Capital £1,000. Electric light and power supply.

INTERNATIONAL RAILOPHONES, Prudential Buildings, Corporation Street, Birmingham. Capital, £10,000. Telegraph and telephone makers, &c. To adopt agreements with Railophones, Ltd., and H. Von Kramer. Among the subscribers are Andrew Stewart, H. Von Kramer, and T. Duckitt, all electrical engineers.

S. BOTTONE & SON: 93 Manor Road, Wallington, Surrey. Capital £2,00). To take over the business of electrical and mechanical engineers, now carried on by A. E. R. Bottone.

BRITISH LIGHTING DEVELOPMENT CO.: 19 Ingate Place, Queen's Road, Battersea, London, S.W. Capital £1,250 (1,000 deferred shares of 1s. each). Manufacturers of electrical and other fittings, &c., and to acquire the business of the British Lighting Development Co.

ENGLISH ELECTRICAL CO.—Registered by Jordan & Sons, 116 Chancery Lane, London. Capital, £5,000. Electrical engineers and contractors

AURIPHONES.—Byron House, Fleet Street, London. Capital, £1,000. Suppliers of auriphones and other telephonic and electric apparatus.

ACCESSORIES MANUFACTURING CO.—11 Dean Street, Oxford Street, London. Capital, £5,000. Dealers in electrical accessories and electrical goods.

GLANTAWE ELECTRICAL SUPPLY CO.—Registered by Alfred H. Atkins, 27 Fetter Lane, London. Capital, £1,000 in £10 shares. To supply electricity in Glantawe, Ystradgynlais, Brecon, or elsewhere in Wales.

SALFORD ELECTRICAL INSTRUMENTS.—67 Queen Victoria Street, London. Capital, £20,000 (10,000 preference shares). To carry on the business of manufacturers of, and dealers in, electrical measuring instruments, meters, wires, cables, and other apparatus, formerly carried on by the General Electric Co., Ltd., 71 Queen Victoria Street, London, and Bow Street Works, Adelphi, Salford. The subscribers are J. Y. Fletcher and T. J. Boorne, Electrical Engineers, 71 Queen Victoria Street, London. The first directors are M. Railing and F. Sells.

CONSUMERS' AND ASSESSEES' PROTECTION SOCIETY.—12 New Court, Carey Street, London. Limited by guarantee. Twenty members each liable for £1 in the event of winding-up. To protect the interests of householders and others in regard to the consumption of electricity, gas, water, &c., or the assessment in payment of rates.

ELECTRIC WATER HEATERS: 16B St. Vincent Street, Glasgow. Capital £2,000. Makers of heating apparatus, &c.

SANDWICH, DEAL & WALMER ELECTRICITY SUPPLY CO.—Registered by Mowll & Mowll, Howard House, Arundel Street, Strand, London. Capital £4,000. To supply electricity in Sandwich, Deal, Walmer, Eastry, Dover, and elsewhere.

ELECTRIC SAFETY BOILER CLEANER.—Registered by Marlow & Patey, 8 Regent Street Pall Mall, London. Capital £25,000 in 20,000 7 per cent. participating preference shares of £1 each, and 100,000 deferred shares of 1s. each.

M. CLARK & CO., Dashwood House, New Broad Street, London, E.C. Capital, £20,000. Electric light, railway, and tramway contractors.

BRITANNIA IMPORT CO., 87 Tabernacle Street, London, E.C. Capital, £500. To acquire the business of electricians, &c., carried on by F. Frohwein.

ELECTRIC TRAIN LIGHTING SYNDICATE.—Registered by Jordan & Sons, Ltd., 116 Chancery Lane, London. Capital, £5,200. To acquire certain patents relating to the lighting by electricity of trains, tramcars, &c.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Theoretische und experimentelle Untersuchungen an der Synchronen Einphasen-Maschine." By Dr. Max Wengner. (München: R. Oldenbourg.) 2s. 6d.; by post in U.K., 2s. 10d.; abroad, 3s.

"Electric Railways," by J. R. Cravath and H. C. Trow. (American School of Correspondence of Chicago.) (London: Crosby, Lockwood & Son.) 4s. 6d. net. By post in U.K., 4s. 10d.; abroad, 5s.

"The Principles of Electric Wave Telegraphy and Telephony." By Prof. J. A. Fleming. 2nd edition. (London: Longmans, Green and Co.) 28s. net. By post in U.K., 28s. 6d.; British Colonies, 29s. 8d.

OSRAM·LAMPS

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OF

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(One Free Entry is given to every Advertiser. Entries under additional headings, 6d. per insertion.)

ACCESSORIES (Electric Light and General Supplies).
Briscoe (W. H.) & Co., 32 & 33, Cox St., Birmingham.
Cable Accessories Co., Ltd., Britannia St. Works, Tividale, Staffs.
Feld Bros. & Co., Ltd., 25, Budge Row, London, E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co., Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
Belliss & Morcom, Ltd., Birmingham.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
British Thomson-Houston Co., Ltd., Rugby.
Electrocarbon, A.-G., Niederglatt, Switzerland.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Jandus Arc Lamp and Electric Co., Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Sloan Electrical Co., Ltd., 12, Golden Lane, E.C.

ARMATURE REPAIRS.
Higginbottom (J.) & Co., Blenheim St., Chelsea, S.W.
Marryat & Place, 28, Hatton Garden E.C.

CABINET WORK.
British L M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
Concordia Electric Wire Co., Ltd., Cricklewood Lane, N.W.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd. 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CLUTCHES (Friction).
Bridge (David) & Co., Ltd., Castleton, Manchester.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Mirrlees Watson & Co., Ltd., Glasgow.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 8, Redcross St., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

FIRE EXTINGUISHERS.
"Kyl Fyre," Ltd., Eastbourne.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
Crossley Bros., Ltd., Openshaw, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.
Mirrlees, Bickerton, & Day, Ltd., Hazel Grove, Nr. Stockport.

HEATING AND COOKING APPARATUS.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dowsing Radiant Heat Co., Ltd., 24, Budge Row, E.C.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.
Bertram Thomas, Worsley St., Hulme, Manchester.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row W.C.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.
Phillips (J. W. & C. J.), 23, College Hill, E.C.
Weston Electrical Instrument Co., Audrey House, Ely Pl., Holborn, E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.
Ruberoid Co., Ltd., 81 & 83, Knightrider St., E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
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LAMPS (Incandescent).
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
Sunbeam Lamp Co., Ltd., Park Rd., Gateshead-on-Tyne.
Welsbach Incandescent Gas Light Co., Ltd., 344—354, Gray's Inn Rd., W.C.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), 8kin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd. Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

MARBLE AND STONE (Reconstructed).
The British Stone and Marble Co., Ltd., Ponders End, Middlesex.

METERS AND METER PARTS.
Bastian Meter Co., Ltd., Kentish Town, N.W.
Bernhard Thormann, 25-26, Wassmannstr. Berlin.
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

MINE EQUIPMENTS AND APPARATUS.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
British-Thomson Houston Co. Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Phœnix Dynamo Manfg. Co., Ltd., Thornbury Works, Bradford.
Reyrolle & Co., Ltd., Hebburn-on-Tyne
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Ingleby & Co., Elland Road, Leeds.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Phœnix Dynamo Manfg. Co., Ltd., Thornbury Works, Bradford.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wilson-Wolf Engineering Co., Ltd., Bradford.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.
Sokal (S.), 55, Chancery Lane, W.C.

PORCELAIN INSULATORS.
Macintyre (Jas.) & Co., Ltd., Burslem, Staffs.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
Willans & Robinson, Ltd., Rugby.

RESISTANCE WIRE.
Drennan, Glover & Cooper, 429-431, Corn Exchange Buildings, Hanging Ditch, Manchester.

SIGNS (Electric).
Electrical and Engineering Supplies Co., Ltd., 36 & 37, Upper Thames St., London, E.C.
Krupka & Jacoby, 11, Queen Victoria St., London, E.C.

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Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
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Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby

STREET LANTERNS.
Haydn Harrison, 11, Victoria St., S.W.
Wardle Engineering Co., Ltd., 112, Portland St., Manchester.

SWITCHGEAR.
Adams Manufacturing Co., Ltd., Bedford.
Adams Watkin Co., Ltd., 36, Victoria St., S.W.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Apparatus Co., Ltd., Milford Works, Queen's Rd., Battersea, S.W.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne.
Spagnoletti, Ltd., Goldhawk Rd., Shepherd's Bush, W.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
Archibald Constable & Co., Ltd., 10 Orange St., Haymarket, W.
Colonial Office Journal, Waterlow & Sons, Ltd., Gt. Winchester St., London.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.

TELEWRITER.
National Telewriter Co., Ltd., 20, Bucklersbury, E.C.

VENTILATION AND FANS.
Ozonair, Ltd., 96, Victoria St., S.W.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122-124, Golden Lane, E.C.

WATCHES (Non-Magnetic).
Batty (W.), & Sons, Ltd., Market St., Manchester.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

NO. 207 [VOL. VI., NO. 50] THURSDAY, DECEMBER 15, 1910. [PRICE ONE PENNY.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

OFFICIAL NOTICES and TECHNICAL COLLEGE ANNOUNCEMENTS are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, *Tuesday first post*
Small Advertisements and Official Announcements, *Wednesday first post.*
Displayed Advertisements, *Tuesday first post.*
Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.
Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*
Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

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SUMMARY

THE first of our special Literary Supplements is included in this issue, and contains a list of new publications, reviews of sixteen works on electrical engineering and allied subjects, and a carefully compiled selected list of recommended technical books which we hope will prove of use to those desiring to acquire the best works in every branch of Electrical Engineering.

THE action by Marconi's Wireless Telegraph Co. against the British Radio Telegraph & Telephone Co. for alleged infringement of three of their fundamental patents is now being heard. Each patent will be dealt with separately. Counsel for the Marconi Co. contended that the first patent covered the use of two oscillatory circuits tuned to one another and inductively coupled by means of a transformer. The defendants' arrangement was identical, except that an autotransformer was employed in place of the double-winding transformer described in the Marconi patent. (Page 791.)

PROF. E. W. MARCHANT, in a Paper read last week before the Illuminating Engineering Society, outlined recent improvements in electric lighting more especially as regards metal filament and flame arc lamps. An interesting note on the blackening of tungsten lamps was contributed to the discussion by Prof. G. W. O. Howe. (Page 792.)

SIR R. H. HADFIELD and Prof. B. Hopkinson read a Paper at last Thursday's meeting of the Institution of Electrical Engineers describing a series of researches on the magnetic qualities of iron and its alloys in intense fields. At high inductions many complications in the effects disappear, and the authors were able to deduce a simple relation between the particular aspect of the magnetic properties which they investigated and the composition of the alloy. (Page 793.)

AN illustrated article deals with some recent designs of motor control gear. (Page 794.)

A DISCUSSION took place on Wednesday last week, under the auspices of the Committee for the Protection of Electrical Interests, on the question of electric wiring powers under the Electric Lighting Acts. Unfortunately, the meeting clashed with the sittings of the Conference now taking place between the Incorporated Municipal Electrical Association and the Electrical Contractors' Association, and for this reason was not largely attended. Nevertheless, representatives of the various sides of the electrical industry spoke, and the majority of speakers were of opinion that both municipalities and companies should have powers to invest capital in wiring, but that the carrying out of these should be placed in the hands of those specialising in wiring work. Mr. Gripper is to send Mr. Harland Bowden a list of those towns supplied by Edmundson companies in which there are no local contractors. (Page 795.)

THE Highways Committee of the L.C.C. recommend that proceedings be taken against the Marylebone and Islington Councils for failing to comply with requirements regarding electricity testing stations. (Page 795.)

AMONG the specifications published by the Patent Office on Thursday was one by A.-G. Brown, Boveri & Cie for non-rusting steam turbine blades of an alloy of pure iron and nickel. A wall-plug which cannot be removed by a direct pull is covered by A. Bonella. There have been no objections to the extension of the original Lodge patent for syntonised wireless telegraphy. The opposition to the grant of patents to C. Steinweg for a solder for aluminium, and to R. Jahoda for a process of manufacturing metal filaments, has been unsuccessful. A patent by G. Ellison for a dash-pot time-lag device for circuit-breakers is opposed. Application has been made for the revocation of a patent relating to mechanical under-feed stokers. (Page 796.)

A CORRESPONDENT sends us particulars of an emergency installation of an electric motor to replace a broken down gas engine. (Page 797.)

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THE London County Council disagree with the Borough Councils that it is necessary to frame regulations for ventilation of telephone street boxes.—The Manchester Corporation have been ordered to pass a bye-law fixing a definite distance between their tramcars.—Scarborough Corporation have been asked to bear the loss on the Tramway Co.'s service in the winter.—The Board of Trade have granted a further two months in which the Dolter system at Torquay is to be removed.—The Board of Trade have refused sanction to the Oldham Corporation for the supply in some outside districts. (Page 798.)

Two 750 kw. sub-station units are required by the New South Wales Government, and mains at Bedford, Fareham, Hackney, and Maidstone. Bradford propose to spend £60,000; Ealing, £20,000; Eastbourne, £8,000, and Hammersmith £60,000 for electrical extensions. A 1,000 kw. generating set is required at East Ham; high- and low-tension switchgear by the London County Council; and a 600 kw. mixed pressure turbine set by the Leyton Council. Meters are to be placed on the tramcars at Darwen. (Page 798.)-

Borough Polytechnic Institute.—The distribution of prizes and certificates by the Earl of Lytton will take place at the Institute, Borough Road, S.E., on Monday, December 19th, at 8 p.m.

Free Wiring at Canterbury.—In our issue of July 7th, 1910, last, we reported a judgment in the Canterbury County Court in respect of free wiring. Some years ago the National Electric Construction Co., Ltd. (then the National Free Wiring Co.) entered into an agreement for the free wiring of premises, the Corporation to pay them 1d. per unit upon all energy consumed in the premises so wired. The Company sued the Corporation for £25 13s. 9d. in respect of particular premises, the present occupier of which is not the person who agreed to the installation to be put in, and who refused to pay the extra 1d. per unit to the Corporation. The County Court judge held that as the Corporation were not empowered under the Electric Lighting Acts to undertake the wiring and fitting of premises, they could not be forced to pay the Company, as their agreement was illegal. The Company entered an appeal against this decision, but when the action was reached in the Divisional Court in London last week, it was announced that the appeal had been abandoned.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, DECEMBER 15TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. "Submarine Cables for Long-Distance Telephone Circuits," by Major W. A. J. O'Meara.

FRIDAY, DECEMBER 16TH.

Electro Harmonic Society.

8 p.m. Smoking Concert, at Holborn Restaurant.

SATURDAY, DECEMBER 17TH.

Junior Institution of Engineers.

3 p.m. Visit to G.P.O. Power Station, Blackfriars.

L.C.C. School of Engineering.

3.30 p.m. At Poplar. "Electric Waves," by E. A. Martin.

Association of Mining Electrical Engineers.

6.30 p.m. Lancashire Branch. At Grand Hotel, Manchester. Address by the President, Mr. W. Maurice.

MONDAY, DECEMBER 19TH.

Institution of Electrical Engineers: Newcastle Section.

8 p.m. At Armstrong College. Discussion on "Switchgear and the Isolation of Faults on Power Systems," to be opened by H. W. Clothier.

TUESDAY, December 20TH.

Physical Society.

3 p.m. to 10 p.m. Sixth Annual Exhibition at Imperial College of Science. Experimental discourse on Detectors by Dr. J. A. Fleming.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At University. "Merz-Price and other Discriminative Protective Apparatus for A.C. Circuits," by K. Faye-Hansen and G. Harlow.

Condensing Plant.—A Paper, entitled "Recent Developments in Condensing Plants," was read recently by Mr. G. L. Kothny, before the Junior Institution of Engineers. The Paper was devoted entirely to the various forms of condensing plant which have been designed to take advantage of the high degree of vacuum obtainable by the use of the Leblanc rotary dry air pump. A number of tests of such plant were given, including some of the multiple-jet Leblanc condensers at the Neasden power-house of the Metropolitan Railway and the L.C.C. power station, Greenwich. A condensing plant of this description was described at some length in ELECTRICAL ENGINEERING, May 19th, p. 321, and some further notes on Westinghouse-Leblanc plants were given on November 17th, p. 733.



The adjourned Conference of representatives of the Incorporated Municipal Electrical Association and the Electrical Contractors' Association, with regard to the question of Municipal Wiring, meets to-day.

(With apologies to Punch Almanack's version of another Important Conference.)

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THE WIRELESS TELEGRAPH PATENT CASE

CONSIDERABLE importance is attached to the result of the action now being heard before Mr. Justice Parker in the Chancery Division of the High Court, in which Mr. G. Marconi and Marconi's Wireless Telegraph Co., Ltd., seek to restrain the British Radio-telegraph & Telephone Co., Ltd., from the alleged infringement of their patents Nos. 7,777 of 1900, 10,245 of 1902, and 4,593 of 1907, all granted to G. Marconi and the Company.

The first patent is claimed to cover the use of a closed oscillatory circuit inductively coupled to the aerial circuit by means of a transformer, the periods of oscillation of these circuits being the same or harmonics of each other, and the use of similar receiving circuits tuned to the transmitting circuits. The second patent is for the well-known magnetic receiver, in which the magnetic condition of a band of iron wire, under the influence of a varying magnetic field, is caused to change suddenly owing to the wiping out by the received oscillations of the lagging flux, the changes being detected by means of a telephone connected to a coil surrounding the band. The third patent is for a high-speed toothed-wheel machine for producing discharges at a very high group frequency.

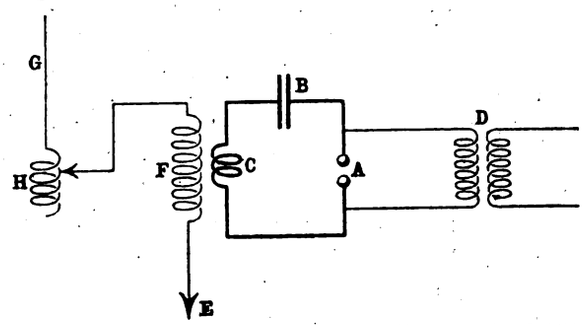
The wireless equipment to which the Marconi Co. take exception is that supplied by the defendant company to the s.s. *Nonsuch*, of Messrs. Bowles Bros., London. While refusing to admit the infringement, the defendant company contend further that the patents in question are invalid, and submit patents by Sir Oliver Lodge, Dr. S. P. Thompson, Nikola Tesla, and others, and also a number of other publications, which in their opinion anticipate Marconi's inventions. Mr. J. Astbury, K.C., Mr. A. J. Walter, K.C., and Mr. J. Hunter Gray appear for the Marconi Co., and Mr. T. Terrell, K.C., and Mr. H. A. Colefax for the defendants. Expert evidence will be given on behalf of the former by Mr. J. Swinburne, F.R.S., Mr. C. Dugald Clerk, F.R.S., and Dr. W. H. Eccles, and for the British Radio-telegraph & Telephone Co. by Dr. S. P. Thompson, F.R.S., Prof. C. B. Boys, F.R.S., and Mr. W. Duddell, F.R.S.

Considerable public interest has been aroused by the fact that in order to demonstrate to the Judge the actual working of their system, the British Radio-telegraph & Telephone Co. have installed a complete wireless station in the Court. A 600-ft. aerial has been stretched from the top of one of the towers of the building to a window of the Court, and messages will be transmitted and received from a considerable distance. Mr. Duddell, also, has arranged several experiments to demonstrate certain points.

On opening the case for the Marconi Co. on Monday, Mr. Astbury stated that, to avoid confusion, he would deal with each patent separately. The witnesses would be called in each case, so that it would be equivalent to three actions. Mr. Astbury commenced with a brief survey of the history of wireless telegraphy, referring to Preece's experiments in telegraphy by magnetic induction, and the early work of Henry, Kelvin, Clerk Maxwell and Hertz in electrical oscillations and electromagnetic waves. He mentioned Sir W. Crookes's production in 1892 of the application of Hertzian waves to telegraphy without wires, and then referred to the use of a filing coherer by Branly and Popoff to detect electromagnetic waves. Continuing, he stated that Mr. Marconi first applied the knowledge of these phenomena to the transmission of signals. In 1895, Marconi managed, by elongating and earthing the aerial, to transmit to a distance of a mile and a half, and in 1896 took out his first patent in this country. The Marconi Co. was registered in 1897, but no rapid development took place until after 1900, the year of the first of the three patents now being contested. In 1901 signals were sent from Poldhu, Cornwall, to Newfoundland, a distance of 1,800 miles; the first Admiralty contract was obtained in the same year; and in 1905 the Post Office accepted telegrams for communication to ships at sea. At the present time every British battleship and a very large number of mercantile vessels were equipped with Marconi apparatus. Recently, communication had been effected between Clifden and South America over a distance of 6,000 miles. The 1896 patent had now expired, but Mr. Marconi had obtained an injunction against the De Forest Wireless Telegraph Co., of America, for infringement of the corresponding American patent.

Returning to the case in question, Mr. Astbury said that he would confine his remarks to the first patent, No. 7,777 of 1900. Hertz's oscillator was, he said, an excellent radiator which gave out practically all its energy in the first swing; Lodge's experiment with the syntonised Leyden jars demonstrated the case of an excellent oscillator which would give persistent oscillations but which was a bad radiator. It was early realised that the strong but highly damped wave emitted by a Hertz oscillator would set an oscillatory circuit of any natural period into vibration, and that the weak but continuous oscillations given out by a "closed" oscillator such as Lodge's would only excite a circuit whose natural period of oscillation was tuned to that of the applied waves. Lodge had stated in his 1894 lecture, which was partly relied upon by the defendants as anticipating Marconi, that good radiation was incompatible with persistence of oscillation, and took out a patent, No. 11,575 of 1897, for a system which struck the mean between these extremes. He modified Hertz's oscillator by placing extra inductance in the circuit to increase the oscillatory effect, and used larger capacities to lessen the radiation. (It will be noticed in the Patent Record on page 796 of this issue, that an application for the extension of the life of this patent will be heard shortly.)

Mr. Marconi, however, continued Mr. Astbury, solved the problem, and produced an oscillator which was a good radiator and at the same time a persistent oscillator. This was the arrangement covered by the 7,777/00 patent, which enabled efficient and selective operation. Referring to Figure 1 of the patent, part of which is reproduced below, Mr. Astbury pointed out that the "closed" circuit comprising the condenser *B*, the inductance *C*, and the spark-



ARRANGEMENT OF CIRCUITS DESCRIBED IN PATENT NO. 7,777 OF 1900.

gap *A* was a persistent oscillator but a bad radiator. By making *C* the primary of a transformer, however, the oscillations in *C* induced corresponding oscillations in the secondary *F*, which was in series with the aerial circuit. This circuit, consisting of an aerial *G* connected through the inductances *H* and *F* to earth or to a capacity, was equivalent to an "open" Hertz oscillator and was a good radiator. Persistent oscillations were thus generated in the "closed" circuit and radiated by the "open" circuit. It was necessary, in order that the aerial circuit should oscillate in response to the influence of the "closed" circuit, that the period of oscillation of these circuits should be the same or harmonics of each other, and the tuning inductance *H* was to effect this. *D* represented the induction coil for exciting the oscillatory circuit. At the receiving end, the coherer would be connected in a "closed" circuit in which oscillations would be produced by transformer action from an "open" aerial circuit, which would easily be set in oscillation by the impinging waves. The patent also covered a method of winding the transformer, but this was comparatively unimportant.

Continuing his opening speech on Tuesday, Mr. Astbury read out portions of a pamphlet published by the British Radio-telegraph & Telephone Co. describing their apparatus on the Balsillie system (*see* ELECTRICAL ENGINEERING, July 21st, 1910, p. 473). This apparatus, he asserted, infringed all the claims of the Marconi patent in question. The diagram of connections published was identical with the above except that, instead of employing two separate windings for the transformer, the aerial circuit was connected in series with one or more turns of the inductance of the "closed" oscillatory circuit, *i.e.*, an auto-transformer is used in place of an ordinary transformer. These, however, were electrically equivalent. The earthing of the "closed" circuit did not affect the oscillations. He would therefore ask his Lordship to say that the defendants infringed.

Mr. Swinburne, examined by Mr. Walter, explained very clearly the nature of electromagnetic waves, and showed how working with a train of weak waves of constant frequency and a tuned receiver was more efficient than working with highly damped waves of large amplitude, and was also the only method of obtaining selectivity.

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RECENT PROGRESS IN ELECTRIC LIGHTING

A PAPER with the above title was read by Prof. E. W. Marchant (Liverpool University) at a meeting of the Illuminating Engineering Society last Friday. Dealing with incandescent lamps, the author said that the most recent development in the construction of tungsten lamps was the use of wire-drawn filaments. A drawback to the older tungsten filaments had been their fragility when cold, although they would stand considerable vibration when hot. He thought that the effect of vibration had been greatly exaggerated. Vibration, however, often caused parts of the filament to become short-circuited, which shortened the life of the lamp. Another matter which was said to affect their life was frequent switching on and off. He had experiments in progress on this, and so far as they went it appeared that the effect was not serious. A few curves of candle-powers at different efficiencies, &c., were shown, and it was mentioned that the British Thomson-Houston Co. had found that the effective life of a tungsten lamp was roughly proportional to the 3·65th power of the initial watts per c.p.

Particulars were given of the illumination of a drawing office of 600 sq. ft. area and 12 ft. high by 18 lamps, using 0·8 watt per sq. ft., and giving an illumination of 3·5 candle-feet on the drawing boards. The lamps were uniformly spaced 3 ft. from the ceiling. The total candle-power used was four times that given by the old rule of 16 c.p. per 100 sq. ft. With inverted silvered reflectors, 2·3 candle-feet had been obtained 2 ft. from the floor with a consumption of 0·83 watt per sq. ft. The character of the light from metal filament lamps corresponded to a continuous spectrum, and he thought their efficiency was due solely to the high temperature and not to selective emission. The nearer we could approach to the temperature of the sun (estimated at 6,200° C.), the nearer we should be to a light for perfect colour matching.

With arc lamps, the principal recent developments had been in flame arc lamps for street lighting, in the directions of suitable light distribution and actual efficiency. Vertical carbons appeared better than inclined in the former respect, and curves were shown for Crompton-Blondel lamps 25 ft. from the ground and 140 ft. apart, where the diversity coefficient was only 4. With Jandus lamps, 20 ft. from the ground and 200 ft. apart, a value of 3·5 had been attained. With V carbons, however, the distribution could be improved by dioptric globes. Some results of tests of efficiency taken by the Ulbricht globe method in the author's laboratory were given. The highest figure attained was 4·5 mean hemispherical candle-power per watt for an enclosed flame lamp with a clear globe. The spectrum given by these lamps was a mixture of a line spectrum and a band spectrum.

Passing on to mercury vapour lamps, the Silica and Quartzlite lamps were described. One of the latter had been found when tested to give 1·73 m.h.c.p. per watt. It was a matter for discussion whether the light from these lamps was injurious to the eye. Their great drawback was the remarkable colour effects which they gave. He had tried mixing their light with that from tungsten lamps with some success, but it appeared that about 54 c.p. from the tungsten lamps should be used with every one c.p. from the mercury arc.

DISCUSSION.

After some opening remarks by Prof. Silvanus Thomson, who was in the chair,

Prof. G. W. O. HOWE (Central Technical College) read a short communication on the blackening of tungsten lamps, and described a case where the deposit had left a clear "shadow" of the filament supports in a position indicating that the bombardment of particles had proceeded from the point where the filament was connected to one of the leading-in wires, and where it had broken. That this is not due to an arc after breakage away of the filament was shown by a similar effect having been seen in unbroken lamps. In many cast "shadows" cast by both leading-in points can be distinguished. But, as far as can be ascertained, the negative seems to be the chief source. Chemical analysis shows that the deposit is almost entirely composed of copper, and a certain amount of copper was found in the leading-in wires, so that all pointed to the fact that the blackening proceeded more from the leading-in wires than from the filament.

Mr. A. P. TROTTER thought that the rate of progress in connection with electric lighting was perhaps rather too rapid. He resented metal filament lamps from one point of view, because he had 205 volts in his house, and could not get anything less than a 20-c.p. lamp. In his office he still retained the carbon filament lamp. Metal filament makers, he supposed, snapped their fingers at a 200-volt 8-c.p. lamp, and yet much lower candle-powers were thought quite sufficient in the olden days.

Mr. HAYDN HARRISON said that when mercury vapour lamps were first put upon the market, their efficiency was put at about 10 candles per watt, but the author's tests showed his efficiency to be only 1·76 candles per watt, which was much nearer the figure he himself had obtained. He did not know whether the quartz or silica glass was responsible for cutting down the efficiency. He did not think the Ulbricht globe was likely to be of much commercial use, because it only gave the mean spherical candle-power, which did not assist the illuminating engineer at all. He also wished to know how the author got the mean hemispherical candle-power. If he took the mean hemispherical as double the spherical, it was wrong.

Mr. A. H. SEABROOK (Chief Electrical Engineer, St. Marylebone Corporation) stated that by issuing instructions to his men to switch on the street lamps when cleaning he had effected a considerable saving in their life. He regarded the introduction of the Holophane globe as an advance in electric lighting as big as that of metal filament lamps themselves. He instanced cases which by using these he had been able to cut down the wattage of the lamps by half, and yet obtained practically the same useful illumination.

Mr. H. D. WILKINSON disagreed with the view that uniform illumination in streets was necessary or desirable, as it was obviously essential to have more light at streets corners and crossings.

Mr. JUSTUS ECK (Union Electric Co.) questioned some of the figures of diversity factor. He had made tests with "Excello" lamps, which had showed a diversity factor of 2·5 to 1·0 with dioptric globes. Unless the lamps were set with great care to secure the arc in the correct position, the whole resultant polar curve was different from what it should be. He also objected to the statement that arc lamps would in future be used mainly for street lighting, for inverted arcs were being used to a large extent for works lighting and drawing-office lighting.

Prof. J. T. MORRIS (East London Technical College) had displaced inverted arcs in three drawing offices at his college by metal filament lamps with holophane reflectors, and had been able to cut down the wattage to about two-thirds, whilst the average illumination was about the same. A change in the make of lamp used frequently altered the results obtained, as the light-giving part was not in the same position in respect to the socket in every lamp, and consequently the distribution was totally altered.

Mr. L. GASTER suggested that some form of standardisation of filaments might be adopted by lamp-makers in respect of the size of filament and the position of centre for every voltage.

Mr. WALDRON, speaking as an architect, said that most of the best efforts of electrical engineers in regard to efficient illumination were being wasted by lamps being placed in unscientific surroundings in regard to wall decorations and papers. There was much work to be done in educating the public in this matter.

Mr. W. R. RAWLINGS suggested that the variation in lives of metal filament lamps was due to voltage variations, and he thought station engineers should pay more attention to this.

Prof. MARCHANT, in reply to Mr. Harrison on the question of hemispherical candle-power, said that the Ulbricht globe did not take into account whether the light was emitted all over a sphere or a hemisphere, but it was obvious that if they had the same flux of light over a hemisphere the mean intensity of emission was twice as great as over a sphere, and therefore it followed that the mean hemispherical candle-power would be twice as great as the result obtained for the mean spherical candle-power from the Ulbricht globe.

Dr. SILVANUS THOMPSON, in proposing a vote of thanks to the author, mentioned that he has a magnetite arc lamp in his laboratory which he has been testing, but the reason why it was not likely to be generally adopted here was that the light was thrown first from one side and then to the other. Some researches in America upon the phenomenon mentioned in Prof. Howe's remarks went to show that there was a discharge of positive electricity at the point of fracture.

The Physical Society's Annual Exhibition.—This exhibition, which is to be held at the Imperial College of Science and Technology, South Kensington, on Tuesday, the 20th inst., will be open in both the afternoon (from 3 to 6 p.m.) and in the evening (from 7 to 10 p.m.). Prof. J. A. Fleming, F.R.S., will give a discourse at 4.15, and again at 8 p.m., on "Some Improvements in Transmitters and Receivers for Wireless Telegraphy," and Mr. R. W. Paul will give a number of cinematograph demonstrations of some physical phenomena. Among the firms exhibiting will be the following:—British Radio-Telegraph & Telephone Co., Ltd.; Cambridge Scientific Instrument Co.; A. C. Cossor, Ltd.; H. W. Cox & Co., Ltd.: Crompton & Co., Ltd.; Elliott Bros.; Everett, Edgcumbe, & Co.; J. J. Griffin & Sons; India Rubber, Gutta Percha, & Telegraph Works, Ltd.; Marconi's Wireless Telegraph Co.; Leslie Miller; Muirhead & Co.; Nalder Bros. and Thompson; Negretti & Zambra; Newton & Co.; R. W. Paul; Weston Electrical Instrument Co. Invitations have been given to the Institution of Electrical Engineers, the Faraday Society, the Optical Society, and the Röntgen Society. Admission will be by ticket only, and those desiring to attend the exhibition should apply to the Secretary of the Society to which they belong.

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LITERARY SUPPLEMENT

REVIEWS of books in technical newspapers are deprived of some of their value by the fact that they are lost sight of once the number of the journal in which they appear has been read and put aside. Some readers, it is true, take pride in maintaining a large and up-to-date library of books on the subjects which interest them, and make a point of obtaining, immediately on publication, any work likely to add usefully to their store of knowledge. The large majority, however, whose time for study is limited, adopt the system of waiting to send for a treatise on any particular subject until they actually require it for some specific object, and then a difficulty often arises in remembering the title of the book and the name of the author, although they may have taken notice of the review at the time it appeared. To both these classes of reader, our Literary Supplement, which will be published periodically, will be of considerable utility, but more especially to the latter class. By filing the successive issues of the Supplement, and by making use of the list of recommended technical books when he requires it from time to time, the student and engineer will always be able, at a moment's notice, to find the publication he has need of, and, by availing himself of the services of the sales department, which we have established for the convenience of our readers, he will be able to obtain a copy of it without delay. A feature of the Book List at the end of the Supplement is that the dates of publication of the reviews of most of the books published during the last two years are given. We have been fortunate in securing the services of experts in the various subjects as reviewers, and, as we have absolute confidence in their recommendations —and also in the validity of their criticisms—we have no doubt that the Literary Supplement to ELECTRICAL ENGINEERING will be duly appreciated by our readers.

NEW PUBLICATIONS

We shall be pleased to send any of the undermentioned works to addresses in the United Kingdom, at the net prices quoted. The price for sending to the Colonies and abroad is also quoted when there is an increase. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Mechanical World" Electrical Pocket Book for 1911. 330 pp. 6 in. by 4 in. 100 figures. (Manchester: Emmott & Co.) 6d. net; by post, 7½d.

"Practical Telephony." By Bell & Wilson. Fifth edition. 306 pp. 7¼ in. by 4¾ in. 232 figures. (London: S. Rentell & Co.) 3s. 6d. net; by post in the United Kingdom, 3s. 10d.; abroad, 3s. 11d.

"The Distington Multiple Boiler Explosion and other Multiple Boiler Explosions." By E. G. Hiller. 60 pp. 8½ in. by 5½ in. 20 illustrations. (Manchester: Taylor, Garnett, Evans & Co.) 1s.; by post 1s. 2d.

"Steam Turbines: their Design and Construction." By Rankin Kennedy. 101 pp. 8½ in. by 5½ in. 62 figures. (London: Whittaker & Co.) 4s. 6d. net; abroad, 4s. 9d.

"Elementary Telegraphy." By H. W. Pendry. 216 pp. 7½ in. by 4¾ in. 200 illustrations. (London: Whittaker & Co.) 2s. 6d. net; abroad, 2s. 9d.

"Aeroplane Patents." By R. M. Neilson. (London: Constable & Co., Ltd.) 4s. 6d. net; abroad, 4s. 9d.

"Who's Who, 1911." 2246 pp. 7¼ in. by 4¾ in. (London: A. & C. Black.) 10s. net (cloth); by post, 10s. 6d.

"The Writers' and Artists' Year-book, 1911." 127 pp. 7¼ in. by 4¾ in. (London: A. & C. Black.) 1s. net (cloth); by post, 1s. 3d.

"The Englishwoman's Year-book, 1911." 384 pp. 7¼ in. by 4¾ in. (London: A. & C. Black.) 2s. 6d. net (cloth); by post, 2s. 10d.

REVIEWS OF BOOKS

The Construction and Working of Internal Combustion Engines. By R. E. Mathot; translated from the French by W. A. Tookey. 554 pp. 9¼ ins. by 5¾ ins. Many illustrations. (London: Constable & Co.) 24s.; abroad, 25s. 3d.

IN adapting M. Mathot's book to the needs of English-speaking people, the translator has somewhat rearranged the work, and has omitted or condensed some of the descriptive matter relating to Continental engines. He has also made some few additions to record recent progress. The book forms a compendium of modern practice in large and moderate-sized gas engine construction of considerable completeness, but views the matter from more than the purely descriptive standpoint by using the examples to illustrate generalised precepts of theory and practice, as revealed by experience. The title of the work leads one to expect perhaps a slightly wider range, but with the exception of brief mention of a few oil engines, including the Diesel and allied patterns, only engines using gaseous fuel are dealt with. The rapidly growing subject of the engine using volatile liquid fuel through a carburettor does not form part of the scheme.

Commencing with a short general introduction, which includes a table of the output of makers of engines over 1,000 h.p., showing the backwardness of this country in that direction, we have a brief discussion of the relative fields of steam and gas power, and some speculations as to the lines on which future development may take place. Here the gas-turbine problem is shortly dealt with, but the majority of opinions quoted are distinctly unfavourable to its early advent. The gas engine is then considered in more detail, and summaries of the principal features of leading American, Belgian, British, and German engines are given. The general characteristics of horizontal engines are noted, and the multi-cylinder vertical engine is called up for review, but the author has few good words to say for it; several types, however, are described. The marine internal combustion engine is then referred to shortly, and here some patterns of eight-cylinder submarine oil engines are illustrated.

Of perhaps more theoretical interest is the comparison between two-cycle and four-cycle engines. The opinions of eminent authorities on both sides are quoted, but the author expresses no partiality. Both, he thinks, have their special spheres. The details of the various two-cycle designs in common use are dealt with first, and another chapter takes up the distinguishing points in a few four-cycle engines presenting features out of the ordinary, but a mistake has evidently been made in including the Vogt engine, as this is described as being on a two-cycle system. The principal operations of ignition, compression, and cooling are then treated, and reference is then made to lubrication, starting apparatus, mean-pressure efficiency, utilisation of waste heat of exhaust, and silencing. All this part is copiously illustrated with examples drawn from current practice. A long chapter on governing and valve gears follows, and the author shows the same strict impartiality between the different systems in use. Matters of mechanical design and general arrangement are dealt with in subsequent chapters on "Details of Construction" and "Moving Parts"; while the remaining part of the book is mainly devoted to engine testing. A useful feature of the work is the carefully classified list of engines with dimensions and other data, together with such results of tests as are available, which forms with some interesting generalisations the last chapter.

Electric Motors. By H. M. Hobart. Second edition. 748 pp. 8¾ by 5¾ ins. 798 figures. (London: Whittaker & Co.) 18s. net; abroad, 19s. 4d.

MOST engineers and designers of electrical machinery are already acquainted with this book, which is recognised as a reliable and exhaustive treatise on the design of electric motors. The first edition appeared in 1904, and since that date considerable progress has been made in the development of motors, particularly in the reduction of weight and cost. The revision for this

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edition has consisted largely in the replacement of the older designs by examples of modern machines representing the best work of important firms in this country and abroad, and the inclusion of some interesting designs which appeared in the French and German editions of the book. An extensive section on single-phase motors has also been added, and the book has greatly increased in size.

About half the space is devoted to continuous-current motors, some important characteristics of which—namely, high starting torque, ease of speed regulation and high "all-day" efficiency, have been, Mr. Hobart points out, somewhat overlooked by many engineers in their natural desire to distribute by three-phase alternating current.

The author wastes no space with historical matter or elementary theory, but plunges at once into the technical details of design and construction. The subject of commutation is dealt with briefly but clearly, the importance of keeping down the reactance voltage being properly emphasised. Forced commutation or the use of interpoles in normal designs is not favoured by Mr. Hobart, but a special chapter is devoted to interpole motors for variable speed and difficult ratings such as a combination of high speed and large output. The various types of armature windings and their application to specific cases are explained, and considerable space is devoted to the question of slot insulation and the arrangement and mechanical fixing of former-wound coils.

To illustrate the author's methods, four comparative designs for a 35 h.p. shunt motor are worked out in detail and compared, and the adaptation of a given design for different speeds is also illustrated. A large number of examples of modern machines with working drawings and photographs then follow.

In spite of Mr. Hobart's evident preference for the continuous-current motor, he recognises the many advantages of the three-phase induction motor, and discusses thoroughly the conditions most favourable to its use. In his opinion, high speed and low periodicity, or at least one of these, are essential for satisfactory working, the induction motor being even far better adapted to high speeds than is the continuous-current motor. The various methods of starting induction motors are fully described, and some instructive comparisons between induction and continuous-current motors are given. The design of induction motors is treated in a most thorough manner, considerable use being made of the circle diagram. Mr. Hobart gives a formula for the calculation of the dispersion coefficient (a modification of Behrend's formula), but prefers the use of a series of curves which he gives. These are based on a large number of tests, and results obtained from them show an average discrepancy of less than 10 per cent. with the observed values for 71 motors. A special chapter is devoted to the calculation of torque and of the necessary resistance for insertion in the rotor circuit at starting. Some notes on heating and ventilation are followed by a series of fully worked out examples of modern machines and descriptions of variable-speed motors with cascade and pole-changing connections. This section is concluded by a chapter on the design of small motors for manufacture in large quantities, adapted from an article contributed to these columns by the author.

True to his principles, Mr. Hobart is outspoken in his disparagement of the single-phase motor, although a polemical treatment of the subject is somewhat out of place in a designers' text-book such as this. The single-phase motor certainly does not offer advantages over the continuous-current or the three-phase induction motor for ordinary power work, but in view of its extensive and growing application for traction purposes it is evident that those who have had experience with it are satisfied that the inherent disadvantages of the motor itself are outweighed by other advantages of the single-phase system. In spite of his prejudices, however, Mr. Hobart describes fairly clearly the working principles of the different types, and explains the difficulties met with in commutation and the various methods of compensation employed. The commutatorless single-phase induction motor and methods of starting it are explained. and particulars are given of the Heyland motor. The compensated series and repulsion motors as developed for traction purposes are described, but full details of the latest designs are naturally not available. Some interesting curves and particulars of the Deri motor are included, however.

The Principles of Electric Wave Telegraphy and Telephony. By Prof. J. A. Fleming. 2nd edition. 906 pp. $8\frac{3}{4}$ ins. by 6 ins. Seven plates and 465 figures. (London: Longmans, Green & Co.) 28s. net; by post to British Colonies, 29s. 8d.

THAT Professor Fleming has worked hard to keep his book up to date with the very rapid advances which have been made in wireless communication since the first edition appeared in 1906 is clearly shown by its 600 pages having become 900, and by the words "and Telephony" having been added to the title. Not only has much been added to the text, but much has also been rewritten in the light of the deeper insight that we now have into the phenomena involved. A smaller proportion of the book is now historical, and although there are many interesting accounts of actual equipments, the object of the work is rather to deal with the scientific principles underlying the whole subject and the operation of the appliances used, than to give descriptive detail of apparatus.

The book is divided into three main sections. The first deals with the methods by which electrical oscillations may be produced and measured, with an exposition of the general mathematical treatment of the subject, including the theory of damping and resonance. A wealth of experimental results are also collated. The second part, entitled "Electric Waves," pursues the subject further, and treats in its three chapters of the principles of stationary waves on wires, of electromagnetic waves, and of the detection and measurement of electric waves in this last-mentioned chapter, a bewildering number of detectors (or, as the author euphoniously terms them, cymoscopes) are described, which have been proposed, experimented with, and used from time to time. But little is said as to their relative merits, or the particular conditions for which they are each suitable, nor is the distinction made clear between those that have never been more than laboratory toys, those that have seen service but are obsolete, and those that are in regular use at the present time, although a little information in this respect may be gathered from the historical notes and descriptions of installations later in the book. The principles and uses of the author's now well-known cymometer and other wave-measurers are also dealt with in this chapter.

Having thus prepared the way, with a full survey of the production, properties, detection and measurement of electric waves, the third and longest section of the book sees them applied to the transmission of messages. A chapter of some 120 pages gives a historical account of the rise of wireless telegraphy, or, as it is now becoming more usually called, "radiotelegraphy," as a definite branch of electrical engineering. A large portion of this follows out in a most interesting manner the work of Marconi, but due recognition is given to the ideas of those before him and the developments due to various other workers at a later stage, and this to a greater extent than in the previous edition. The chronological sequence is not followed throughout, as for the sake of continuity the work of each investigator is kept in a separate section. The latter part of the chapter forms a valuable bibliography of wireless telegraph patents. The next chapter is entitled, "The Appliances of Electric Wave Telegraphy," and deals successively with various forms of aerials, directive systems, including that of Bellini and Tosi, and the functions of the earth connection. Various dischargers, including the rotating form of Marconi and several for quenched spark systems, are also given attention here.

Turning now more completely to the practical aspects of the subject, we have some general notes on stations and systems, and as examples of actual equipments, descriptions are given of the Post Office station at Bolt Head, and of a typical Marconi ship installation. A few notes are also given on the Clifden Marconi Transatlantic station and the long-distance station at Nauen, on the "Telefunken" system. The Poulsen

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station at Cullercoats is also described. The author, however, remarks that "the exact details of the equipment of the large radiotelegraphic stations are difficult to obtain, and, owing to improvements, are subject to alterations. Any statistics, therefore, of the type of equipment are but of temporary interest." The final chapter deals with wireless telephony, but the treatment is necessarily not so full as that of the older part of the subject. The nature of the difficulties yet to be surmounted is indicated, and work already accomplished is described. It is a pity that two obvious misprints have remained undetected in the very last paragraph.

Taking the work as a whole, there is no doubt that it should be regarded as the standard work on the subject, for there is no other volume with anything like its completeness, or with as thorough a treatment of the theoretical side of the subject.

Continuous Current Machine Design. By W. Cramp. 240 pp. 8¾ ins. by 5½ ins. 137 illustrations. (London: Harper & Bros.) 5s.; abroad, 5s. 6d.

THIS is a text-book of practical designing suitable for students who are already acquainted with the theory of the subject, but who wish to study it from the commercial standpoint. Throughout the book the author shows a full appreciation of the influence of cost, and also of the possible discrepancies under practical conditions between calculated and actual values. Only normal designs are considered; such special machines as turbo-generators and variable-speed motors are not included. Interpole designs are fully dealt with, however, and much space is given to the question of temperature rise as limiting the outputs of such machines. The author has evidently carefully studied the methods of other authorities, and in many cases makes most interesting comparisons of these. The section on temperature rise is particularly instructive, and there is a very useful chapter on armature windings. The difficulties of commutation are clearly explained, Hobart's approximate method being utilised for estimating the reactance voltage. The chapter on general mechanical construction and that on methods of estimating the approximate relative costs of alternative designs should be of particular help. The book concludes with some examples of procedure in design.

Standard Handbook for Electrical Engineers. Third edition. 1497 pp. 6¾ in. by 4¼ in. Several hundred figures. (London: McGraw-Hill Book Co.) 17s. net. Abroad, 17s. 6d.

THERE are numerous electrical works of the pocket-book or handbook class, but we have not met with many that are more complete than the one before us. It must, of course, be understood that the book is an American production, and, being primarily addressed to readers on the other side of the Atlantic, relates entirely to standard American practice. This is not such a disadvantage to English readers as might be supposed at first, as the differences are not really very great, and indeed in certain branches of electrical engineering, such as traction and telephony, it was upon American experience that British practice was subsequently founded. Treating the work as a complete compendium of American electrical engineering with a broad range, a wealth of detail and a commendable conciseness, we have little criticism to make, but the use throughout of the Brown & Sharpe wire gauge and the circular mil may cause a little inconvenience to readers on this side. Again, one turns usually to a work of this class for the various rules and regulations under which schemes have to be carried out in this country, such as those of the Board of Trade, the Home Office, the Insurance Companies, and the Wiring Rules of the Institution of Electrical Engineers. The very excellent standardisation rules of the American Institute of Electrical Engineers and the American "National Electric Code" are interesting, but have not the same application here. Nevertheless there is a vast store of well-arranged information and tabular matter of the utmost value to engineers in all countries, and this, the third edition, has been thoroughly revised by the various authors responsible for the different sections of the book. The compiler of the greater part of the volume is Mr. Otis A. Kenyon, and among other well-known contributors are Dr. A. S. McAllister, Mr. H. M. Hobart, Dr. Louis Bell, and five or six other technical writers.

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The Application of Arc Lamps to Practical Purposes. By Justus Eck. 101 pp. 8¼ in. by 5½ in. 92 illustrations. (London: S. Rentell & Co.) 2s. 6d. net. By post, U.K., 2s. 9d.; abroad, 2s. 10d.

It is only within recent years that scientific methods have been applied to artificial illumination, and though much has been written on the subject, there is certainly a need for a good book dealing with the various methods of illuminating by artificial sources of light. The present work covers the applications of arc lamps only, but contains a large amount of useful information and data which should be of considerable value to the electrical engineer. Such points as the choice of carbons, the proper selection and disposition of the lamps to obtain the most satisfactory results for different purposes, are dealt with in a useful manner, and the collection of descriptions of the mechanisms of the various lamps will be duly appreciated by the practically inclined reader. Mr. Eck can, of course, write with authority on all questions connected with arc lighting, and on technical matters is above criticism. We are bound to say, however, that there is room for improvement in the literary style of the writing, and that the significance of some of the tables and diagrams might be more clearly brought out. The use of the Lux or Hefner candle-metre as the unit of illumination seems a mistake in view of the general acceptance in this country of the British candle-foot, and the combination of the Lux with areas in square feet in one table is a regrettable oversight.

The Theory of Ionisation of Gases by Collision. By J. S. Townsend. 88 pp. 7¾ in. by 5 in. Twelve figures. (London: Constable & Co., Ltd.) 3s. 6d. net; by post, 3s. 9d.

The author in this little book propounds a theory of ionisation by collision in order to explain the development of currents in gases. He says in his preface that "researches have brought to light the fact that ionisation by collision takes place when comparatively small potential differences are established between electrodes in a gas at a suitable pressure, so that considerable multiplication of the ions may be obtained by this process with 40 or 50 volts, consequently with comparatively small velocities of the ions." This, of course, is quite different from what happens in cases of ionisation by means of radioactive substances, or by cathode rays. In such cases the ionic velocities are extremely high, as they are produced by the potentials of the order of thousands of volts.

The book is divided up into four chapters: (1) Ionisation by negative ions, (2) ionisation by positive ions, (3) sparking potential in a uniform electric field, (4) theory of electric discharges in fields of force which are not uniform.

It is strange how most new theories when first propounded meet with intense opposition. The theory of ionisation in aqueous and other solutions had to run the gauntlet of most severe, sometimes ludicrous, criticism, but it triumphed, because it could be demonstrated experimentally. Ionisation, to explain conductivity in gases, was a necessary corollary, although, perhaps, not at first sight an obvious one. It, in turn, met with opposition and scepticism; but it again admits of experimental verification. Prof. Townsend's book is based on experiment, but, of course, such a subject has also to be treated mathematically. The mathematics will make it difficult for some, but, on the whole, we consider it clearly written and expressed.

Depreciation of Factories, Mines, and Industrial Undertakings, and their Valuation. By Ewing Matheson. Fourth edition. 230 pp. 8¾ in. by 5¼ in. (London: E. & F. N. Spon.) 10s. 6d. net; abroad, 11s.

Mr. Matheson's book well deserves to have reached a fourth edition. There is no manager of a manufacturing concern who would not profit by its perusal, and the general principles upon which the whole treatment of the subject is based are unimpeachable.

The Indicator Handbook. By C. N. Pickworth. Part I. Fourth edition. 142 pp. 7¼ in. by 5 in. 93 illustrations. (Manchester: Emmott & Co.) 3s. net; abroad, 3s. 3d.

The fourth edition of the first part of Mr. Pickworth's "Indicator Handbook" has been extensively revised and added to. A new section on special indicators for gas and oil engines has been necessitated by recent advances in this field, and some thoroughly up-to-date forms, as the Hopkinson and other mirror indicators, have been included. Extension has also been made in the section on reducing gears in view of applications to gas engines, &c. The volume before us deals with descriptions of

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actual instruments and notes on their use, with valuable hints as to causes of error; but the working out of results from the diagrams obtained is dealt with in Part II., which forms a separate volume. A review of the last edition of Part II. appeared in ELECTRICAL ENGINEERING of July 21st, 1910.

Practical Testing of Electrical Machines. By L. Oulton and N. J. Wilson. 210 pp. 6½ in. by 4 in. 90 illustrations. (London: Whittaker & Co.) 4s. 6d. net; abroad, 4s. 9d.

THIS little volume contains full instructions for carrying out the usual tests which are made on electrical machines, together with worked examples and typical curves and results for each test described. The latter have been supplied by various well-known manufacturers as representative of modern practice. Methods necessitating alterations to the machines, such as the various ways of loading alternators by splitting up the windings, and others not in general use, such as the loading back on each other of induction motors and railway motors, are not included. The more usual tests, however, are described in a lucid manner, and valuable information of a practical nature as to the methods to be followed in connecting up the machines and instruments and in taking the readings is distributed throughout the book. The first part deals with alternating-current machines, and includes rotary converters and various types of single-phase railway motors. A chapter devoted particularly to direct-current railway motors is also included. It would seem desirable in a future edition of the book to include some notes on the use of the oscillograph. No method of obtaining the wave-form of an alternator is given, mention only being made of the fact that the oscillograph enables one to take it direct and to observe variations.

Engineering Workshop Machines and Processes. By F. zur Nedden. Translated and revised by J. A. Davenport. With an introduction by Sir A. B. W. Kennedy, F.R.S. 216 pp. 8½ in. by 5½ in. (London: Constable & Co.) 6s. net; abroad, 6s. 8d.

THIS translation or adaptation of a German work is particularly directed to students and "others" taking a course of training in the shops of an engineering works. Its object is to set out in a condensed form those matters which a learner frequently finds taken as data, but with some of which he may not already have made himself familiar in his lectures. A number of alterations from the original have been necessitated to bring the work into line with English requirements, and these have involved the omission of some eight chapters relating to the German scheme of technical education. The chapters on materials of construction, foundry and pattern shop, forging, the machine shop, measuring and marking off, and fitting, erecting, and turning, are, however, translated direct from the German, but the translating is so excellent that they are thoroughly English in character. The introductory chapter is new, and a chapter consisting of a description of a typical English works, that of Messrs. W. H. Allen, Son & Co., at Bedford, has been added. An interesting introduction is provided by Sir Alexander Kennedy, and the full report of the Committee on the Education and Training of Engineers, appointed by the Council of the Institution of Civil Engineers (1906) is reprinted as an appendix by permission of the Institution. This report lays stress on the desirability of adequate workshop training for all classes of engineers.

Elementary Treatise on Electricity and Magnetism. By Prof. G. Carey Foster and A. W. Porter. Third Edition. Founded on Joubert's "Traité Elémentaire D'Electricité. 633 pp. 8¾ in. by 5½ in. 377 illustrations. (London: Longmans, Green & Co.) 10s. 6d. net; abroad, 11s. 2d.

THE rapid advance of science, both pure and applied, causes even the most excellent works to become soon out of date, but there is no reason why their good points in method and exposition should not be embodied, with due acknowledgment, in the treatises which supersede them. It was with this end in view, presumably, that the present work was founded on Joubert's famous treatise, and it is no disparagement to the original to say that the authors might have allowed themselves greater freedom in departing from their foundation with advantage. Many of the experiments described might have been superseded by others bearing more closely on practical work, and the illustrations and diagrams are also, in many cases, too reminiscent of the early text-books. The general theory has, however, been brought well up to date by suitable modifications and additions, and a chapter at the end of the volume introduces the student to the results of the most modern researches, including the cathode stream, Röntgen and Becquerel rays, and a brief account of recent investigations bearing on the modern theory of electrons. The chapter on terrestrial magnetism has been revised with the assistance of Dr. C. Chree. The concluding chapter, "Miscellaneous Technical Applications," is too superficial to be of much use, nor is it always accurate, as for example, where the Osram lamp is described as having a filament "principally of Osinium."

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Theory of Electric Cables and Networks. By Alex. Russell. 8s. net; abroad, 8s. 8d. (*Reviewed in* ELECTRICAL ENGINEERING, *October 7th*, 1909.)

Localisation of Faults in Electric Light and Power Mains. By F. C. Raphael. 2nd edition. 7s. 6d. net; abroad, 8s.

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Elementary Manual of Steam and the Steam Engine. By A. Jamieson. 12th edition. 3s. 6d.; abroad, 3s. 9d. (*Reviewed in* ELECTRICAL ENGINEERING, *December 31st*, 1908.)

The Indicator Handbook. By C. N. Pickworth. *Part I.*, The Indicator: Its Construction and Application. 3s. net; abroad, 3s. 4d. *Part II.*, The Indicator Diagram: Its Analysis and Calculation. 3s. net; abroad, 3s. 4d.

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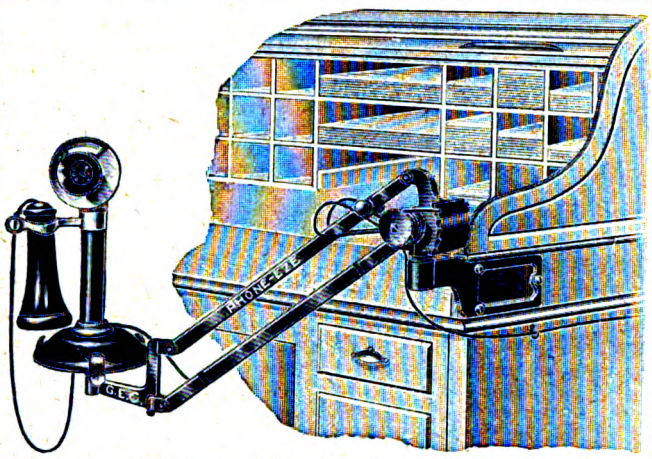
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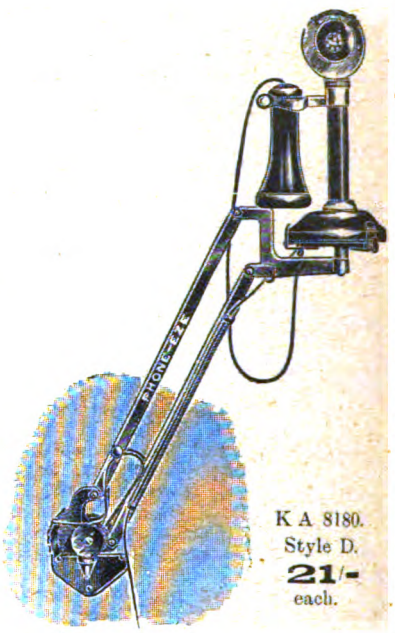
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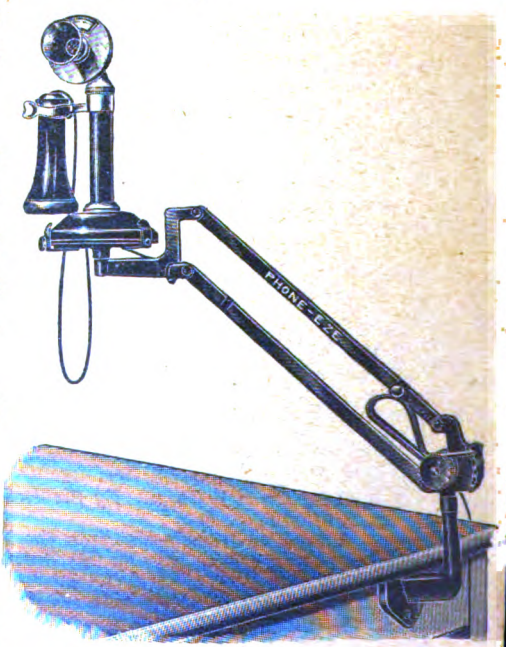
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MAGNETIC PROPERTIES OF IRON AND STEEL IN INTENSE FIELDS

A PAPER by Sir Robert A. Hadfield, F.R.S., and Prof. B. Hopkinson, F.R.S., entitled "The Magnetic Properties of Iron and its Alloys in Intense Fields," was discussed at the London meeting of the Institution of Electrical Engineers last Thursday. The authors described a long series of tests which they had made of the magnetic quality of iron and various alloys in the region of saturation, where the value of $4\pi I$ (the amount by which the induction exceeds the magnetising force) is practically constant. They attach great importance to the saturation value I, and propose to call this constant the "magnetism" or specific magnetism of the material.

Most steels, they remark, consist of a mixture of constituents, the arrangement of which is an important factor in the results of magnetic testing of the ordinary kind. The arrangement of the constituents as revealed by the microstructure is dependent upon a great variety of circumstances, and this makes it hopeless to look for any simple quantitative relation between the magnetic properties of an alloy as ordinarily tested and its composition. When the alloy is saturated, however, this complication disappears.

The tests were carried out by the isthmus method, with a search coil over the short cylindrical specimen between the poles of a powerful electromagnet, and the change of flux, on reversing the current in the main magnet coils, was measured by the throw of a ballistic galvanometer. Fields up to 25,000 C.G.S. units could be obtained. Various causes of error were carefully investigated, and corrections introduced where necessary. The value of $4\pi IS$ (where S is the sectional area of the test piece) was calculated from the difference between the throws of the galvanometer with the test piece in place, and with a brass cylinder substituted, corrections being made for the redistribution of the flux. In some tests a magnet with a laminated magnetic circuit was used, provided with two similar search coils, only one of which contained a specimen, and these were connected in opposition, so that the required difference could be obtained with one observation. Very numerous tests were made, of which results are given in the Paper, and from them the following general conclusions were drawn:—

Every alloy examined, without exception, has a definite saturation intensity of magnetisation. In most cases this is reached in a field of 5,000 units, but in a few there is a small increase, as between 5,000 and 25,000. The forms of the curves of magnetisation connecting I and H in these exceptional materials, however, leave no doubt of the existence in them also of a saturation value of I. Every one of the materials tested, without exception, behaves as though it consisted of a mixture of magnetic substances with non-magnetic substances having a permeability not differing materially from unity. This holds good also for the non-magnetic or nearly non-magnetic nickel or manganese alloys which appear to be saturated at about 7,000 to 8,000 C.G.S. units, and, in this respect, the results differ from those obtained by Ewing and Low—according to whose experiments a nearly non-magnetic manganese steel had a constant permeability of about 1·4. According to these experiments on the non-magnetic steels, however, the difference in the values of I does not in any case exceed 30 units. Among all the alloys tested there is none having a constant permeability differing from unity by more than 2 per cent.

There is no alloy having a higher magnetism than has pure iron. The saturation value of I for pure iron of density 7·80 in absolute units is 1,675 within 1 per cent. (This is slightly lower than the values obtained by Ewin and Low and other experimenters.) Among the alloys there are two whose magnetism is greater than the sum of that of their constituents taken separately. One of these contains 11·4 per cent. of nickel.

It appears that the less-magnetic alloys behave as though they consisted of some substance having a permeability which does not differ from unity by more than 2 or 3 per cent. mixed with varying quantities of magnetic matter which is practically saturated with magnetism in a force of 8,000 C.G.S.

In an annealed iron-carbon steel in which other elements are present in small proportions the specific magnetism is less than that of pure iron by a percentage equal to six times the percentage of carbon. This result constitutes a verification, in the case of annealed iron-carbon alloys, of the linear relation of the magnetism of a mixture with the magnetisms of its constituents. In this case there are two constituents, mechanically mixed, viz., pure iron and iron-carbide, the percentage of iron-carbide being 15·5 times that of the carbon in the steel. It is readily deduced that the magnetism of carbide of iron is about two-thirds of that of pure iron.

Quenching an iron-carbon alloy from a high temperature reduces the specific magnetism by a large but somewhat uncertain amount. The addition of silicon or aluminium to iron results in a reduction in specific magnetism which is roughly in proportion to the amount added as though the addition behaved as an inert diluent. If carbon be present, however, silicon seems to neutralise its action to some extent. For instance, an alloy containing 2·28 Si and 0·67 C is 3·6 per cent. less magnetic than pure iron, whereas if the carbon had its full effect as in iron-carbon alloys, and the silicon were simply an inert diluent, the reduction would be 6·3 per cent.

The observations on the alloys of iron with nickel and with manganese, or with both these elements, have failed to reveal any simple relation between their magnetism and their composition. It is probable that this is due to the peculiar effects of heat treatment on these substances. When these effects are sufficiently known it may be possible to apply to the manganese and nickel alloys the same kind of magnetic analysis as has been applied to the carbon steels.

Discussion.

Dr. Silvanus P. Thompson, F.R.S., wished to know the upper limits of magnetising force to which the experiments had been carried, and the limits of permeability to which the specimens had been reduced. With regard to Hadfield's non-magnetic manganese-steel, the late Dr. John Hopkinson gave a permeability of 1·3 and Dr. Ewing gave 1·4. It was difficult to understand how that material could be what it was if it had a constant permeability, and did not, like all other specimens, have a diminishing permeability on very high fields. A most important point had been established in the Paper, viz., that every single specimen of iron or steel behaves magnetically as the sum of its separate constituents. He hoped that the authors would proceed in their tests of specimens quenched at different temperatures.

Mr. J. E. Sears asked if it had been proved that a compound behaved as a mixture. With regard to the iron-nickel specimens, were any experiments made up to, say, 43 per cent. nickel? The authors spoke of 24 per cent. nickel as the highest.

Mr. W. M. Mordey said that pure iron was a very unstable material from the point of view of dynamo and transformer construction, as its physical qualities changed very much, and particularly with regard to hysteresis, and it was not one to be looked forward to in this connection with any great hopefulness. He would have liked particulars of the specific resistance, as this was increased to some 300 or 400 per cent. by causes which did not affect the magnetic qualities prejudicially throughout the range required for practical work. Figures of the hysteresis losses would also be valuable. He suggested to the authors some further researches in order to discover an iron or iron alloy that would have a very high permeability at a very low density.

Mr. W. H. Murdoch thought the ballistic method of testing with complete reversals was open to certain objections. He had made a rough instrument in which the ballistic reversal method was entirely avoided, but had not had time to develop it further.

Mr. G. G. Stoney expressed the hope that the authors would continue their work on non-magnetic alloys, so as to get one that could be machined. If they could get one with, say, 35 or 40 tons tensile strength and with 30 per cent. elongation, it could be used for high-speed armatures and rotors. Perhaps they might eventually get a material that could be machined first, and then, by suitable treatment, be rendered non-magnetic.

Prof. J. T. Morris (East London Technical College) mentioned the action of manganese under magnetic forces, and said there was a feeling that manganese would be found to be a magnetic body. Its atomic weight was very close to that of iron, nickel, and cobalt, and it was possible that at low or high temperatures it might pass some critical point and become magnetic. His brother, Dr. D. K. Morris, some years ago investigated a method of producing high flux densities up to 20,000 lines per sq. cm. by means of a transformer. He used alternating current, and although this introduced some complications, at the same time it did away with a number of the difficulties experienced by the authors.

Mr. T. H. Churton asked if any experiments had been made as to the change, if any, in the molecular structure of the specimens which had been subjected to high magnetism several times. He had known some armature teeth that had been subjected to very high flux densities to break off after being run in such a condition for a comparatively short time. Investigations as to the amount of the actual pull that would be exerted on the teeth showed that it was nothing like sufficient to break off the teeth under ordinary conditions, and it seemed to suggest that the teeth had become brittle in some way. Was this due to the molecular action going on under the reversals of the high field?

Mr. W. H. Patchell, on this latter point, said that some years ago he put in some bare copper battery connections at Maiden Lane station of the Charing Cross Co. After a fire there it was found that every one had gone rotten, not through

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the fire, but simply with the heavy current. By annealing them they were used again. But he did not think it was altogether due to the heating effect.

Prof. HOPKINSON, in reply, said that, with a few exceptions, all the specimens mentioned in the Paper were tested up to a maximum of 25,000 C.G.S. units. The permeability of pure iron, in a field of 25,000, was about 2. He hoped it would be possible in the future to learn more about the question of quenching. In reply to Mr. Seares, in the case of an iron-carbon alloy, the magnetism was a linear function of the amount of carbon. He did not think that could be regarded as proof that the stuff behaved simply as if it were a mixture, but assuming that it was a mixture of iron and iron carbide, he thought it was proof that they did not influence each other magnetically. Mr. Mordey's remark as to iron being unstable was true in the ordinary fields employed in the ordinary methods of testing, but it ceased to be true with very high values. He had not made any measurements of specific resistance, nor of hysteresis loss. He thought there was something in the complaint against the ballistic method of testing in low fields, but not with high fields when the material became saturated.

MOTOR CONTROLLERS

A VERY complete range of motor controllers are described in a new catalogue issued by the British Thomson-Houston Co., Ltd. (Rugby), which gives a good idea of the thoroughness with which the requirements of widely differing classes of work have been studied. The types dealt with embrace continuous-current drum controllers, with magnetic blow-out where necessary, both for plain rheostatic control with and without braking points, and in special forms for printing-press work. The controllers for alternating-current induction motors are made in a number of patterns, including special oil-immersed designs for mining service, one of which is illustrated in Fig. 1. These are used in conjunction with oil-immersed resistances, to which they are connected by special cables unaffected by oil.

For motors of larger capacity than those for which standard tramway type controllers are listed, contactor control is recommended. The control gear consists of a set of electrically operated switches or contactors for making and breaking the motor circuit, and generally a small hand-operated master controller to admit current to the operating coils of the contactors. The electro-magnetic switch has all the requirements necessary for circuits carrying heavy currents which

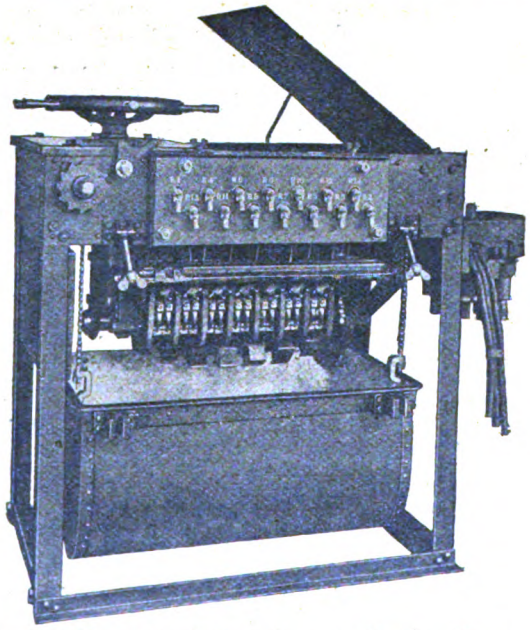


FIG. 1.—OIL-IMMERSED CONTROLLER FOR MINING WORK, WITH OIL TANK LOWERED.

are to be frequently made and broken, as it can be fitted with magnetic blow-out, and its actuating solenoids and compression springs are so apportioned that it will open and close with a quick positive action.

One of these contactors is illustrated in Fig. 2. Each accelerating contactor includes, as an integral part of itself, an overload relay, the plunger of which is held in the open position by a mechanical connection with the contactor until the contactor is closed. When the contactor closes, the plunger is free to drop as soon as the current in the motor armature falls to a predetermined value due to the armature speeding up.

The relay plunger in its lowest position completes the circuit (up to the master controller) of the operating coil of the next contactor. This ensures that after one resistance contactor is closed, the next cannot be closed until the armature current falls to a predetermined value. Such a scheme is suitable where hand control is necessary, and gives protection to the motor equal to that obtained with automatic starting devices. If several hand-control points are not required and the motor is to be started and stopped automatically by the opening and closing of a single switch, the master controller can be replaced by a small single-pole switch.

The drawback to some automatic acceleration systems hitherto designed has been the large number of interlocking contacts necessary for their operation. For this reason time-limit control and systems of counter E.M.F. control have been frequently used. In the former system the apparatus is set by means of dashpots or similar devices to start always in a certain period independent of the load. The master controllers for these time-limit systems are dependent for their operation upon dashpots or escapements more liable to derangement from slight causes than master controllers

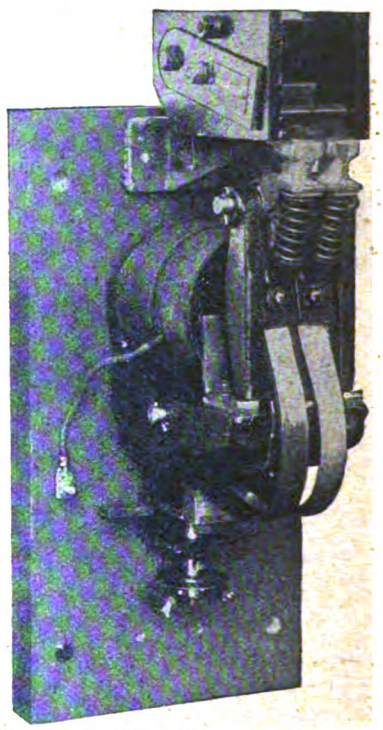


FIG. 2.—CONTACTOR WITH CURRENT LIMIT INTERLOCK.

for either counter E.M.F. or current-limit control. In the counter E.M.F. control the contactors may be made to control the motor by arranging them so that each successive contactor requires a higher voltage to operate it than the one preceding. The contactors are connected in multiple with the armature of the motor, and as the motor comes up to speed, the counter E.M.F. meanwhile increasing, the contactors close in their proper sequence. Although this is a simple form of automatic control it is subject to certain limitations, among which is the effect of abnormal voltage on the line. First—if the line voltage is high, contactors will close prematurely, and if it is low some of them will not close at all. Second—the system is not well suited to series motors without important modifications, for the reason that the counter E.M.F. of a series motor is a function of the current as well as of the speed. The action of counter E.M.F. control is also liable to be interfered with by changes in temperature of the contactor operating coils.

Current-limit control is free from these disadvantages, and is recommended for rolling-mill service, and for all cases where the conditions are such that the motor has to be started, controlled, and reversed on widely different loads. With such control the starting period is controlled by the armature current, light loads being automatically accelerated rapidly, and heavy loads slowly.

The system is equally applicable to continuous and alternating currents. The list also contains numerous patterns of resistance for various classes of service.

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ELECTRIC WIRING POWERS

THE discussion upon electric wiring powers which took place on Wednesday last week, at the instance of the Committee for the Protection of Electrical Interests, brought out a few points of interest. The attendance was very meagre, however, as there was obviously a disinclination both on the part of municipal electrical engineers and contractors to discuss the question while it is still the subject of a friendly conference between representatives of the Incorporated Municipal Electrical Association and the Electrical Contractors' Association. Mr. Robert Hammond occupied the chair.

Mr. A. A. CAMPBELL SWINTON, speaking as a director of a number of electric supply companies which have invested large sums of money in electric wiring, said he did not see how they could logically object to municipalities having these powers, but the one point he wished to make clear was that municipalities, when purchasing electric lighting companies, should be forced to purchase their wiring businesses as well. He believed that municipalities held the view that they are not bound to do this. In a recent case the original proposal of the corporation was to ignore the company's wiring business, but fortunately an agreement had been come to.

Mr. W. A. VIGNOLES (Chief Electrical Engineer, Grimsby) gave some figures to show the large increase of consumers owing to the facilities given for the hire of motors. He thought they had to recognise that the electrical industry was largely bound up with municipalities, and it was the action of those corporations who had first taken up the hire and sale of apparatus that had given an impetus to this side of the electric supply business.

Mr. E. GARCKE did not think it was right to put barriers in the way of the efficient development of municipal undertakings, especially as a large number of corporations had already been granted the wiring powers. At the same time, he threw out the warning that local authorities should not make the mistake of thinking that because it was their duty to carry on a particular enterprise, that duty involved the destruction of interests which might be in opposition to their own.

Mr. J. S. RAWORTH, after pointing out that municipalities and companies should stand upon exactly the same footing in this matter so far as having the powers to do wiring, expressed the opinion that it was only right that the work should be placed in the hands of those people who made a speciality of it. A supply station engineer could not efficiently supervise the supply of electrical energy and also its application in consumers' premises. To do this involved depriving those who were specialising in the work from making a reasonable living, whilst at the same time the supply station people made no profit upon it.

Mr. G. HARLAND BOWDEN (President of the Electrical Contractors' Association) said that the conference between the Municipal Association and the Contractors had not broken up, and that it would sit again on the 15th inst. He took the opportunity of saying how the Contractors' Association appreciated the honourable manner in which the municipal engineers had met them in this matter, but in view of the conference still sitting he would not discuss the point of principle in detail.

Mr. W. RAWLINGS said his experience was that consumers resented the supply station authorities wishing to wire and fit their premises, as the feeling existed that the only interest of the supply station people was to increase the supply of energy. He further pointed out that many of the difficulties at present existing between contractors and the supply station authorities were due to a number of petty obstacles, such as refusing to make appointments over the telephone, insisting upon 48 hours' notice to test, and so on.

Mr. F. E. GRIPPER (Edmundsons' Electricity Corporation) expressed similar views to Messrs. Campbell Swinton, Raworth, and Garcke, and as representing companies who also did wiring, said he preferred to encourage contractors than to have to do this himself. His companies did not compete with the contractor except in special cases, and did not cut prices. In many of their towns, however, there were no contractors to compete with.

Mr. HARLAND BOWDEN said that if Mr. Gripper would send him a list of those towns he would undertake that two or three electrical contractors would start business there.

Mr. JUSTUS ECK (Union Electric Co.) complained of manufacturers frequently undertaking wiring work and cutting into a branch of the industry for which they were not fitted.

Mr. R. TWEEDY SMITH (Honorary Solicitor to the Contractors' Association) spoke on the general question of municipal trading in this matter, and mentioned the case of a municipal engineer who, before he undertook the wiring of premises, was making a profit, but afterwards this profit gradually dwindled and a loss was involved. Later on it was found that the wiring business was making a profit but the supply side a loss. He thought it pointed to the moral that supply station engineers had best confine themselves to their own branch.

Mr. ROBERT HAMMOND, in closing the debate, said that it had shown how much could be gained by talking over their differences in a quiet manner, and expressed the hope that contractors and municipalities would come to an agreement, in the general interests of the electrical supply industry. It had been, he said, the original intention of the committee to discuss whether there should be united action in asking Parliament to sanction all electricity supply undertakers to put capital into the wiring of premises, and the hire of apparatus, but the discussion had been rather narrowed down to the point as to who should carry out the work.

ELECTRICITY TESTING STATIONS IN LONDON

Proposed Prosecution

UNDER the terms of London Electric Lighting Provisional Orders the various supply authorities are bound, if so required by the London County Council, to provide testing stations in order that the pressure may be tested from time to time. As the result of suggestions put forward in February, 1909, by a deputation of Borough Councils owning electricity works, the County Council agreed that where the supply undertakings have "pilot wires" leading back from distant points of the mains to generating stations or sub-stations, instruments connected to such pilot wires and fixed in such premises might, in approved cases, in order to save expense, be recognised for the time being as testing stations within the meaning of the Electric Lighting Acts, provided that such instruments are sealed during the course of any testing, and that proof is shown that the wires are properly connected at the distant parts of the system.

The Highways Committee of the London County Council report that for some considerable time they have been in negotiation with the Islington and the Marylebone Councils with a view to securing their compliance with the Council's requirements in this connection, but it appears quite clear that these Councils have no intention of complying or of going to arbitration. In the case of Marylebone, three "pilot wire" stations already exist. The County Council require five, but the Borough Council regard the provision of special premises or of boxes in the streets as unnecessary. The Islington Borough Council also regard the requirements as unreasonable, and point out that the following resolution was passed by a conference on November 11th last, which dealt with this matter. At this conference there were present representatives of the Battersea, Fulham, Hackney, Hammersmith, Hampstead, Islington, Poplar, St. Marylebone, St. Pancras, Shoreditch, Southwark, and Woolwich Councils, and the resolution in question reads, "That it is desirable that the provisions of section 41 (3) of the Electric Lighting Clauses Act, 1899, should apply to local authorities in the metropolis who are electric lighting undertakers in lieu of the corresponding sections with regard to the establishment of testing stations in their respective Provisional Orders." The Highways Committee point out that if this resolution were agreed to by Parliament it would transfer the Council's powers in regard to testing stations to a court of summary jurisdiction which could only act on the application of ten consumers.

The Highways Committee further point out that the establishment of testing stations was initiated about eight years ago by some of the Borough Councils themselves who wished to enforce them upon supply companies. The companies suggested that any such provision should be binding upon both company and municipal undertakings, and this request the County Council regarded as reasonable. As a result, all the companies have met the requirements of the Council. Although, however, there are fourteen Borough Councils owning electricity undertakings, only three, namely, Poplar, Stoke Newington, and Woolwich, have met the Council's requirements.

After pointing out the importance of testing stations owing to the ever-increasing use of electricity for all purposes, and to the fact that the Islington and Marylebone Councils have been shown to have actually supplied current at a "faulty" pressure, the Highways Committee recommend that proceedings should be taken against them to enforce the Council's requirements.

Metal Filament Lamps at a Bowling Green.—The General Electric Co. have sent us some particulars of an installation of five 200 c.p. Osram lamps which are used with great success by a hotel proprietor at Redditch for the illumination of a bowling green. This lighting enables matches to be played at night without difficulty. The green is 45 yards by 25 yards, and the lamps are placed on bracket arms attached to poles, one at each corner. One is also suspended from the centre of a steel wire stretched across the green. The wires are carried round the sides of the green on insulators.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published December 8th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

27,217/09. **Steam Turbine Blades.** A.-G. Brown, Boveri & Cie. Turbine blades are formed from an alloy of pure iron and nickel, which is manufactured in an electric furnace, and must not contain the slightest trace of carbon. This alloy does not rust, and is equal to nickel-steel as regards strength, while it withstands high temperatures without becoming brittle.

28,804/09. **Electrical Propulsion of Ships.** Siemens Bros. Dynamo Works, Ltd., and E. A. Holmes. There are two groups of motor-driven propellers supplied by turbo-alternators of different frequencies. At normal speeds the generators drive the motors of like frequency. For a reduced speed (assuming frequencies of 75 and 50 cycles) the 75-cycle motors are driven from the 50-cycle generators, thus obtaining two-thirds normal speed. For the next speed, the frequency of the generators is halved as described in Patent No. 9,048/09. A fourth speed intermediate between these is obtained by driving the 50-cycle motors by the 50-cycle generators delivering current at half the frequency. Four figures.

29,506/09. **Wall Plug.** A. and G. J. Bonella. To prevent the removal of wall plugs by a direct pull, the plug is provided with a spring catch which enters a recess in the socket and engages with it. The catch is released by means of a button at the side of the plug. Four figures.

6,650/10. **Ignition System.** H. J. Haddan (*L. B. Lesperance, California*). This specification describes apparatus for supplying the sparking plug of an internal combustion engine with a high-frequency oscillatory discharge. A resonator is excited by the discharge of a condenser charged intermittently through an inductance. One figure.

13,520/10. **Circuit-Breaker.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). To avoid burning of the arc shields of the magnetic blow-out, the arc is confined to the centre by a magnetic field produced by the current flowing through the contacts. These are so shaped that the flow of current has a directional component transverse to the shields, and in opposite directions on opposite sides of the central plane between the shields. Four figures.

14,116/10. **Metal Filaments.** Wolfram Lampen A.-G. (Augsburg, Germany). This specification covers a process for decarbonising metal filaments by raising them to incandescence in an atmosphere of menthane gas (CH_4) at a pressure of a few millimetres.

Application for Extension of Life of Patent

11,575/97. **Wireless Telegraphy.** Sir Oliver Lodge. It was announced in Mr. Justice Warrington's Court in the Chancery Division on Saturday that no objections had been entered to the extension of the life of this patent. (*See* Electrical Engineering, October 27th, 1910, p. 685.) Leave was granted to amend the petition with regard to some foreign patents which are referred to. The hearing of the petition will come before Mr. Justice Parker on or shortly after March 20th, 1911. The patent relates to a syntonised system of wireless telegraphy, in which the receiving apparatus resonates in response to a sufficiently prolonged series of waves of a definite frequency, and covers various arrangements of the oscillatory circuits.

Opposition to Grant of Patents

6,138/09. **Aluminium Solder.** C. E. Steinweg. This patent has been allowed in spite of opposition. The specification, abstracted in Electrical Engineering, January 20th, 1910, p. 50, describes tubular sticks of a cadmium alloy of aluminium filled with a special flux.

15,496/09. **Metal Filaments.** R. Jahoda. This patent has been granted in spite of opposition. It covers the use of copper and silver oxides in the manufacture of filaments. (See Electrical Engineering, June 23rd, 1910, p. 415.)

19,872/09. **Electrical Propulsion of Ships.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). The hearing of the opposition to this patent by Mr. W. P. Durtnall came before the Comptroller last week. The patent was abstracted in Electrical Engineering, June 23rd, 1910, p. 415. Mr. Durtnall requires that a reference to his patent covering an electrical reduction drive with polyphase machinery should be inserted. The Comptroller-General reserved his decision.

24,115/09. **Time Lag Device for Circuit Breakers.** G. Ellison. Opposition has been entered to the grant of this patent. It relates to time lag devices of the dash-pot type, in which the piston works in a constricted part of the pot, and covers the formation of this portion to a conical shape, so that the size of the passage between the piston and the cylinder increases as the piston ascends. The piston may be conical also, and means is provided for axially adjusting either so as to vary the lag.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials &c.: Phillips and Hutchings [Apparatus for enamelling wires] 27,569/09.

Dynamos, Motors, and Transformers: Crawford [Train-lighting dynamos] 27,604/09; Walker [Machines] 27,968/09; A.-G. Brown, Boveri et Cie. [Single-phase motors on polyphase circuits] 6,402/10.

Electric Ignition: Maggiora, 28,378/09; R. Bosch, 7,639/10; Justin [Magneto generators] 9,772/10.

Electrometallurgy and Electrochemistry: Helfenstein [Electric furnaces] 26,844/09; Henri, Helbronner, and Von Reckinghauser [Sterilisation of water] 27,798/09; Specialfabrik für Aluminium-Spulen und Leitungen Ges. [Production of insulating oxide layers on aluminium wire] 2,711/10; Fitzgerald [Electric furnaces] 11,718/10; Hiorth [Induction smelting furnaces] 12,214/10.

Switchgear, Fuses, and Fittings: Clarke, Chapman & Co., and Harris [Resistances] 27,922/09; Schultz [Motor-starters] 30,184/09; Orton [A.C. electro-magnets] 620/10; Winsborough [Safety apparatus] 3,013/10; Holmes [Motor-starters] 4,744/10; Houskeeper [Contact devices for use with moving conductors] 7,332/10; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Motor controllers] 9,736/10; Siemens Bros. Dynamo Works (*Siemens Schuckertwerke-Ges.*) [Switches] 10,315/10; Routin [Voltage regulator] 13,709/10; Marmion [Alarm contacts under carpets] 14,742/10; Lundberg [Switches] 18,591/10.

Telephony and Telegraphy: Dick [Wireless apparatus] 27,484/09; Creed and Coulson [Telegraphic transmitters] 5,374/10; Tschörner [Telegraphic transmission of pictures] 13,104/10; Western Electric Co. (*Western Electric Co. U.S.A.*) [Telephone transmitters] 21,285/10.

Traction: Haase [Apparatus for grinding rails] 1,912/10. Asmus [Starting and stopping trains independently of driver] 11,725/10; Shemwell [Operating tramway points] 12,180/10. Dixon [Brakes] 19,568/10.

Miscellaneous: Pringle and Richards [Production of smokeless briquettes from coal] 27,828-9/09; Cletren [Electro-mechanical power transmission] 29,995/09; James (*Compagnie générale de Phonographes*) [Electromagnetic apparatus for cutting out stencils for colouring films] 2,410/10; A.-G. Brown, Boveri et Cie. [Steam and gas turbine installations] 19,750/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: Allgemeine Elektricitäts-Ges. [Compensation of polyphase commutator machines] 26,685/10.

Electrochemistry: Nogier [Apparatus for sterilising liquids by ultra-violet rays] 26,783/10.

The following amended Specifications can now be obtained.

Murphy [Vibratory current rectifier] 5,081/09; Seacomb [Magneto massage machine] 12,844/09.

Application for Revocation

28,475/04. **Mechanical Stokers.** E. E. Taylor (Boston, U.S.A.). Application has been made for the revocation of this patent under Section 27 of the Patents Act, on the ground of inadequate manufacture in this country. The patent covers an underfeed stoker consisting of a retort having a long sloping mouth and reciprocating mechanism for feeding the fuel.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: E. A. Corolan (*General Electric Co., U.S.A.*) [Mercury vapour lamp starting device] 18,344/03.

Dynamos, &c.: British Thomson-Houston Co. (*F. S. Jeannin, U.S.A.*) [Synchronising of A.C. motor-generator sets] 18,329/02.

Electrometallurgy, &c.: P. Gredt [Induction furnace and refining process] 17,178/05.

Incandescent Lamps: W. Nernst [Filament of Nernst lamp] 19,424/97.

Instruments, &c.: W. Stanley and F. Darlington [Magnetically relieving pressure on bearings of motor meters] 19,479/97.

Traction: W. J. Brewer and J. E. Cooper [Motor trucks and gear] 19,579/97.

Miscellaneous: R. Hoenicke [Fire alarm] 18,383/04.

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CORRESPONDENCE

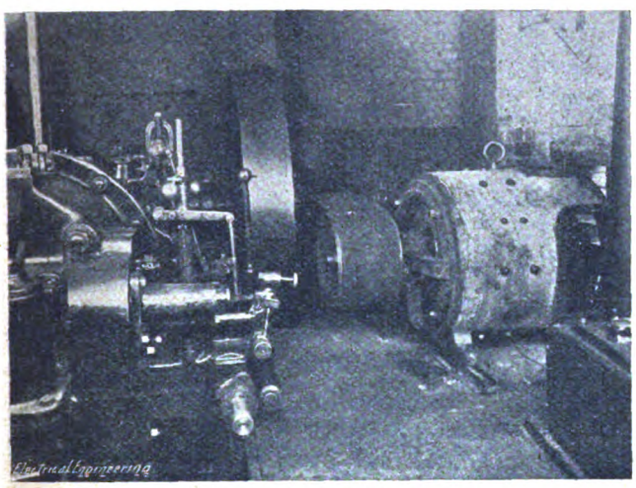
To the Editor of Electrical Engineering.

Sir,—I enclose herewith a photograph of a breakdown of a 100-h.p. suction-gas plant at Messrs. George Christie, Ltd., wire drawers and weavers, Broomloan Road, Govan, which caused a complete stoppage of the factory, and was remedied by the Electricity Department installing a motor.

Messrs. Christie telephoned to me at 7.30 a.m. on Thursday, December 1st, and I arranged to meet their manager at their works at 9 a.m., and then agreed to get a motor on hire for them to carry on the work. We telephoned to Messrs. Mavor & Coulson, who fortunately had a 105-h.p. motor of the right speed available.

The mains men were at work in a different part of the town, and we got them on to the job by noon, laid 35 yards of main through frozen ground, and had current in the building by 7.30 p.m. There was unfortunately a delay of six hours in getting the motor, as, owing to a mistake on the part of the carter, it was taken first of all to the wrong place, and did not reach Messrs. Christie's works till 11.30 p.m.

The motor weighed over two tons, and, as will be seen from the photograph, the engine-room into which it had to be taken is very confined and there was no means of lifting it from above, so that it had to be got into position by pinching it along planks laid on the ground. A hole also had to be knocked in the wall to allow the motor to be



Temporary Motor to Take Up Load of Disabled Gas Engine.

placed in line with the driving pulley. In spite of these difficulties the machine was in position and running by 9.45 a.m. on Friday, 24¾ hours after the Electricity Department had undertaken the job. There was then a further delay as the belt had to be lengthened, but this was done and all the factory running by 3 p.m., **exactly 30 hours after** the commencement of the job.

This is the second gas-engine breakdown that the Electricity Department has remedied in the past six months, the previous one being one of 40 h.p., when a 45-h.p. motor was installed in its place within 24 hours' notice of the breakdown being received. In this case the owner decided to keep the motor. The department also brought current into an engineering works only the previous day to replace a broken-down engine.

The photograph had to be taken through a window from the outside of the engine-room, as there was no room to get the camera inside. It is interesting to notice the difference in floor space taken by the two machines, and it must be borne in mind that the space taken up by the suction plant itself is not shown, and takes quite as much room as the engine.

Yours truly,

Burgh of Govan Electricity Works, T. C. Parsons.
December 6th, 1910.

"Onewatt" Lamps.—Messrs. Siemens Brothers Dynamo Works, Limited (Tyssen Street, Dalston), advise us that they are shortly placing on the market a range of 50-c.p. "Onewatt" lamps, with drawn tungsten filaments, for 100 to 130 and 200 to 250-volt circuits, for street lighting only. Messrs. Siemens are making a speciality of street lighting schemes with these lamps, as will be seen from our "Tenders Accepted" columns.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

LIFTS.—Messrs. Aldous & Campbell, Ltd. (21 Lower Bland Street, Great Dover Street, E.C.) have sent us a series of blotters which they are issuing. One of these carries a view of their works, and the others illustrate some of the types of lift made by them, including push-button control passenger lifts, electric goods, and service lifts. Attention is drawn particularly to their arrangements for inspection and maintenance contracts.

CALENDAR.—An attractive wall calendar for 1911, bearing a very effective embossed representation of a group of statuary, is being distributed to their friends by the United States Metallic Packing Co., Ltd. (Soho Works, Thornton Road, Bradford).

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ARC LAMP ACCESSORIES.—New lists are to hand from the North-Western Electrical Appliance Co. (Cathcart, Glasgow), dealing with arc lamp lowering gear, including automatic locking contact suspension gears, self-sustaining winches, &c., and particulars of these and other accessories for various forms of arc lamp suspension are given on a large coloured sheet.

DECORATIVE LIGHTING AND SIGNS.—The Electrical and Engineering Supplies Co., Ltd. (36 and 37 Upper Thames Street, E.C.), describe in a new leaflet a series of outfits for Christmas-tree and other decorative lighting with miniature lamps arranged in suitable small holders in series. Other leaflets deal with small flashing signs for shop windows, counters, &c., motor-driven automatic sign flashers, and a number of patterns of exterior illuminated signs.

TANTALUM LAMPS AND HOLOPHANE SHADES.—The advantages of lighting by tantalum and "Onewatt" lamps in conjunction with holophane shades are well pointed out with the aid of illustrations of actual installations in a new booklet issued by Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston). The company are willing to send a copy of this attractive little publication to all interested.

Optical Convention.—At a meeting at the rooms of the Chemical Society on Tuesday, November 29th, it was decided to hold an Optical Convention in the spring or early summer of 1912.

Tramway Brakes.—We have received from the Electro-Mechanical Brake Co., Ltd. (West Bromwich), who are the proprietors of the "Maley" track brake, a pamphlet containing some correspondence between them and the manager of the Glasgow Corporation tramways. It will be remembered that the company were somewhat dissatisfied with the results of some tests of their brake described in a Paper read before the Institution of Electrical Engineers (see Electrical Engineering, April 14th, p. 249), and claimed that the trials had not been made under best conditions. They issued a reply to the Paper, in which they expressed their readines to refit the brake for further tests. It now appears that the chief point in dispute is that the proportioning of the resistances and the further trials have fallen through owing to Mr. Dalrymple (Tramways Manager, Glasgow Corporation) not having seen his way to permit alterations of the resistances belonging to the standard equipments.

An Electrically-Propelled Fire Engine.—Messrs. Merryweather & Sons (63 Long Acre) have sent us some particulars of an electrically-propelled "first aid" fire engine which they have placed on the market. The vehicle carries eight men, and is equipped with a gas cylinder and 30-gallon tank, enabling a jet to be thrown for ten minutes, while hydrants or suction hoses for other engines are being coupled up, and carries a 30-ft. extension ladder and a supply of 1,000 ft. of hose, with standpipes, &c. It is propelled by two independent motors, one driving each rear wheel through worm-gear and side chains. The accumulators are of the special light traction type of the Electrical Power Storage Co., and are of sufficient capacity to take the engine twelve miles out and twelve miles back. A maximum speed of 20 miles per hour is attainable on the level. The engine is of particular interest as being the first all-British machine of its kind. Electrically-propelled fire appliances are much commoner on the Continent than in this country, and in some towns, especially in Austria, are used exclusively.

OSRAM-LAMPS

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LOCAL NOTES

Bournemouth: *Tramways Profits.*—The gross profits on the tramways for the first half of the current financial year amount to £23,224, against £18,901 in the corresponding period of the previous year.

Burnley: *Tramway Through-Running.*—The Colne & Trawden Light Railway Co. have proposed a scheme of intercommunication between their tramways and those of the Burnley Corporation.

Colchester: *Mails by Tramcar.*—An arrangement has been entered into with the Post Office for carrying mailbags on certain routes.

Dudley: *Charges for Tramway Energy.*—Some dissatisfaction is being expressed at the result of the recent award in connection with the price which the Tramway Company is to pay the Corporation for electrical energy. On the new basis the revenue from the company will be decreased by about £1,000 a year, and as the electricity works incurred a loss of £600 last year, the award is not viewed with favour.

Glasgow: *Tramways.*—The total length of the Glasgow tramways now amounts to 97¾ miles. Since the beginning of the financial year on June 1st, 116,958,329 passengers have been carried, which is about 5,500,000 more than in the corresponding period of the previous year.

Glasgow: *Interruption to Supply.*—Last week a short-circuit occurred on a 0·2 sq. in. trunk main running between the Port Dundas and Pinkston power stations. This had the effect of causing such a serious drop on the extra high tension pressure that the motor generators and rotaries in the sub-stations connected to Port Dundas all shut down. As quickly as possible the switch on the trunk main was tripped by hand, although it would have been automatically tripped by the overload relay. The fault was located to a manhole about 300 yards from Port Dundas station, and fully a yard of 0·2 sq. in. 3-core cable was burned out. The southern and western districts of the city were hardly affected, but the central area was seriously affected from 10 to 20 minutes.

Ireland: *Electric Lighting.*—The public lighting of Ballyclare was inaugurated on Saturday.

Kent: *Electricity Supply.*—It is proposed to form a company to supply electricity in the towns of Sandwich, Deal, and Walmer.

Liverpool: *New Telephone Exchange.*—The Bank exchange of the Liverpool telephone service was opened on Friday.

London: *County Council: Ventilation of Street Boxes.*—With reference to the proposal to render it compulsory for the Post Office and National Telephone Co. to ventilate their street boxes as suggested by several London Borough Councils, the County Council consider it undesirable that any step in this direction should be taken at the present time.

City of London.—A new telephone exchange is to be erected by the Post Office in St. James's Place, E.C.

Manchester: *Tramway System.*—In the Divisional Court last week the National Association of Carriage Owners sought to compel the Manchester Corporation to fix a definite distance between their tramcars in the central area. Under the Corporation's Act of 1900 there is a statutory obligation to make bye-laws in relation to the distance at which tramcars should be allowed to follow each other. The Corporation left the control of the tram traffic to the police, but the Court held that they were bound to fix the distance themselves. On the surface the action seems somewhat trivial, for, as is pointed out by a Manchester contemporary, the Corporation have only to pass a bye-law to fix an interval between the cars of anything short of bumping.

Newark: *Electric Supply.*—It is proposed to form a company to take over the Council's Electric Lighting Orders of 1900 and 1907.

Oldham: *Supply Outside District.*—The Board of Trade have refused the Corporation an order to supply electricity in Chadderton, Royton, and Limehurst, which are beyond the borough boundaries. The reason given is that the supply proposed is such that a Provisional Order should be applied for.

St. Andrews: *Street Lighting.*—The Council are discussing a new contract with the Electric Supply Corporation for street lighting.

Scarborough: *Tramway Service.*—The Scarborough Tramways Co. have not yet complied with the order of the Board of Trade to run a winter service. An offer to commence the service on condition that the Corporation reimburse the company any loss they may sustain has been refused by the Corporation.

Southend: *Tramways.*—At the last meeting of the Council a scheme of tramway extensions prepared by the Tramways Committee was discussed at considerable length. All the lines were sanctioned with the exception of one down the High Street.

Sunderland: *Electricity Tariffs.*—The Electricity Committee have prepared a scheme of tariffs for lighting houses on the rateable value system. A fixed rental, varying from 10 per cent. to 15 per cent. per annum on the rateable value for houses from £15 to £70 rateable value, plus ¼d. per unit metered, is suggested, the percentage to be varied where the assessment is influenced by causes which do not affect the use of electricity. For offices and banks an alternative tariff is proposed of 3d. per unit where not less than 70 units per annum are used per 100 watts. For heating and cooking the charge is to be ¾d. per unit in premises electrically lighted. For low-tension power supply an alternative tariff of £3 per annum per kilowatt of maximum demand, plus ¼d. per unit, is proposed. Meter rental will not be charged in the case of the new tariff for domestic supply. An alternative scale has also been prepared for lighting shops, warehouses, theatres, concert and picture halls, &c.

Torquay: *Tramways.*—At a special meeting dealing with the tramways it was announced that subject to the Council waiving their right to bring points of law before the courts in regard to the arbitration, the company have expressed their willingness to pay the costs of the arbitration on condition that the Council contribute £500 and bear the cost of the award. The Board of Trade have granted an extension of two months in which the Dolter system is to be removed. The Tramway Company have asked for an early reduction in the price charged for current instead of waiting for the expiration of the period provided by the Act. If the Corporation will consent to this, the company will take a supply for a period of seven or nine years.

Uttoxeter: *Electric Lighting.*—An electric lighting scheme is under consideration.

West Hartlepool: *Tramway Arbitration.*—It is expected that the arbitration with regard to the purchase of the Tramway Company will take place in January.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—Two 750-kw. sub-station units are required by the New South Wales Government railways. Tenders by January 23rd, and particulars from Electrical Engineer's Office, 61 Hunter Street, Sydney, N.S.W.

Bedford.—Mains are to be laid along London Road for street lighting.

Bradford.—An application is to be made for a loan of £60,000 for extensions to the electricity mains, &c.

Ealing.—Application has been made for sanction to a loan of £20,000 for electrical extensions.

Eastbourne.—Application has been made for a loan of £8,000 for electrical extensions.

East Ham.—A 1,000-kw. triple-expansion engine and generator is required, together with an evaporative condenser, air pumps, circulating pumps, &c. (See an advertisement on another page.)

Fareham.—A loan will shortly have to be taken up for house services, and an additional feeder at an estimated cost of £550.

Ireland.—A scheme of electric lighting in Dungiven (co. Derry) is under consideration. Mr. A. Semple, J.P., who has a mill in the district, proposes to erect generating plant in connection with it.

Leyton.—The Electricity Committee require a 600-kw. mixed-pressure turbine set. Particulars from the Engineer and tenders by December 29th.

Llandudno.—A motor-driven induced draught plant and two mechanical stokers are required. Particulars from the Engineer, and tenders by December 24th.

London: *County Council.*—Tenders are invited by January 10th for high- and low-tension switchgear. Particulars from the Clerk.

Hackney.—Some small extensions of mains are to be carried out.

Hammersmith.—Application is to be made to the L.C.C. for a loan of £5,429 for electrical extensions.

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Maidstone.—A new main is to be laid in Hastings Road at a cost of £160.

Portugal.—The *Board of Trade Journal* states that the Companhia Carris de Ferro do Porto have applied for power to construct an electric railway in Oporto.

Turkey.—The Turkish Ministry of Public Works, says the *Board of Trade Journal*, are inviting tenders for a concession for working electric tramways in Adrianople, and for an electric lighting undertaking in the Sandjak of Adrianople. Tenders to Monsieur le Ministre du Commerce et des Travaux Publics, Constantinople. A list of commission agents established in Constantinople may be seen at 73 Basinghall Street, London, E.C.

West Hartlepool.—A sub-committee has been appointed in connection with an application to the Local Government Board for a loan for extensions at the electricity works.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Church on L.C.C. housing estate, Tottenham.

Proposed new buildings on site of present Middlesex Guild hall, Westminster.

Electric lighting installation at new County High School, Leytonstone. Architect, W. Jacques, 2 Fen Court, Fenchurch Street, E.C.

Buildings on sites of numbers 25 to 34, and 39 to 47 Pickering Place, Paddington, and 98 Bishop's Road.

Buildings between Nos. 641 and 645 Holloway Road, Islington.

New telephone exchange, Ilford. H.M. Office of Works.

Alterations and additions to Mount Pleasant Parcel Office. Architect, J. Rutherford, 22 Carlisle Place, S.W.

PROVINCES.

Aberdeen.—Proposed additional Public Baths.—Extensions at Technical College.

Aberystwyth.—Isolation Hospital.

Bangor.—Infirmary.

Barrow-in-Furness.—New fire station.

Birkenhead.—School in Temple Road.

Birmingham.—Additional departments for cookery, laundry, and manual work at various schools.—The late Mr. John Feeney has bequeathed £50,000 for building a picture gallery on a site to be provided by the Corporation. Three galleries are to be added to the Art Gallery at present in course of erection.

Camborne.—Public hall and shops.

Carlisle.—New Court House. Architect, G. Dale Oliver.

Chislehurst.—Electric theatre, Sidcup Hill.

Darlington.—Business premises in Park Gate.

Derby.—Congregational Church, Cordon Street.

Glasgow.—Extensions to Poor-house at Craw Road.—Proposed Branch Library at Saracen Street.—Branch bank for British Linen Bank.

Gravesend.—Alterations to Town Hall.

Handsworth.—Assembly Hall, Lecture Hall, and Primary School.

Hull.—New training college, Cottingham Road. Architects, Messrs. Crouch, Buller & Savage, Birmingham.

Leeds.—Alterations and additions to Guardians' offices.—Additions to imbecile wards at Beckett Street Workhouse.

Llandrindod Wells.—Pavilion on recreation ground.

Llandudno.—West Shore Church.

Manchester.—Alterations and additions to Municipal School. Accountant, Education Offices.

Newton Abbot.—Additional ward at the Infirmary. Clerk of the Guardians.

Nottingham.—Public baths in the Meadows district.

Swansea.—The local Y.M.C.A. have purchased a site for new headquarters.

Watford.—Extensions to County Court. Registrar, County Court Offices.

Wimborne.—Elementary School for Dorset County Council.

MISCELLANEOUS

Blackpool.—The Corporation have received sanction for a loan of £3,400 for the purchase of six new tramcars.

The Tramways Company are to relay the tramway track along Central Beach.

Buenos Aires.—The Buenos Aires Western Railway Co., which has a concession for constructing an underground electric railway in Buenos Aires, have undertaken to sign the contract for the work in six months, and to submit the plans and specifications within twelve months.

Darwen.—Meters are to be placed on all the tramcars of the Corporation.

Derby.—It was stated at the last meeting of the Council that at the present rate of progress new tramcars will soon be required.

London: *St. Pancras.*—The Finance Committee of the L.C.C. recommend sanction to a loan of £2,582 for electrical extensions.

Stepney.—The Finance Committee of the L.C.C. recommend sanction to a loan of £10,000 for electrical extensions.

Manchester.—The Tramways Committee require tenders for the supply of special track work. Particulars from the General Manager, and tenders by January 9th.

TENDERS RECEIVED AND ACCEPTED

Blackburn.—Mr. R. Baron, of Fleetwood, has received the contract for an electric lighting and power installation at the new works at Wyre Dock of the Fylde Ice & Coal Storage Co.

Brighton.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the annual contract for street lighting with 50-c.p. "Onewatt" lamps.

Calcutta.—The Maschinenfabrik Oerlikon have recently received orders for 10,000 kw. of plant for the Calcutta Electricity Supply Corporation. This includes three 3,000 three-phase turbo-generators, and an 800-kw. mixed-pressure turbine and three-phase generator complete with condensing plant and air circulating pumps driven by Oerlikon motors.

Derby.—The tender of Messrs. Chamberlain & Hookham, Ltd., for tramcar meters at £152 15s. has been accepted.

London: *County Council.*—The following tenders have been received for electric lighting at the new fire station in course of erection in Brunswick Road, Poplar:—G. Harland Bowden & Co., £156 14s.; Waring & Withers, £184 8s.; G. E. Taylor & Co., £192. The first tender is recommended for acceptance.

The Highways Committee recommend the acceptance of a tender by Messrs. Walter Scott, Ltd., at £32,855 for track rails and fastenings, and that of the Frodingham Iron & Steel Co., Ltd., at £6,913 15s. for conductor rails.

The following tenders have been received for the supply of overhead electrical equipment for the Putney Bridge to High Street, Wandsworth, trams:—Clough, Smith & Co., Ltd., £2,015 14s.; British Insulated & Helsby Cables, Ltd., £2,222 5s.; Dick, Kerr & Co., Ltd., £2,257 14s. The Highways Committee recommend the acceptance of the first-named tender.

In connection with the reconstruction of the horse tramways from Finsbury Park to Southgate Road, it is proposed that the following portions of the equipment be placed in the hands of contractors carrying out existing contracts for the Council:—Cables, W. T. Henley's Telegraph Works Co., Ltd.; duct laying, Reid Bros., Ltd.; switchgear, Johnson & Phillips, Ltd.; motor generators, Dick, Kerr & Co., Ltd.

The tender of the James Keith & Blackman Co. for an ash dust removing plant at the Greenwich generating station at £3,507 15s. is recommended for acceptance.

The tender of the Medway Safety Lift Co. at £295 has been accepted for an electric lift at the Council's premises at 23 Belvedere Road, S.E.

Walsall.—The tender of the Underfeed Stoker Co. for a stoker at £267 is recommended for acceptance.

Amongst the numerous installations which have been recently carried out with "Stannos" wire, the following are worth mentioning:—Messrs. Baxter & Impey, Birmingham, have carried out the installation of a large country house at Knowle, Warwickshire. Messrs. J. H. Harpin & Co., Birmingham, have put in a complete installation of four Siemens motors with "Stannos" wiring for Richard Cooper & Sons, Atlas Works, Wolverhampton, and have also put in "Stannos" in country houses at Cobham, Surrey, and Burton Point, Cheshire. Messrs. E. D. Wishart, Southampton, are carrying out for Siemens Brothers the installation of a new theatre at Eastleigh, consisting of a 16-h.p. gas engine, "Stannos" wiring and "Zed" fuses. This firm are also carrying out the wiring of Summers & Payne's yacht-building yard, to the order of Siemens Brothers.



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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 to £59 10s. per ton (last week, £59 5s. to £59 10s.).

George Ellison (Birmingham).—From a recent visit to Mr. George Ellison's Birmingham works, we notice that this firm are particularly busy just now, and have some interesting contracts in hand, including one for 51 mining switch pattern panels with oil circuit breakers, interlocked with three-phase rotor starters, for a Liverpool distillery. They have also brought out a new "fool proof" form of three-phase starter for colliery work.

Buenos Aires Exhibition.—Messrs. A. Reyrolle & Co., Ltd., have been awarded a diploma of honour for their exhibit at the Railway & Land Transport Exhibition, Buenos Aires.

Extension of Works.—The Crypto Electrical Co. have found it necessary to again enlarge their factory in Bermondsey Street. The firm's numbers in Bermondsey Street, London, will be in future, 149, 155, 157, and 159.

APPOINTMENTS AND PERSONAL NOTES

Mr. F. B. O. Hawes has resigned his managing directorship of the Langdon Davies Motor Co., owing to the large increase of work in connection with the National Electrical Manufacturers' Association and other matters. He is now consulting engineer to the company.

Seventy-three applications for the post of Borough Electrical Engineer at Limerick have been received. The short list has been reduced to Messrs. White, Cloran, Martin, and Dowling.

An Electrical Supply Company in London require a junior draughtsman. (See an advertisement on another page.)

Model Specification for Street Lighting.—At the meeting of the Illuminating Engineering Society on Friday, Dr. Silvanus P. Thompson, F.R.S., the President, stated that the Council of the Society had decided to appoint a committee of its own members, with power to consult with others, to draw up in a preliminary form a model specification for street lighting. Their idea was to produce something which will serve, irrespective of any particular form of illumination, to show borough surveyors and architects the proper way to specify how streets should be lit.

Obituary.—We regret to record the death of Sir Charles Scotter, which took place on Tuesday evening at Kingston. Although chiefly conterned with the main line railways of the country, Sir Charles Scotter planned the Waterloo & City Railway, and was at one time Chairman of the Great Northern & City Railway Company. He also served on the Board of Trade Departmental Committee on the Ventilation of London underground railways.

We also regret to have to announce the death on Monday of Mr. R. G. Simpson, of the Great Western Railway Electrical Department. Mr. Simpson was a vice-president of the Batti-Wallahs' Society.

Rating of London Electricity Undertaking.—The Local Government Records and Museums Committee of the London County Council, in a report upon the rating of municipal electricity supply undertakings in London, calls attention to the under-assessment of the Marylebone undertaking. Originally this stood at £7,347, but at the recent quinquennial valuation, the figure was increased to £15,123. The L.C.C. are advised that a fair assessment would be £40,000 but the Assessment Committee have reduced the figure to £14,650. In view of the large difference between these figures the Local Government Committee recommend that an appeal should be made to Quarter Sessions. A difference has also arisen in regard to the St. Pancras undertaking, and an appeal is recommended in this case should the figure inserted in the list be considerably below that which the Council is advised is fair.

Central London Railway Staff Dinner.—The fourth staff dinner of the Central London Railway Co. was held on Saturday at the Holborn Restaurant. Mr. Granville C. Cuningham, general manager of the company, presided, and a large number of the staff were present, as well as some guests. Mr. Cuningham said that few railways had such a good record as regards smooth working. No serious accidents had occurred since the line opened ten years ago. This was not owing to chance, but was largely, if not wholly, due to the efficiency of the staff. The Secretary of the company, Mr. R. O. Graham, in replying to the toast of the Central London Railway, said that he hoped the extension to Liverpool Street, which would be open for traffic in about fifteen months' time, would mean largely increased dividends, and that they would be able to compete more successfully with the motor-'buses.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Eastern Telegraph Co.—Third quarterly dividend of 1¼ per cent. on the ordinary shares.

Johnson Lundell Electric Traction Co.—A loss of £1,731 is shown by the accounts for the 16 months to October 31st, 1910. The debit balance now stands at £97,136.

British Insulated & Helsby Cables.—The transfer books will be closed from December 17th to 31st inclusive.

India Rubber, Gutta Percha & Telegraph Works Co.—There was a net profit of £55,414 for the year to September 30th. The sum of £55,012 was brought forward and after meeting preference and interim dividends there is a balance available of £93,239. Special reserve is credited with £30,000, and after meeting a final dividend at the rate of 10 per cent. per annum, £22,614 are carried forward. The report contains the remark that "the electrical industry continues dull."

R. Waygood & Co.—Interim dividend at 2½ per cent. on the ordinary shares.

Cleveland & Durham Electric Power Co.—The scheme for reducing the capital of this company from £1,000,000 to £300,000 was sanctioned in the Chancery Division this week.

NEW COMPANIES

AMERICAN SURFACE CONTACT CO.—Capital $250,000. To acquire the American and Canadian rights of the S. P. Surface Contact Syndicate, Ltd., 18 Fenchurch Street, London, E.C.

CRYSTAL PALACE KEARNEY HIGH SPEED RAILWAY SYNDICATE, 100 Victoria Street, London, S.W. Capital £30,000. To deal with the Kearney high-speed system in the Crystal Palace grounds or elsewhere. Among the subscribers are H. W. Healy, electrical engineer, 4 Glebe Road, Barnes, and E. W. C. Kearney, 100 Victoria Street, London, S.W.

L.C.C. School of Engineering.—A conversazione was held by the Association of Electrical Engineering Students of the London County Council School of Engineering and Navigation, Poplar, on Saturday, December 3rd. Mr. H. A. Garratt received the visitors, and, in addition to a concert, several lecturettes were given, among them being one by Mr. J. Paley Yorke on "Colour and Electric Light."

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ELECTRICAL ENGINEERING

NO. 208 [VOL. VI., NO. 51] THURSDAY, DECEMBER 22, 1910. [PRICE ONE PENNY.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.
Canada. 8s. 8d. per Annum.
Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

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All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203–206, TEMPLE CHAMBERS, LONDON, E.C.
Telegrams: "Circling, London." *Telephone No.: 5509 Holborn.*
Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

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SUMMARY

A DEMONSTRATION of the possibilities of up-to-date electric street lighting is being made in the City by the City of London Electric Lighting Co. Flame arc lamps on high central posts are used in Farringdon Street and centrally suspended flame arc lamps light Cheapside. The distribution is assisted in both cases by prismatic globes. A demonstration of metal filament lighting is being given in Paternoster Row. (Page 803.)

AN installation of street lighting by metal filament lamps has been arranged in Gower Street by the Metropolitan Electric Supply Co. (Page 806.)

AN important Paper on the new submarine telephone cable between England and France was read by Major O'Meara (Engineer-in-Chief to the Post Office) before the Institution of Electrical Engineers last Thursday. Major O'Meara explained the reasons for adopting coil loading rather than continuous loading, and for not employing paper as a dielectric; a description of the laying of the cable was included, and particulars of the subsequent tests. An excellent discussion followed: Dr. Fleming pointed to an error in predetermining the attenuation constant of continuously loaded cables by taking the permeability of the iron from the ordinary magnetisation curve, and advocated the comparison of the resistance of iron to high frequency currents with that of non-magnetic wire for ascertaining the permeability; Mr. Dieselhorst explained that repairs to the cable would be easy, and would not affect the result of the loading; Sir John Gavey mentioned the results obtained with continuously loaded cable made to his specification for the Buenos Aires telephones; Mr. Kempe explained that the question of continuous *v.* coil loading was really one of cost, and gave indications of useful experiments that were being carried out with a view to improving cables of the former class; Mr. Whalley said that the tests indicated that a large proportion of the losses in the cable were due to reflection at the ends; Mr. Siemens said that the majority of the repairs in the Channel cables were rendered necessary by fishermen's anchors; and Dr. Silvanus Thompson put in a plea for experiments with cables with inductive leaks. The discussion will be continued on January 12th. (Pages 807-810.)

MR. HAYDN T. HARRISON'S Paper on "Street Lighting" has been further discussed at Birmingham. (Page 810.)

IN the Chancery Division last week, Mr. Justice Swinfen Eady decided that the Newcastle Corporation are bound to take the supply of electrical energy for their tramways in Walker from the Newcastle-upon-Tyne Electric Supply Co. Walker now forms part of Newcastle, but before it was absorbed, the Company had purchased the Walker electric lighting Provisional Order, and were entitled under an agreement to supply all the electrical energy required in Walker. (Page 811.)

THE annual dinner of the Glasgow Local Section of the Institution of Electrical Engineers was held last week. (Page 811.)

IN a report to the Limerick Corporation, Mr. A. V. Clayton recommends the scrapping of the present producer gas plant, engines, and battery, and the purchase of a new steam plant. (Page 811.)

A CORRESPONDENT writes to prevent confusion arising between two companies with somewhat similar names. (Page 811.)

AMONG the specifications published by the Patent Office on Thursday was one by Miles Walker for a method of automatically adjusting the strength of commutating poles. W. P. Orton describes a method of preventing chattering in A.C. electromagnets. A method of preventing explosions in oil switches by filling them entirely with oil is covered by Messrs. Siemens Bros. Dynamo Works. The opposition to the grant of a patent to R. C. Lyness for a replaceable contact finger for controllers has been unsuccessful. The British Thomson-Houston Co. wish to amend a 1904 patent covering a system of protecting transformers. (Page 812.)

THE hearing of the action by Marconi's Wireless

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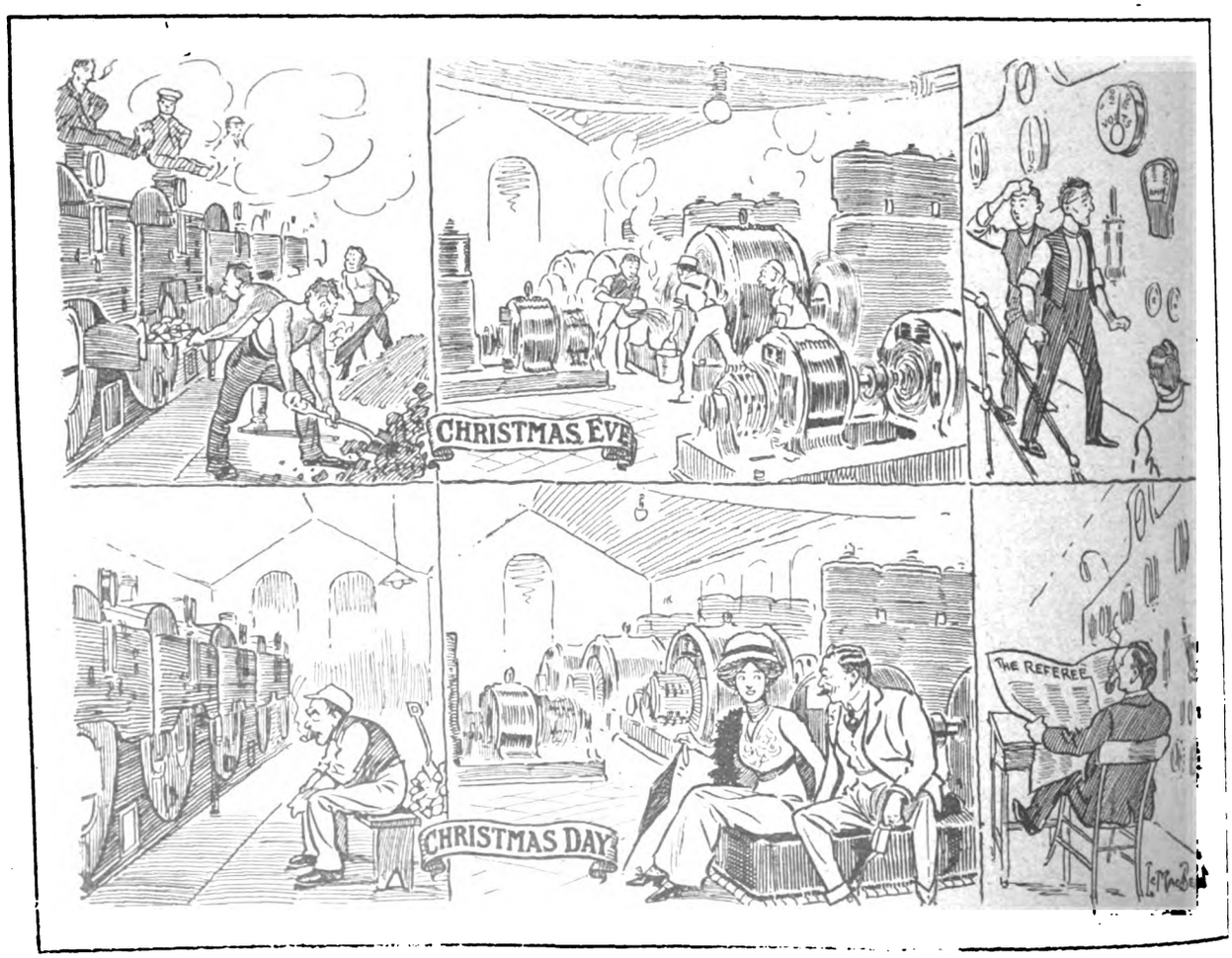
Telegraph Co. against the British Radio-Telegraph & Telephone Co. for alleged infringement of patents has been adjourned until after the vacation. During the last week, evidence has been given by experts for the Marconi Co. on the question of anticipation and on infringement with regard to the first of the three patents concerned. Mr. Terrell has opened the case for the defendants on both questions. (Page 814.)

THE Board of Trade have raised objections to the transfer of the Frome Electric Lighting Order to Messrs. Edmundsons'.—An appeal against the rating of the L.C.C. Greenwich power house is to be made.—The accounts of the Marylebone electricity undertaking for September quarter show an increased revenue of £2,482. The Sales Department shows a loss of £178.—The Scarborough Corporation are to proceed against the Tramways Company in the courts in respect of the winter service.—The Handsworth Council complain that the Birmingham Corporation are not proceeding with the electrification of the lines in this district.—Street lighting experiments are to be carried out in Lewisham by the County of London Electric Supply Co. and the South Metropolitan Gas Company.—Mr. James Swinburne has reported upon the reorganisation of the Leicester Electricity Department. (Page 815.)

EDINBURGH CORPORATION propose to take up a loan of £75,000; Harrogate, £2,500; Leyton, £7,000; and Southampton, £2,150. Additional sub-stations are to be erected at Brighton; extensions to mains, cooling tower, and public lighting are to be undertaken at Yarmouth; a telephone installation is required at the Homerton Infirmary; cable ducts by the London County Council; and a pumping plant at Salford. Tramway extensions are proposed at Ayr and Dundee; an electric lighting and tramway installation is required in Turkey, and an electrical installation by the Gateshead Union. The Australian Postmaster-General's Department invites tenders for telephone material. (Page 817.)

Yorkshire Local Section of the Institution of Electrical Engineers.—A reception was held by the Chairman of the Yorkshire Local Section, Mr. T. Harding Churton, followed by a smoking concert, at the Hotel Metropole, Leeds, on December 15th. There was a good attendance of members and their friends, and an excellent programme of vocal and instrumental music was greatly enjoyed. Mr. Kitchen's orchestra played, violin solos were contributed by Mr. Montagu-Nathan, while Messrs. R. Wilson, S. H. Smith, and W. E. Lang sang a number of songs.

Telegraphic Traffic and Movements of Cable Ships.—We may now every day expect to hear of the repair of the Puerto Plata—Cape Hayti cable of the Compagnie Française des Cables Télégraphiques, which has been down since the 23rd ult. The Paramaribo-Cayenne cable of the same company will then be taken in hand. It has been down since September 28th last, but of course the repairing ship was being overhauled at New York. Owing to an earthquake, four cables of the Eastern Telegraph Co. at Mozambique and Zanzibar have been broken. The line between Bagdad and Bassorah was down for a short while on 13th inst., otherwise there is nothing fresh to report. At the present moment there are three cable repairing ships in the West India Docks, the *Faraday*, the *Buccaneer*, and the *Mackay-Bennett*, of the Commercial Cable Co. The last-named is being overhauled and fitted with electric light and a new wireless installation. The *Contre Amiral Caubet*, of the French Telegraph Co., was recently engaged repairing the St. Pierre—Cape Cod section, and also the Brest—Cape Cod cable, but bad weather interfered with the work in connection with the latter cable. After completion she took more cable inboard at New York. The *Pouyer-Quertier*, of the same company, has completed her overhaul at New York, and is now in the West Indies. The cable steamer, *Mima*, of the Anglo-American Telegraph Co., was engaged in a repair of the Direct United States Co.'s cable to Harbour Grace, and also of the St. Pierre—Duxbury section. The Western Union Telegraph Co.'s ship *Robert C. Clowry*, returned to Halifax, N.S., after repairing one of the Canso—New York cables.



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STREET LIGHTING IN THE CITY OF LONDON

IN the year 1878, when Mr. Bassingham and Colonel Haywood reported to the Streets Committee on the Jablochkoff lamps, installed in the Avenue de l'Opéra, Paris, by the Société Générale d'Electricité, the question of the lighting of the City of London assumed an interest which has continued ever since. There have been repeated demonstrations and disappointments, the latter ultimately turned to success by the persevering efforts of the various enterprising electrical companies, who from 1878 to the present time have spent much time and money in bringing public lighting to its present state of perfection.

The early lighting of Holborn Viaduct (November, 1878) by 16 Jablochkoff lamps, displacing 86 gas lamps, may be looked upon as the initial step in the substitution of electricity for gas; but, as is well known, this experiment was not a financial success. In 1880 the City Commissioners again decided to experiment, and Ludgate Hill, Cheapside, and King William Street were lighted by the Brush Co., the Electric Light & Power Generator Co., and Messrs. Siemens for one year, which ended in April, 1882. Further experiments by the Brush Co. followed, while the Ediswan Co. made a demonstration in Holborn Viaduct with 92 16-c.p. glow lamps installed in place of 86 14-c.p. batswing gas burners. Owing to the passing of the Electric Lighting Act of 1882, matters were held in abeyance while the Commissioners considered the position, but the Anglo-Brush Co. continued the arc lighting in Bridge Street, Ludgate Hill, &c., until the end of 1885.

The first practical electric lighting of the City streets on a large scale may, however, be said to date from the Brush Co.'s proposal of 1885, the conditions of which were practically those adopted by the Commissioners in 1889, the matter being continuously before them throughout the intervening five years, during which Sir William (then Mr.) W. H. Preece was consulted. After 13 years of deliberation and experimental trials, 1890–91 saw the Brush Co. and the Laing, Wharton & Down Co. obtaining Provisional Orders and definite contracts for lighting the main thoroughfares by arc lamps by the end of 1893. In February, 1891, the two companies concerned transferred their obligations to the City of London Pioneer Co., which in turn was absorbed, in July, 1891, by the present City of London Electric Lighting Co., who completed the contract for over 500 arc lamps in accordance with the recommendations of the Commissioners' advisers. Since the date of this instalment, the City of London Electric Lighting Co. has continued to take a most active interest in public lighting requirements, and for this purpose have equipped extensive test rooms at their Bankside Works for examining each new type of lamp brought out. It was not until about 1903, when the magazine flame arc became a commercial success, that it was found feasible to advocate any material change in the open arc lamps, which had so far proved satisfactory for the public lighting of the City. At this date defects still existed in connection with flame arcs, not the least being the question of carbon supplies and deterioration of the lamp due to fumes. The company, however, decided to apply these lamps practically, and in 1904 erected the flame arcs on the front of the Mansion House, these being followed early in 1905 by the erection of similar lamps in Poultry and Mansion House Place. The success of these lamps led to a further demonstration of flame lighting in October, 1905, at Blackfriars Bridge approach.

These demonstrations resulted in the City Co. obtaining a contract from the Corporation for lighting the Central Meat Market, Smithfield; the old open arcs being replaced by 10-amp. Oriflamme lamps in May, 1907. In this year the City Co. also asked for and obtained the permission of the Corporation to replace the old 10-amp. lamps in hexagon lanterns on the posts in Holborn by Oriflamme arcs with opalescent globes supported on swan-neck brackets. The instalment of these lamps was completed by November, 1907; and, notwithstanding the fact that the City Co. had provided all the new capital required, and had greatly improved the lighting of the street, they were able to reduce the annual charge per lamp from £26 to £17 10s. Further progress in the improved lighting of the streets was held over for a while pending the various experimental trials with high-pressure gas, but contracts were entered into for the electric lighting of Billingsgate Fish Market in January, 1908, and of Leadenhall Market in July, 1909.

Improvements which were made in flame arc lamps and flame carbons, and the advent of metallic filament lamps, which are exceptionally suitable for minor street lighting, rendered it possible for the City Co. to lay before the Corporation further offers to demonstrate more completely the possibility of improving the lighting of the City streets by electricity, and at the same time substantially reducing the cost thereof. After lengthy consideration, the Corporation allowed this work to proceed, and the following schemes were carried out and put in operation last month.

The lighting in question demonstrates three systems, viz., the central suspension system, central lighting by high standards, and the bracket system, which we shall treat in the order named.

Probably the chief merit of the central suspension system, which is employed in the Cheapside and Watling Street area, lies in the advantageous position, relative to cross streets, in which it enables lamps of high candle-power to be placed, at any desired height above the roadway, without blocking the traffic by centreposts. This part of the demonstration involves the use of the latest improved magazine flame arc lamps, in conjunction with a central suspension allowing the lamps to be lowered to the side walk for trimming in the main side streets, and courts enclosed within the area bounded by Cheapside, St. Paul's Churchyard, Watling Street, and Bow Lane. For this purpose, 10 flame arc lamps have been suspended over the centre of Cheapside, which is 60 ft. in width. Five of the lamps are opposite the junctions of side streets, and remain alight from sunset to sunrise, while the rest are extinguished at midnight.

Four flame arc lamps of the same type are suspended in a similar manner in Watling Street, the width of which varies from the junction of the cross streets, so that the latter are illuminated at one end by the Cheapside lamps and at the other by those in Watling Street. Watling Street has, in addition, two high candle-power lanterns containing metal filament lamps of 300 c.p., centrally suspended in the long intervals between the arcs. The lighting of the side streets, passages, and courts adjoining is augmented where necessary by 12 metal filament lamps of from 75–100 c.p., enclosed in fittings supported from side brackets of the same type as those described below for Paternoster Row. On the small traffic rest at the west end of Cheapside by Peel's Statue is a pilot standard having two 100-c.p. metallic filament lamps, supported in fittings attached to a double bracket top of a similar pattern to those described for Farringdon Street.

These 29 new lamps have displaced eight open arcs and 41 gas lamps. The total actual candle-power now obtained is more than double that of the old lamps displaced, while the annual cost of lighting shows a very material reduction. 1,897 ft. of main street are lighted by the 14 arc lamps, and the side streets, courts, and passages also partly lighted by these arcs, in combination with metallic filament lamps, amount to 2,475 ft., so that the total length of thoroughfare illuminated by the combined arrangement is 4,372 ft. The height of the centrally suspended lamps is 27 ft. 6 in. to the roadway, and that of the tungsten lamps on brackets in the minor streets and courts from 12–13 ft.

The arc lamps are the latest pattern of Messrs. Oliver's 12½-amp. magazine flame lamp, having special carborundum economisers and other recent improvements. They are fitted with the special prismatic reflector, designed by the City Co. and shown in Fig. 5. This consists of a funnel-shaped ribbed glass dish screwed to a movable tubular stem, supported by a special fitting attached to the bottom of the outer globe. These reflectors greatly increase the candle-power available near the horizontal plane; they also enlarge the visible area of the light source, and screen the eye from the direct rays of the arc at all angles 35° below the horizontal, permitting of the use of a clear glass outer globe, which in itself increases the efficiency by about 20 per cent. They also reduce the deposit on the globes, and all carbon ends and dust pass through the reflectors into a detachable copper ball fitting below the globes. An effective candle-power of 3,500 is obtained just below the horizontal plane, while the mean hemispherical candle-power is maintained above 2,800. The special carbons burnt in these lamps give but a slightly golden-tinted light, devoid of any excess of the yellow or red rays which are the cause of the somewhat glaring effect of many flame arc lamps, and of excellent fog-penetrating quality. The strong illumination of the building fronts assists greatly in the general effect.

The suspension gear was specially made by the London

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Electric Firm (Croydon), after experiments, in conjunction wth the City Co., and embodies many ingenious devices.

The general view of the cross span wire arrangement is shown by Fig. 6. The central headpiece and weatherhood contains the electric contact device and automatic coupling, which holds the lamp when in position independently of the.

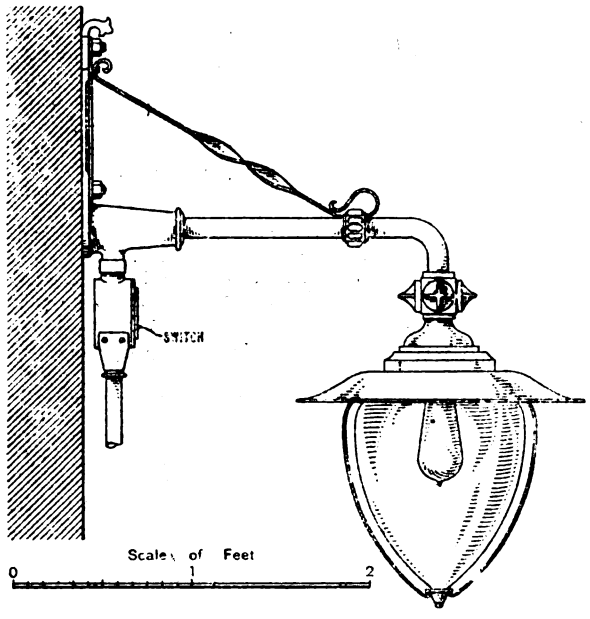


FIG. 1.—SPECIAL BRACKET FOR METAL FILAMENT LAMP IN PATERNOSTER ROW.

winch wires. This hood is rigidly attached to the two span wires crossing diagonally at the centre of the roadway. These main span wires (which consist of $\frac{5}{16}$ in. diameter compound steel ropes of the type used for aerial ropeway work), are secured at their ends to special rosettes on wrought-iron wall plates, held to the building frontage by two 1 in. diameter Lewis bolts cemented into the wall 11 in. apart. The lamp carriage, shown separately in Fig. 6, is made to traverse one of the main span wires by the operation of a winch-box containing two winding drums, one for supporting the carriage draw wire and the other the lamp-lowering wire. These drums may be worked separately or together by means of an interlocking gear, which is brought into action by pressing a button provided on the winch-box. It is thus possible to drop the lamp any convenient distance from the central hood and maintain its height above the ground level until drawn into the required position for lowering, which can be done at any desired point. The lamp and draw wires from the winch-box to the span-wire rosette are both protected by being enclosed in a 1 in. diameter Simplex steel tube, rendering it possible to keep the wires thoroughly coated with a suitable waterproofing lubricant. The electric leads, consisting of a twin cable, rise at the opposite side of the roadway, crossing to the central hood below the same span wire, to which it is attached by the usual hangers. An isolating switch-box is provided on this cable at a height of about 8 ft. from the ground, the automatic cutout-box being placed in a convenient position above the shop frontages. The whole of the cabling, from the ground to the span wire, is entirely enclosed in $1\frac{1}{4}$ in. diameter Simplex steel tubing.

The next system, central lighting by high standards, is adopted in Farringdon Street, and the central standards are placed on the roadway rests recently provided by the Corporation of the City of London. One of the designs of standards (supplied by Messrs. Macfarlane) is shown in Fig. 1. The base above ground is approximately 2 ft. square by $5\frac{1}{2}$ ft. high, surmounted by a circular column tapering from 8 in. diameter at the enlarged make-up on base to 5 in. diameter at the top. The footing consists of a rectangular root about 20 in. square, flanged at the bottom about 3 ft. below the base, the whole consisting of one casting, bolted down to *H* girders secured in a concrete foundation. Special provision had to be made for mounting the standard over the public lavatory at the south end of the street, above a large existing ventilating base. A suitable column of somewhat different design, having an inverted spigot to fit the ventliating base, and a 7 in. diameter steel tube extension for anchoring to the girders below was provided for the purpose.

The arc lamps installed are of the latest $12\frac{1}{2}$ amp. Excello flame type, fitted with inner dioptric deposit free globes within very slightly opalescent spherical outers. The candle-power distribution around these lamps is of a nature most suitable for street lighting, the candle-power near the horizontal exceeding 4,000. The height of the lamps above the roadway is 25 ft. 6 in., and the distance apart about 180 ft.

A novel feature is the central harp-carrier, which was designed and manufactured in the workshops of the City of London Co. Reference to Figs. 3 and 4 shows the general appearance and construction of these carriers. The top of the standard terminates in a spigot, over which is fitted the bell fitting forming the base part of an outer, fixed, fork-shaped, webbed casting, having at the top rectangular trunnion boxes. The inner harp-carrier is free to rotate between the carrier arms—within the limits provided by the draw wire and catch chains. At the apex of the harp is pivoted the weather-hood, within which is fitted the London Electric Firm's standard contact device and automatic locking gear. The lamp leads and winch wires are entirely confined within the forked casting and harp tubes.

The bases of the columns are provided with two doors, giving ready access to the lamp-isolating switch, automatic cutouts, and winch-boxes, all of which are conveniently fitted in the ample space at the base.

The space under Holborn Viaduct is illuminated by metal filament lamps, supported from the Viaduct girders by suitable lanterns and reflectors. Immediately below the centre of the Viaduct is a small traffic rest; there is a pilot standard having a double bracket, supporting two pendant lanterns, each containong a 50-c.p. metal filament lamp. This is represented by the initial letter of this article. Similar standards have been erected on the small rest between Fleet Lane and Seacoal Lane, and also at the Charterhouse Street end of the lavatory entrance at the north end of Farringdon Street, the candle-power of the lamps in the latter instance, however, being increased to 200 candles.

At the end of Snow Hill near its junction with Farringdon Street, and also at the rest at the south-east end of St. Bride's Street near Ludgate Circus, Oriflamme arc lamps on suitable bracket tops have been erected, attached to the old City posts, which were originally fitted with hexagonal lanterns, containing 10-amp. open arcs.

The total length of thoroughfare lighted is 2,162 ft.

For Paternoster Row, which is typical of the many narrow minor streets in the City having a roadway for a single line of traffic and a number of narrow courts and passages leading

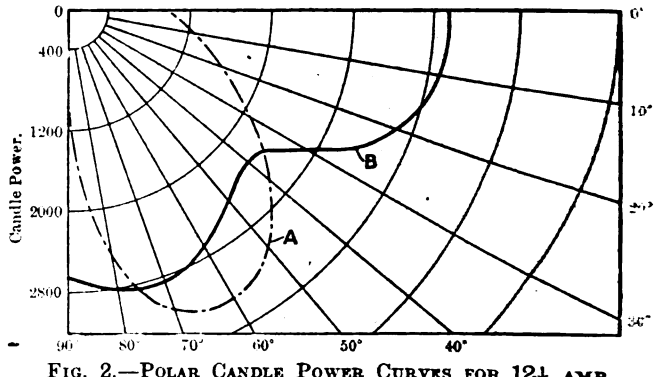


FIG. 2.—POLAR CANDLE POWER CURVES FOR $12\frac{1}{2}$ AMP. ORIFLAMME MAGAZINE FLAME ARC LAMPS.

A. With ordinary light opalescent globe.
B. With clear outer globe and "Peard" prismatic reflector as used in Cheapside.

therefrom, the bracket system has been employed. Eleven gas lamps have been replaced by nine 75-c.p. metal filament lamps in pear-shaped clear glass globes, with internal reflectors and external white enamelled shades (specially made for the City of London Electric Lighting Co. by Mr. Haydn Harrison), the combination giving an actual effective candle-powder of 95 candles per lantern. One of the brackets is illustrated in Fig. 1. Other designs are used in special situations.

The height of the lamps is from 12 ft. 6 in. to 14 ft. 0 in. above the footway.

The increase in effective candle-power and improved disposition of the lamps in the street, has enabled the Corporation to dispense with several lamps in side courts, the result being that 15 gas lamps have been extinguished on account of the nine new electric lamps installed, and a very material saving in the cost of lighting of this street has been obtained.

Having now given a general description of the new lamps

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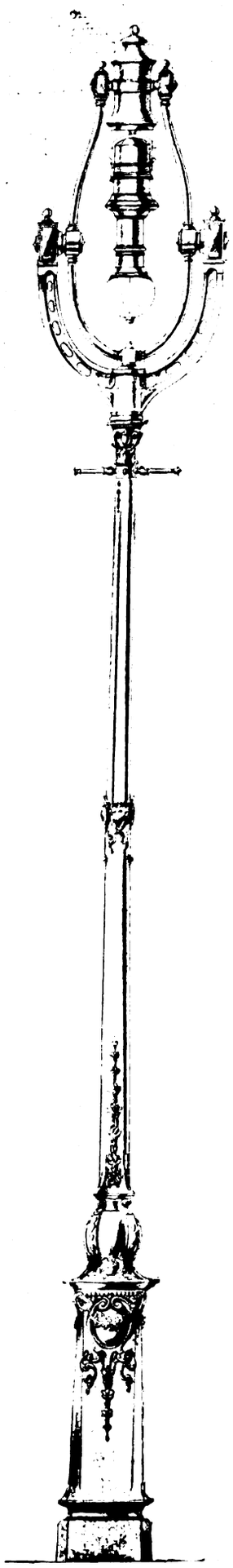


Fig. 3.—Tall Lamp Standard used in Farringdon Street.

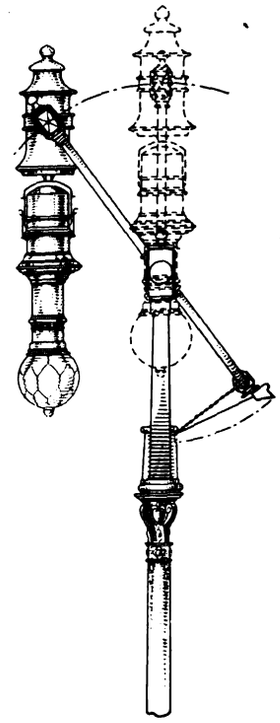


Fig. 4.—Details of Tilting Lamp Carrier.

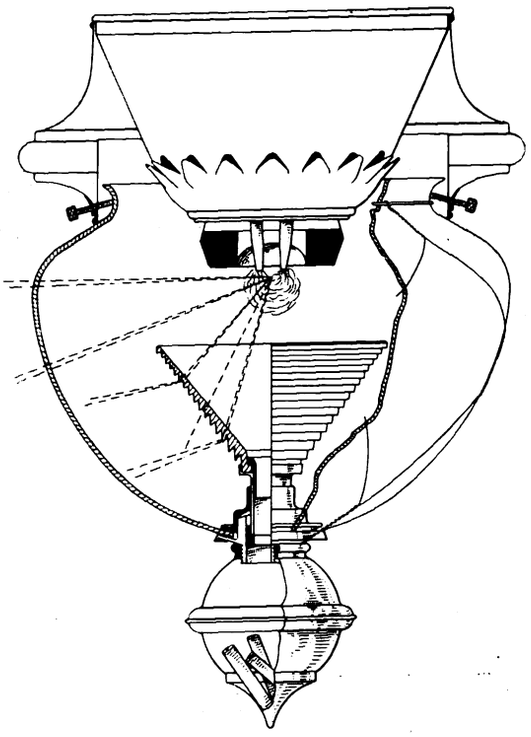


Fig. 5.—Oliver 12½ amp. Magazine Flame Arc Lamp, fitted with Special Prismatic Reflector and clear Outer Globe, as used in Cheapside.

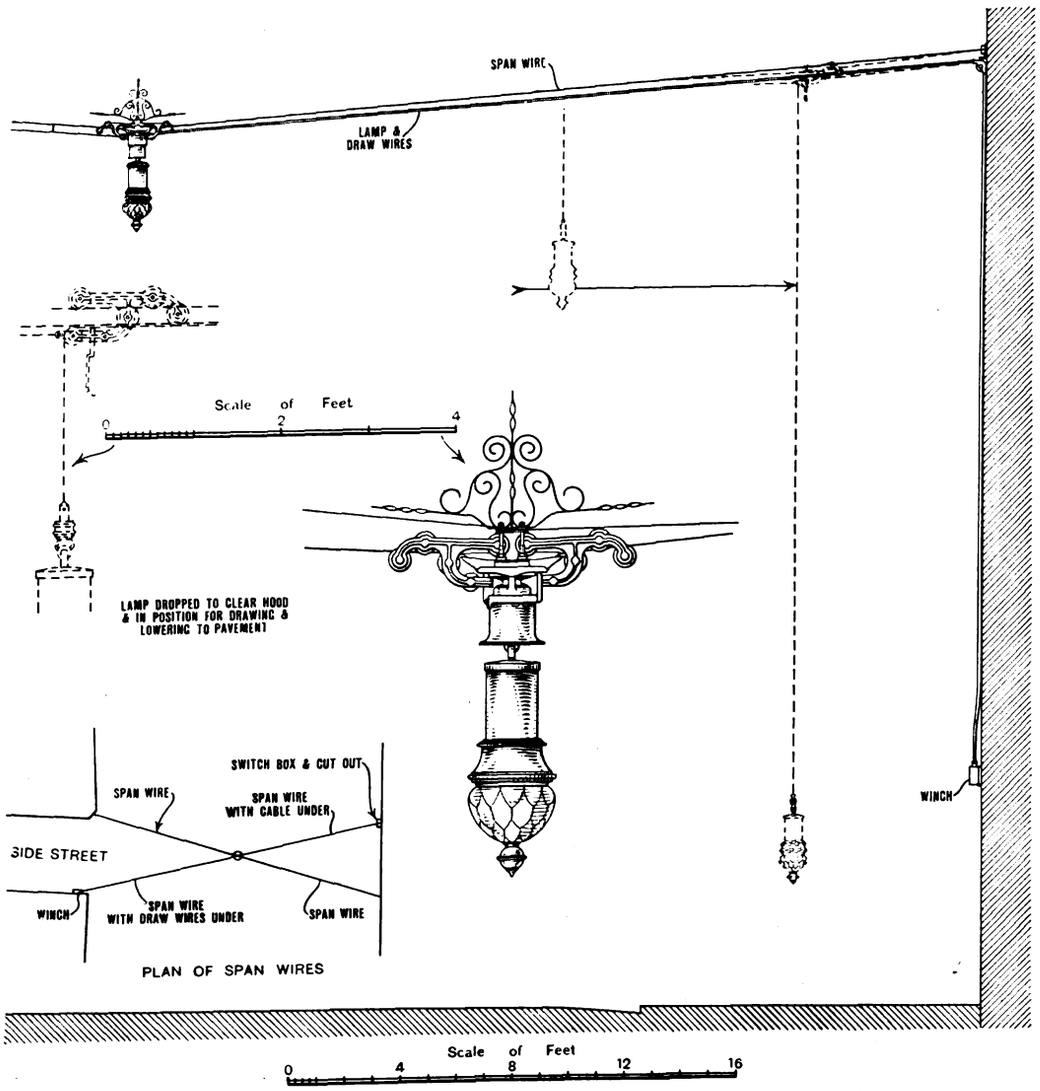


Fig. 6.—Details of Arrangement of Lowering Gear, &c., of Centrally-hung Flame Arc Lamps in Cheapside.

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and their method of instalment in the streets, a consideration of the photometric qualities of the lamps, and the effect of the various fittings, globes, and reflectors employed will be of interest.

Fig. 2 shows the effect of the reflectors to the Oriflamme 12½ amp. lamps used in Cheapside. The dotted polar curve shows the candle-power fitted with the ordinary semi-elliptical slightly opalescent globe usually supplied with these lamps, and the full line shows the improved distribution with the reflector and clear glass outer globe.

Fig. 7 shows the horizontal illumination along the kerb

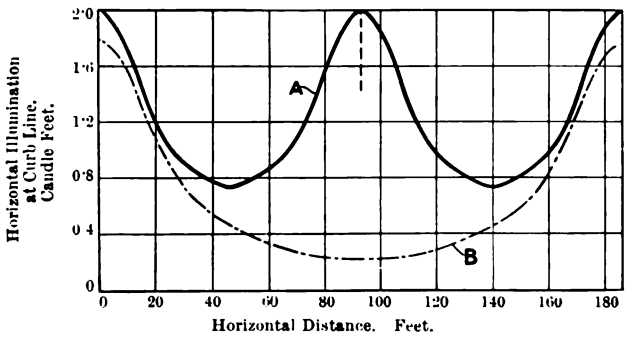


Fig. 7.—Illumination Curves, Cheapside. (Centrally-suspended Flame Arcs.)

Curve A. All lamps alight.		Curve B. Alternate lamps extinguished.	
Mean	1·23 ft. candles.	Mean	0·66 ft. candles.
Max.	2·00 ,, ,,	Max.	1·78 ,, ,,
Min.	0·72 ,, ,,	Min.	0·22 ,, ,,

line; curve *A* being that due to three lamps alight before midnight, curve *B* with the intermediate lamp extinguished after 12 midnight.

Fig. 8 shows the horizontal illumination in Farringdon

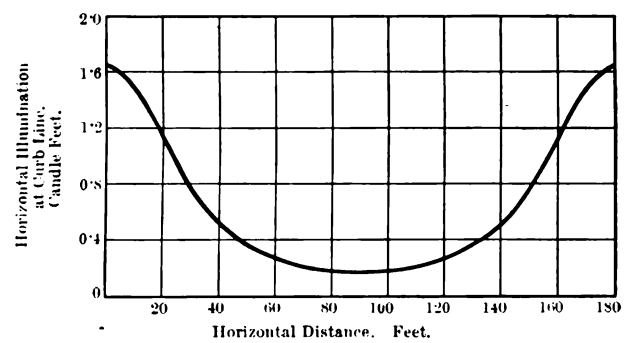


Fig. 8.—Illumination Curve, Farringdon Street. (Central Post Arc Lighting.)

Mean ... ... 0·67 ft. candles.
Max. ... ... 0·17 ,, ,,
Min. ... ... 1·64 ,, ,,

Street. The horizontal illumination along the centre of the roadway in Paternoster Row is similarly shown in Fig. 9.

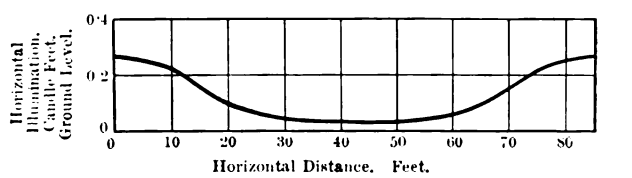


Fig. 9.—Illumination Curve, Paternoster Row (Metal Filament Lamps).

Mean ... ... 0·13 ft. candles.
Max. ... ... 0·27 ,, ,,
Min. ... ... 0·03 ,, ,,

Street.	Length of streets lighted.	Nominal candle-power of old lamps displaced.	Effective candle-power of new lamps installed.	Increase. C.p.	Increase. Per cent.
	Feet.	C.p.	C.p.		
Cheapside and Watling Street area	4,372	18,665	43,850	25,185	135·0
Farringdon Street ...	2,162	28,290	33,075	4,785	16·9
Paternoster Row ...	996	715	810	95	13·3
Totals	7,530	47,670	77,735	30,065	63·0

Some idea of the improvement effected in the street lighting by the instalment of these fittings is shown by the accompanying table. The whole of the cost of this instalment has been borne by the City Co. with the object of actually proving the great advances effected in electric lamps in recent years.

EXPERIMENTAL LIGHTING IN HOLBORN

We have already detailed (Electrical Engineering, December 8th, page 772) some of the circumstances which led to the comparative demonstrations of electric and gas street lighting which are now being made in different parts of Gower Street, in accordance with a specification of the Borough Surveyor of Holborn. The installation is now complete, and an excellent object lesson in up-to-date lighting by metal filament lamps is afforded.

The electric lighting of the southern portion of Gower Street has been carried out by the Metropolitan Electric Supply Co., who have powers of supply over the whole borough in conjunction with the County of London Electric Supply Co. and the Charing Cross, West End & City Electricity Supply Co., both of which companies have also powers in portions of the area. The demonstration involves eight new lamp standards, of which six carry a single lantern, each



Fig. 1.—Single Lantern Posts in Gower Street.



Fig. 2.—Special Double Lantern Post at Corners.

containing a group of four metal filament lamps in a clear glass globe, with a white reflector, giving an aggregate candle-power evidently well over that called for in the specification, and probably amounting to some 400 to 500 c.p. These lanterns were designed by Mr. Haydn T. Harrison. They are placed on the curb on both sides of the road alternately, and are 60 ft. apart. Fig. 1 shows their general arrangement. The remaining two standards, at the corners of Bedford Square and Montague Place respectively, are of a special pattern, shown in Fig. 2, with two lanterns hanging from separate arms. Each lantern contains a single lamp within a crinkled glass globe, and was made by the General Electric Co. to the designs of Mr. H. S. Highfield, Chief Engineer to the Metropolitan Electrical Supply Co., Ltd. All the new standards are 18 ft. in height. This height was considered more suitable than that of the lower gas standards replaced for giving the best effect, as regards light distribution, with units of the candle-power adopted, and is much to be preferred from the point of view of drivers of vehicles, as it raises the position of the light well out of their line of vision. Actual results of illumination tests are not at the present time available, but the lamps have only to be seen alight for the excellence of their illumination, and their suitability to their purpose to be appreciated. The evenness of the illumination is particularly noticeable.

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LONG-DISTANCE SUBMARINE TELEPHONE CABLES

At the Institution of Electrical Engineers last Thursday, Major W. A. J. O'Meara, Engineer-in-Chief of the Post Office, read a valuable Paper on the subject of "loaded" cables for long-distance submarine telephony. By his courtesy we were enabled to publish a description of the new "loaded" telephone cable between England and France last March (Electrical Engineering, March 17th, 1910, p. 179), after its manufacture had been completed, and favourable weather for laying was being waited for. This cable is made up of gutta percha insulated core, with loading coils at intervals, and (after an interesting historical sketch and descriptions of the previous submarine telephone cables laid by the Post Office) Major O'Meara explained his reason for adopting gutta percha insulation without paper. The hygroscopic properties of paper cause it to absorb moisture from the gutta percha, and, therefore, neither of the suggested cables in which it was proposed to utilise layers of paper between the copper and the gutta percha were adopted. An effort is being made, however, to discover some effective means of overcoming the practical difficulties which have been encountered, owing to the moisture exuding from the gutta percha.

The "continuously" loaded type of cable would have offered the advantage of being mechanically simpler than the "coil loaded" cable, but investigation showed that the increase in efficiency which it was desired to obtain could only be realised at an incommensurate cost. Moreover, it was found that it was not possible to predict with sufficient accuracy, by mathematical calculation, the results likely to be obtained by the continuous loading, owing to the difficulty in attaching correct values to the electrical constants involved. In theory, the designing of a cable of this type seems to require merely the solution of the apparently simple problem of ascertaining the increase of inductance which can be obtained by providing layers of iron wire or tape of known permeability over copper conductors of known diameter, assuming that the nature of the dielectric to be employed has been determined, and that the overall diameter of the finished cable shall remain a fixed dimension. Although such a method of applying the iron would give the greatest possible inductance, either for a given outer diameter of the iron covering or for a given weight, yet Major O'Meara explained that it cannot be adopted owing to the excessively large increase of effective resistance which will accompany the increase of inductance, for at high frequencies the eddy-current loss in such an iron sheath would be impracticably large. Hence the iron covering must be electrically divided, not continuous.

Investigations by the Post Office engineers indicated that it was possible to obtain more appreciable improvements by employing loading coils. It was known that a lead-covered paper-insulated cable provided with loading coils had been laid across Lake Constance from Friedrichshafen to Romanshorn; but in view of the difficulties which would have arisen in the event of the lead sheathing being punctured, it was deemed that it would have been a costly and hazardous experiment to lay a cable of this class across the English Channel.

Whilst investigations were in progress, an article appeared in the *Elektrotechnische Zeitschrift* (vol. 29, 1908, p. 588), in which doubt was thrown on the possibility of improving transmission in gutta percha covered cables by means of the so-called Pupin coils, on account of the low effective insulation of gutta percha to currents of high frequency. In order to settle the point definitely, some experiments were carried out by the Department on No. 7 gutta percha covered wire (weight of copper, 40 lbs. per mile; of gutta percha, 50 lbs. per mile), having a number of inductance coils inserted at intervals. It was found that the actual improvement in transmission was in complete agreement with the estimates based on the calculations that had been made, and that commercial speech was practicable on 105 miles of this particular type of coil-loaded gutta percha wire. The question of providing a non-uniform loaded type of cable was therefore proceeded with.

In order to be absolutely on the safe side, however, when preparing the specifications for this new Anglo-French cable, it was decided that the general design of the new telephone cable in respect of the copper and the dielectric should be exactly similar to the type already in use, which it was known would provide telephonic transmission of a certain quality, and that the improvement desired might be obtained by the contractors either by means of continuous loading or coil loading, the Department simply stipulating in the specification that the attenuation constant should not exceed a certain definite value. The main reason for this was that if it had been discovered after the cable had been laid that coils introduced effects not foreseen, the coils could easily have been cut out at a small cost, and the Department would still have had a cable as good as the existing one. Under certain conditions of design in the relation of the weight of gutta percha to that of copper, an effect is created referred to colloquially as "drumminess," which causes speech to be muffled. In an unloaded circuit "drumminess" is generally unmistakable, when the ratio K/R per mile is equal to 0·003. Selected firms were asked to tender. No tenders were received for the "continuous" type of loading, but three tenders were received for the "coil" type of loading. Messrs. Siemens Bros. & Co.'s tender was accepted. A detailed and illustrated description of the cable, the loading coils, and the method of armouring appeared, as as been already stated, in Electrical Engineering of March 17th, 1910. The coils are inserted at intervals of 1 naut (1·153 miles); the two coils nearest the ends are half a naut from the terminal apparatus, as experiments have shown that in this arrangement reflection losses are considerably reduced. Each coil is protected with a sheet of metal foil in order to exclude all possibility of the silk covering of the wires of the coils absorbing moisture

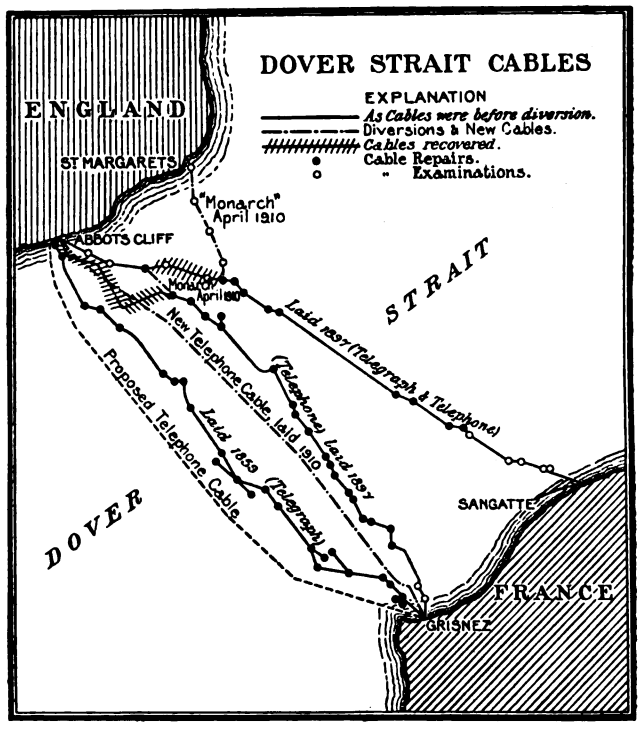


Fig. 1.—Map showing Routes of Cables, and Positions of Repairs and Diversions.

from the cylindrical envelope of gutta percha in which they are contained. The result of tests indicated that the attenuation constant of the loaded cable was 0·0147 per mile.

Major O'Meara then referred to an important point in connection with the maintenance of the cable. In repairing cables, intermediate lengths have to be inserted at times, but fortunately if repairs of this character have to be effected in the coil-loaded cable, no noticeable impairment in the quality of the speech will result if the coil spacing is disturbed to an extent not exceeding 5 per cent. on either side of the best location from the theoretical point of view. It has been found that when physical conditions impose a variation of not more than 50 per cent. of the spacing for a single coil, no appreciable impairment in the quality of the speech will result provided the deficiency in loading is made up within the next ten loading sections. The frequency with which repairs have been carried out on the existing telephone cables, as shown in Fig. 1, will convey some idea of the importance of this matter.

Mr. W. Dieselhorst was entrusted by Siemens Bros. & Co.

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with the actual operation of laying the cable, and the cable ship *Faraday* was employed for the purpose. As a precautionary measure, the ordinary paying-out drum had been replaced by one of larger diameter, and fleeting-knives were also provided in order to prevent the cable from over-riding.

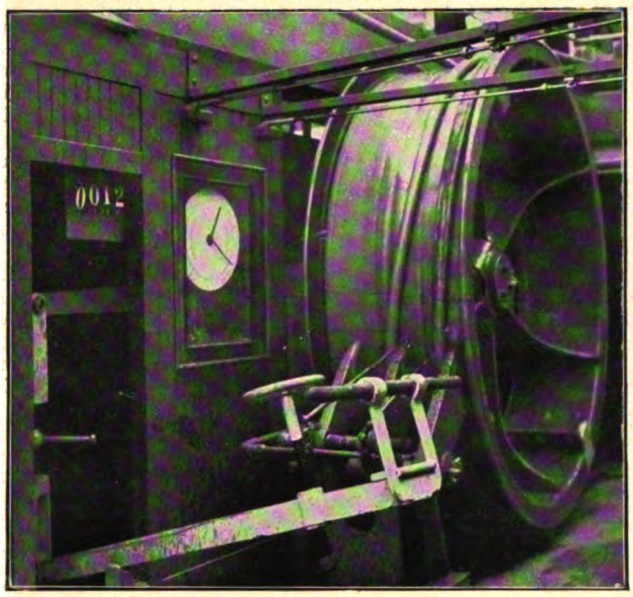


FIG. 2.—C.S. *Faraday's* PAYING-OUT DRUM WITH FLEETING-KNIVES.

The new drum was 8 ft. in diameter, and 30 in. wide, and three fleeting-knives were fitted side by side to this rather wide drum to prevent any undue pressure on the loading coils, which would be caused if two turns on the drum were fleeted by one knife only (Fig. 2). It was further decided to pay the cable out without passing it under the dynamometer wheel as is usually the case where deep-water cables are concerned. All bends were avoided by letting the lead from the tank go on to the upper part of the drum, and an open wood trough was fixed from the cable tank to the drum to support and protect the cable between these points. Since the upper part of the drum is nearly in line with the stern sheave there was no extra bending of the cable over any intermediate supporting sheaves after it had left the drum. The stern sheave on board the *Faraday*, which has a diameter of 4 ft., can be swung out at will to any angle, and this was found to be exceedingly serviceable when turning the ship round at right angles near Abbot's Cliff, and again when the French coast was reached.

The cable was paid into the *Faraday's* tank on the 2nd and 3rd of May, 1910, and the ship left Woolwich on the 4th with the official representative of the Post Office on board. A large party of gentlemen—from this country and Germany—especially interested in telephone enterprise embarked on the *Faraday* as guests of Messrs. Siemens. The day being fairly clear and the sea smooth, the laying of the cable went off without a hitch, but a brisk wind sprang up late in the afternoon, and the *Faraday* had a somewhat rough passage back. The English Channel is becoming very congested as regards cable routes (see Fig. 1), and to assist the *Faraday* in keeping her course, buoys had been placed at intervals by H.M.T.S. *Monarch*, the positions of which were recorded on a chart supplied to the contractors. Fig. 1 shows some recent alterations in the routes of old cables to avoid the laying of the new cable over old ones. Operations were commenced at 5 a.m. on May 5, 1910, by dropping a buoy, to which the shore end was attached, overboard about half a mile from the South Eastern Railway Company's retaining wall south of the tunnel works. For some distance the cable was laid parallel to the British coast, until a point was reached opposite the landing-point, when the ship's bow was turned towards the French coast. It was not possible for the *Faraday* to approach nearer than 1½ miles to the French landing-place, as the coast shelves out very gradually. Therefore, when the ship was about that distance from the coast, the course was altered, and the remaining portion of cable paid overboard approximately parallel to the coast.

The landing of the shore ends was commenced at 5 a.m. on May 18th, 1910, by Mr. F. Pollard, Submarine Superintendent; H.M.T.S. *Alert* was employed. The shore end on the English coast was first picked up, and the cable coiled into the ship's forward tank. The *Alert* then steamed in as close to the shore as her draught would allow, and anchored. A raft was made, and the shore end paid out on to it. The raft was then towed ashore by means of a warp rope, the cable being paid out into the water. This work was completed at 11 a.m., and the *Alert* at once proceeded to the French coast, where the section of cable parallel to the coast was picked up. When the tide permitted, the ship steamed in towards the French shore, paying out the cable. A short length provided in excess of the actual length required to reach the shore was cut off, and the remainder of the cable was paid



FIG. 3.—EASING A LOADING COIL OVER THE SHEAVES.

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overboard at a distance of about 350 yards from the cable hut. When the tide receded up to this point the end was carried to the cable hut.

Since the bow sheaves of the *Alert* are only 2½ ft. in diameter, the loading coil sections were not allowed to ride on the bow sheaves, but tackle was fixed to a derrick, and the coils were carefully lifted over the sheaves (see Fig. 8, p. 808). However, in the case of the coils in the section of the cable in excess of that required for present needs, the opportunity was seized to ascertain whether the coils would be injured if allowed to pass over the *Alert's* sheaves in the absence of the precautions referred to. This portion of the cable, therefore, was hauled aboard in the usual manner, and a speech test was then made; no injury was disclosed in the test.

The cable has been under continuous observation since it was laid, and a large number of tests have been carried out. From the details of these, given in an appendix to the Paper, it appears that the value of βl (where β is the attenuation constant per naut and l the length of the loop in nauts) varied from about 0·6 at a frequency of about 750 periods per sec. to 1·33 at 1,720 periods per sec. The graph depicting these results gives a value of 0·63 for βl at the frequency of 800, which is considered to represent that of the voice in applying such tests as these. This works out to 0·0158 per naut, as the length of the loop was 40 nauts, and the value of β deduced from speech tests was 0·0169. The speech tests consisted of inserting lengths of "standard cable" in series first with the old cable, and then with the new cable until the limit of satisfactory audibility was reached in each case. Four observers, Messrs. W. R. Cooper, W. Duddell, F.R.S., W. Judd, and J. E. Kingsbury, made the test with the two pairs of the cable looped at the French end, and the English ends connected to two telephone sets, and the mean gain by the use of the new cable was found to be 17 miles of "standard cable" * for the standard of audibility accepted as commercial by the four observers named.

The employment of unloaded 800-lb. copper aerial conductors, such as are in use for the most important long-distance trunk circuits in this country, will render it possible for very satisfactory conversations to take place from call-boxes between centres in England and on the Continent when the added distances from the ends of the cable do not exceed 1,700 miles; that is to say, with land-lines of this description well-maintained conversations between London and Astrakhan on the Caspian Sea would be possible.

In his concluding remarks, Major O'Meara referred briefly to the work that is being done in similar directions in other countries. Mr. J. J. Carty, of the American Telegraph and Telephone Company, is engaged in solving the problem of putting the towns of the East Coast and West Coast of the United States into communication, and stated recently, at Paris, that he hoped to establish satisfactory communication between New York and Denver (distance, 1,700 miles) during the autumn of this year. Experimental investigations are being carried out by, amongst others, M. Devaux-Charbonnel in France, Drs. Breisig and Ebeling in Germany, M. Bela Gati in Hungary, and in this country in our midst Mr. Gill, Engineer-in-Chief of the National Telephone Co., is vying with Mr. H. R. Kempe, the Electrician to the General Post Office, both working in conjunction with their able staffs. Major O'Meara urged that a means should be found by which the scientific and practical results obtained by the investigators in these widely separated centres shall be in such a form as to be easily comparable. Although it has been agreed to abandon standards of commerce and to adopt those of the laboratory to record values affecting the efficiency of telephone circuits, the final results, he thinks, must be measured from the point of view of the non-scientific user; it is not possible to deal with telephonic transmission from the consideration of the attenuation constant in its mathematical aspect alone, but it is necessary to take into consideration its practical aspect as affecting audition. In the early part of September, 1910, he took part in experiments at Paris arranged by Dr. Breisig and M. Devaux-Charbonnel, which consisted in talking over actual telephone circuits, into which, in turn, artificial cables were introduced of three different types designed to reproduce conditions representing aerial wires, unloaded cables, and loaded cables respectively. The talking circuits were so arranged that in each case the total attenuation was by mathematical calculation exactly the same. Yet the quality and volume in audition under the three different cases were by no means in agreement. For comparative purposes, it is desirable, therefore, that not only should the conditions with regard to the circuit arrangements, including terminal conditions, be identical, but that all those who are engaged in this important investigation should employ, in connection with their experiments for measuring audition, apparatus manufactured to the same specification and compared with an international standard. He hopes that this result may have been attained as a consequence of the recent International Conference at Paris.

* Standard cable is that having a wire-to-wire capacity for each pair of wires of 0·054 microfarads per statute mile, a loop resistance of 88 ohms per statute mile, and an average insulation resistance of not less than 200 megohms per statute mile wire-to-wire.

There are no less than sixteen appendices to the Paper, all containing information of value. Two of these give particulars of other types of submarine telephone cables proposed, another two compare the cost of some of these, both per naut and for equal values of the attenuation constant, and particulars of some "continuously loaded" foreign cables are tabulated. Methods of calculating attenuation are explained, details of the tests we have already quoted are given, and the full specification to which the new cable was supplied is published.

DISCUSSION.

Dr. J. A. FLEMING, F.R.S., said that a great share of the credit must be given to Professor Pupin, who had shown that if they had a loaded cable and applied a wave of potential which occupied a certain distance, and called that 2π, and if the interval between the loading coils were expressed as an angle θ, the difference between a loaded cable and the corresponding cable with distributed inductance was represented by the difference between $\sin \frac{1}{2}\theta$ and $\frac{1}{2}\theta$. The Anglo-French cable practically complied with this law. At the frequency of 750, the wave length was about 12 nauts; as the coils were one naut apart, θ was 30°, and the difference between sin 15° and 15° (*i.e.*, $\pi/12$) was not much more than 1 per cent. The same law was followed by the cable originally suggested by Dr. Silvanus P. Thompson. Dr. Fleming also explained on the blackboard why the low effective insulation resistance of gutta percha gave no deleterious results, even if it was really a true conduction current. The difficulty in predetermining the attenuation constant of continuously loaded cables arose, he thought, from the difficulty of predetermining the permeability of the iron for these low magnetising forces. He had recently been carrying out some experiments on that very point, and had found that a very simple and effective way of determining the permeability was to measure the high frequency resistance of the wire, and compare it with that of non-magnetic wire. He found that this gave a permeability much lower, and consequently an attenuation constant higher, than was given by the ordinary magnetisation curves, so that cables designed on the latter basis would have in practice a larger attenuation constant than had been expected.

Mr. W. DIESELHORST (Siemens Bros. and Co.) said that, in his opinion, it would be as easy to repair cables with Pupin coils as ordinary submarine cables. Another point in connection with this cable was that there were more coils than were necessitated by the Pupin law, and, therefore, the shifting of coils during repair would not influence β.

Sir JOHN GAVEY, C.B., thought that continuous loading might be advantageously employed in connection with the trunk lines connecting submarine cables with the great centres of commerce. Owing to overhead tramways necessitating the employment of heat coils and fuses, the effective resistance of the heavy conductors erected by the Post Office (the weight of copper in which had been adversely criticised) had been increased by something like 20 per cent. Moreover, there was a feeling against the use of overhead wires in large towns. In connection with an undertaking that he had to deal with in Buenos Aires it had occurred to him that they could introduce underground cables with continuous loading. In such cables he thought it a mistake to employ two or three layers of fine wire, as it increased the cost, wasted space, increased the electrostatic capacity, and, further, the wire was hardened in laying it on the conductor. This was, no doubt, one of the factors which prevented the application of the ordinary formula in determining the value of β. He had, therefore, prepared a specification for an air-space paper insulated cable, the conductor to be 100 lbs. copper wire, to be lapped with a soft iron tape 1/100th inch thickness and 1/10th inch wide, the compound conductor to be thoroughly annealed, then coated with a hard varnish and insulated in the ordinary way. On the first section tested they got a conductor with a self-induction L=10; the effective resistance was 20·2 ohms per mile loop; and the calculated value of β was 0·024. This indicated an improvement of 70 per cent. on the ordinary unloaded cable. The actual results of the speaking tests showed an improvement of 77 per cent. In the second lot of cable they got a capacity of 0·059; self-induction 17, the effective resistance of the conductor when laid 22·4 ohms per mile, and the value of β was reduced to 0·0207, and one mile of the cable was equivalent to 4·97 miles of ordinary standard cable. This gave an improvement of 103 per cent. The speaking tests on the whole cable gave an improvement of 94 per cent.

Mr. H. R. KEMPE (Electrician to the Post Office) said that not many years ago he held the opinion that the use of loading coils would not be very effective, but he had since had to

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modify that opinion considerably. On the question of durability of this type of cable, he had had it under continuous observation, and when he last tested it the results were just as perfect as when it was laid; there was not the slightest doubt that it would last as long as any ordinary cable. Incidentally, Mr. Kempe also mentioned the enormous drop of effective dielectric resistance which he had found to occur with alternating currents of very high frequency. Continuous loading was purely a question of finance. It was possible to obtain the required value of β without loading, if they made the conductor big enough, and the dielectric thick enough. Of course, they would get drumminess, but with continuously loaded cables this was got rid of because it was caused by the absence of self-induction. The best result so far obtained for continuous loading was about 70 per cent., but possibly a further investigation would show that the efficiency would be greater by continuous loading than with loading coils. Any experimental evidence which could be obtained in order to reduce the size of loading coils would be of very great value. The Post Office at present were engaged in making an extensive series of experiments in order to determine the permeability of iron and the conditions under which continuous loading could be obtained in the most simple and economical manner. Drumminess was largely a question of opinion. When the first cable was laid across the Channel unloaded, the public were entirely satisfied with the quality of the speech, but when they used the loaded cable there was no doubt they would say that it was very much better.

Mr. A. W. WHALLEY asked when the new cable to be laid by the French Government would be completed, and what type of cable would be used. He also raised the question whether the relatively thin insulation on the two wires involved in the use of loading coils would necessitate special protection against lightning. His chief point on the Paper was the value of β. There were, he said, five different values given in the Paper; both the highest and lowest appeared to be for speech values, but differed by 14 per cent. It seemed desirable when declaring the value of β, to make it clear how far frequency affected it, and whether terminal losses were included or allowed for. The speech test made by the four gentlemen who went to Dover gave results varying so widely that he hoped that the alternator method for reliable frequency control, mentioned in the Post Office Institution Journal this year, would be developed to produce a composite wave representing a fair average speech wave. Mr. Whalley also referred to some discrepancies in the published figures relating to continuously loaded cables, and in conclusion adduced some figures from the Paper, which, he contended, showed that 43½ per cent. of the losses in the new cable represented terminal loss due to reflection. Finally, he suggested the use of Mr. Kempe's name as representing one of the new electrical terms.

Mr. ALEXANDER SIEMENS said that fishermen's anchors were responsible for most of the repairs which had been rendered necessary in the cables. He also pointed out that the lengths had been spoken of in the Paper as knots, instead of nauts. A knot, he said, was a nautical mile per hour, and length should be referred to as naut. [We have, in accordance with our usual custom, employed the unit naut—representing 2,029 yards—in our report of the Paper and discussion.]

Dr. SILVANUS P. THOMPSON, F.R.S., pointed to the inaccuracy which beset mathematical calculations owing to the necessity of assuming a definite frequency; if they had a cable which was perfectly compensated for one particular note, then that note, when they talked through the cable, would sound greater than anything else, so that it was evident they could only get at an average result at the best. Therefore, experiments would have to play a great part. Referring to the use of inductive shunts across the cable at intervals which he had proposed in 1891, he said that this had not yet received the same grateful attention from His Majesty's Government, or from any other authority, as had the rival method of putting in inductance coils in series. Professor Fleming had been good enough to point out that the mathematical theory was the same for both so far as the distribution was concerned, but the problem was really a very different one. He had not arrived at his method by anything that he read in Heaviside, because that would have led him in another direction. In 1874 in the *Journal* of the Society of Telegraph Engineers, Winter described the use of inductive resistances as shunts at the ends of the cable, as previously suggested by Varley. If an inductive shunt placed across the ends of the cable would improve the action, why would they not when placed anywhere else. He was led to think it was good in telephony because of a communication by Sir William Preece in 1891, in connection with the London-Paris telephone cable, where it was stated that with a metallic circuit the talking from London to Paris was in no way interfered with when telephonic receivers were bridged across the circuit at the two ends of the cables; in fact, they rather improved the working of the line. He suggested in 1891 that for telegraphic signalling, one should be placed, say, every 500 miles or 100 miles, and perhaps for telephonic signalling, every 10 or 20 miles. If they wanted to make an Atlantic cable speak easily 300 words a minute, they would require one such inductive shunt across every 360 nauts, or only five in all, or seven with one at each end. If they wanted to get it to 1,000 words they would have to put one every 110 nautical miles. He pleaded for his particular solution being given a trial.

The PRESIDENT (Mr. S. Z. de Ferranti) announced that, owing to the large number of speakers wishing to take part in the discussion, it would be adjourned until January 12th, 1911.

STREET LIGHTING

AT a meeting of the Birmingham section of the Institution of Electrical Engineers on the 14th inst., a discussion was held on Mr. Haydn T. Harrison's Paper on street lighting, which has already been read and discussed in London and Manchester (see ELECTRICAL ENGINEERING, December 1st, page 763).

Mr. MAURICE SOLOMON (General Electric Co.) opened the discussion. He wished to know what was the shape of the special reflectors used by the author for incandescent lamps, and suggested that lamp globes should be standardised. He considered that the only comparison of candle power of value was the mean spherical, and wished to know if the costs per annum in the Paper were worked out on the candle-power of the rays from 10° to 16°.

M. R. A. CHATTOCK (City Electrical Engineer) asked if the author's figures as to candle power, etc., were obtained from independent and reliable sources; also, were the figures of 30–34 c.p. per cubic foot of gas obtained with new mantles? He agreed that 1d. per unit was a satisfactory figure to charge for street lighting, but he did not consider a street lighting load of more value than a motor load, although the load factor were the same. Tungsten lamps with suitable reflectors would solve the lighting of side streets. Mr. Chattock also held that the Local Government Board should not refuse to grant loans for street lighting.

Dr. W. E. SUMPNER (Municipal Technical School) considered the most important point in the Paper to be the improvement which can be effected by the proper distribution of the light and of the increase in the area of the source of the light which has been achieved lately. Horizontal illumination is required for street lighting, and vertical, downwards, for lighting interiors, but hitherto arc lamps, which have naturally a vertical illumination, have been used for street lighting, and glow lamps for interiors; this can be corrected by the use of suitable globes and reflectors. He held that the unit of measurement should be mean spherical candle-power.

Mr. ANGOLD (G.E. Co.) made some remarks with respect to the peculiarities and efficiencies of various types of arc lamps.

Mr. H. T. HARRISON, in reply, said that the measurement of spherical candle-power was of no use. The rating of candle-power should be at the angle at which the light is required, i.e., 10° to 15° from the horizontal. The reflectors were first designed on theoretical lines, but this was found to be not entirely satisfactory, as they only gave an increase in the light where it was required of 50 per cent., whereas a modified design of which the chord of the curve was 45° increased the light 2½ times. The reflectors were made of enamelled zinc, and he had found that a difference in the illumination was caused by so slight a matter as the graining of the enamel, and that therefore a dead smooth surface was desirable.

Annual Exhibition of the Physical Society.—At the exhibition held by the Physical Society at the Imperial College of Science and Technology last Tuesday, a quantity of representative apparatus was brought together, and the interest was much enhanced by the discourses given in the afternoon and evening by Prof. J. A. Fleming, F.R.S., on recent improvements in transmitters and receivers for wireless telegraphy and the cinematograph demonstrations with Mr. R. W. Paul's apparatus of moving diagrams of lines of force by Prof. S. P. Thompson, F.R.S. Among the exhibits much interest centred round the rotary multiple spark-gap discharger, shown by the British Radiotelegraph and Telephone Co., Ltd., and the demonstration of a new "valve" receiver by the Marconi Co. Most of the well-known instrument makers were represented. Electric portable and testing instruments were shown by Crompton & Co., Nalder Brothers & Thompson, R. W. Paul, the Weston Electrical Instrument Co., and Everett, Edgecumbe & Co., who also made a fine display of photometric apparatus including a new pocket "luxometer," an illumination photometer on the Trotter principle, weighing less than 1 lb. They also showed Mr. A. W. Pott's pattern of leakage indicator for tramcars, which gives an audible signal should the trolley standard become alive. Messrs. Evershed & Vignoles showed their "dionic" water tester (see ELECTRICAL ENGINEERING, November 17th, page 735), and the new Bleeck-Love 2·7 volt primary cell, for which great capacity and constancy is claimed, was among the exhibits of the India Rubber, Gutta Percha, & Telegraph Works Co., Ltd. The time-element circuit breakers of Morris & Lister may also be mentioned, also the electro-magnetic rectifier of Muirhead & Co., for which 96 per cent. conversion efficiency is claimed. A number of Dr. C. V. Drysdale's instruments were shown by Messrs. H. Tinsley & Co., and Messrs. Wright & Co., demonstrated Prof. E. & W. H. Wilson's new high frequency apparatus (see ELECTRICAL ENGINEERING, November 17th, page 732).

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THE NEWCASTLE-WALKER TRAMWAYS: AN INTERESTING DECISION

AN interesting dispute between the Newcastle-upon-Tyne Electric Supply Co. and the Newcastle Corporation, with regard to the supply of electrical energy to the Walker tram ways, was heard before Mr. Justice Swinfen Eady in the Chancery Division on Friday and Saturday. Mr. C. A. Russell, K.C., and Mr. A. B. Shaw represented the Company, and Mr. Freeman, K.C., Mr. Macnaughton, K.C., and Mr. Sargeant were for the Corporation.

The question between the parties was whether the Corporation were under contract to take from the Company the electrical energy necessary for working the tramways in Walker (which has now become a part of Newcastle).

The Walker Urban District Council obtained a Provisional Electric Lighting Order in 1900, but leased it to the Company for 10 years, expiring on August 6th, 1910. In March, 1902, the Newcastle Corporation promoted a tramway in Walker, and, under the terms of the lease of the Walker Electric Lighting Order, were compelled to take the supply of energy from the Company. The leasing agreement also provided that at the end of the 10 years the Corporation was to take their supply from the Walker Council "or their contractors," and that no other authority should be allowed to supply electrical energy in Walker without the consent of the Walker Council. In March, 1903, the Company decided to improve its position, and, instead of merely holding the Walker Provisional Order under lease, decided to purchase it from the Council, and the Court held that in this way they became the Council's "contractors" as laid down in the agreement of 1902. A few years later, the Newcastle boundaries were extended to include Walker, which thus ceased to exist as a separate Urban District. The argument put forward by the Corporation now was that, having absorbed Walker, the agreement of 1902 only required their own consent for themselves to supply the energy necessary for the Walker trams. Mr. Justice Swinfen Eady, however, held that as the Walker order had been passed on to the company, even the Walker Council, if it still existed, could not consent to the Newcastle Corporation supplying. It should be pointed out that up to August 6th, 1910, the date of the expiry of the original agreement between the old Walker Council and the company, the Newcastle Corporation had been supplying the necessary energy under an arrangement with the company, with whom they had made terms, but they claimed the absolute right to continue the supply without terms after that date. The company did not take this view, and the present proceedings arose out of an application by the company for an injunction to prevent a continuance of the supply by the Corporation. This was granted. The injunction was, however, suspended until Jan. 13th in order to give time for the fresh electrical connections to be made. The Corporation will endeavour to deal with this point in the Bill which they are promoting in Parliament next session.

This is an extremely interesting result, as the position now is that the Newcastle Corporation, which owns its own tramways and supplies them from its own power house, is compelled to buy the energy for a portion of the lines within their boundary which they have hitherto been supplying.

LIMERICK ELECTRICITY SUPPLY

MR. A. V. CLAYTON'S report to the Borough Council of Limerick on the condition of the Corporation electricity supply works and distribution system has already been referred to in these columns. As the result of a careful examination of the whole system, and a series of tests on the generating plant, Mr. Clayton found the entire undertaking in a most exceedingly neglected condition, and complained of an entire lack of system and discipline. The plant consists of four gas engines driving D.C. generators, and supplied from gas producers. These latter were found to be working inefficiently, and one engine was in such a bad state, due to neglect, as to be incapable of being put into service. The switchboard and battery were likewise in a bad state, and severe criticisms are made on the condition of the distribution system.

Mr. Clayton recommends scrapping the gas plant altogether and replacing it by either Diesel oil engines or compound high-speed reciprocating engines; the latter are preferable, in his opinion, owing to the limited experience with Diesel engines in this country. A steam plant without a battery would, he estimates, show a gross saving of about £800 per annum over the cost of running at present, or nearly £700 after allowing for interest and amortisation on the extra capital for the new plant. He estimates the cost of the new plant at £4,500, which might be reduced to £3,700 by sale of the old plant.

ANNUAL DINNER OF THE GLASGOW LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE annual dinner of the Glasgow Local Section of the Institution of Electrical Engineers was held on Wednesday of last week. Mr. Sam Mavor presided, and some 240 members and friends were present.

Professor Barr, when proposing the toast of "the Imperial Forces," said that in all branches in which the Navy had made progress, the electrical side was the one which had shown the most definite advance. Sir J. H. A. Macdonald replied. When proposing "the Corporation of Glasgow," Sir Hugh Shaw Stewart complimented the Council on the advance made in the electrical side of their undertaking. The Corporation were encouraging the use of electricity for heating and cooking purposes, and the relation of electrical power to the abatement of the smoke nuisance was not being neglected.

Bailie A. Campbell responded, and gave some interesting details in connection with the Glasgow Electricity Department. He pointed out that the department was started about eighteen years ago with a capital of £18,000, whilst at present the citizens had invested, through their Corporation, something like £2,250,000 in their Electricity Department. The revenue from electricity for light and power, apart from tramways, amounted last year to something like £260,000. Eighteen years ago it was necessary to charge 7d. per unit to pay expenses, but now it had reached 2½d. per unit for lighting purposes, and 1d. for power. By the existence of the Electricity Department, and the interest shown by the users of electricity for driving motors, there was an annual saving of about 30,000 tons of coal. Sir Donald McAlister submitted the toast of "The Institution of Electrical Engineers," and Mr. S. Z. de Ferranti (President, I.E.E.) in his reply emphasised the importance of all electrical engineers assisting in original scientific research in electricity, which had, up to the present, only been done by individual members instead of a co-operated body. "The Glasgow Local Section" was then proposed by Mr. W. H. Patchell, and the chairman replied.

CORRESPONDENCE

THE CHICHESTER ELECTRIC LIGHT & POWER CO., LTD.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—The attention of my Board having been called to a notice in the Press of the voluntary winding up of "The Chichester & District Electric Supply Company, Ltd.," I have been directed to ask the favour of your giving publicity to the following facts:—

That this company is the only body authorised to undertake the supply of electricity in Chichester, its powers being derived from a Provisional Order transferred to it by the Corporation of Chichester, and

That this Company is not, and never has been, in any way associated with the concern above referred to, or with any person connected therewith.

Yours obediently,
F. D. PEPPER.
Secretary.

The Chichester Electric Light & Power Co. Ltd.
7 Victoria Street, Westminster, S.W.
December 17th, 1910.

Atlantic Cable Amalgamation.—It is announced that negotiations have been completed for the amalgamation of the Western Union Telegraph Co. and the Anglo-American Cable Co. The Commercial Cable Co. have refused to enter into any combination for the control of the Atlantic cable service. According to the *Daily Telegraph* an agreement has been signed with the Postmaster-General for accepting half-rate for messages not in code. It is also stated that the British Government have granted landing rights for a third cable of the Western Union Telegraph Co.

Telewriter Shares.—In the King's Bench Division last week Mr. O. Bird sued Sir John Craggs and Mr. C. Howard Craggs for alleged misrepresentation in connection with the National Telewriter Co., Ltd. He stated that he was induced to underwrite 5,000 shares on an understanding that he would not be called upon to take them up, if the public did not subscribe for them. The public, as a matter of fact, did not subscribe for them, and several calls were made in respect of these 5,000 shares. Mr. Justice Eldon Bankes, after hearing the plaintiff's case, decided that no misrepresentation was proved, and that there was no case to go to the jury.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published December 15th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

27,968/09. **Commutating Poles.** Miles Walker (British Westinghouse Co.). This patent describes a method of obtaining automatic regulation of the commutating pole flux by connecting the exciting windings between two brushes close together in the neutral zone, one slightly in advance of the other. Wider brushes, and therefore a shorter commutator, can be employed. Four figures.

620/10. **A.-C. Electromagnets.** W. P. Orton (British Westinghouse Co.). In electromagnets with a central limb and side extensions outside the coil which almost touch the central limb at the bottom, a short-circuiting ring is sometimes employed to reduce chattering. According to this invention, an additional ring is placed round one of the faces of the outer limbs opposite the central moveable limb. This causes the latter to be tilted into contact with the outer limb, and the friction between them further reduces chattering. Five figures.

2,711/10. **Aluminium Field Coils.** Specialfabrik für Aluminium-Spulen und Leitungen Ges. (Berlin). Coils of bare aluminium wire are plunged, when hot, into a cold bath of sodium hydroxide or sodium carbonate solution. The liquid penetrates into the coils and, on drying, a strong insulating layer of aluminium oxide is formed on the wires. The carbonate solution is preferable, as it removes any grease remaining from the drawing process.

4,744/10. **Motor Starter.** I. Holmes (Keighley, York). A starter for large motors consists of a series of switch arms operated successively with time intervals by swivelling cams and each retained in the closed position by a pivoted bar engaging with a flat surfaced shaft. On the energising of the overload or no-voltage release coils, the shaft is rotated and all the switch-arms released. Nine figures.

10,315/10. **Oil Switches.** Siemens Bros. Dynamo Works, Ltd. (*Siemens-Schuckertwerke Ges.*). To obviate the danger of explosion in oil switches, the oil space in which the breaking movement takes place is completely filled, the oil extending upward either into a vent tube or into a narrow space enclosed by the rim of the vessel, so that the oil is kept under a slight head, whilst any gas can rise and escape. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Schmidt [Projection arc lamps] 1,751/10; Malachowski, 5,660/10; W. C. Heraeus [Tilting devices for mercury-vapour lamps] 8,126/10; Siemens Bros. Dynamo Works (*Siemens-Schuckertwerke Ges.*) [Search-lights] 8,507/10; Heraeus [Mercury-vapour apparatus] 19,563/10.

Dynamos, Motors, and Transformers: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Ship propulsion] 29,250/09; Siemens Bros. Dynamo Works (*Siemens-Schuckertwerke Ges.*) [Control of electrical machinery] 1,716/10; Crawford [Driving of train-lighting dynamos] 12,690/10; Siemens Bros. Dynamo Works (*Siemens-Schuckertwerke Ges.*) [Speed control of induction motors] 17,731/10, and [Polyphase commutator machines] 21,399/10.

Electric Ignition: Fortescue, 2,216/10; Cherry [Sparking Plugs] 17,745/10.

Electrometallurgy and Electrochemistry: Mulacek and Hatlanek [Induction furnaces] 674/10; Brougham (*Poldihütte Tiegel Gusstahlfabrik*) [Induction furnaces] 5,266/10; Henri, Heilbronner and Von Recklinghausen [Liquid steriliser] 14,129/10; Johnson (*McNitt*) [Electrolytic manufacture of alkali metals] 20,519/10.

Heating and Cooking: Binko and Mayer [Heating elements] 2,890/10.

Incandescent Lamps: Horvath, 7,373/10.

Instruments and Meters: Read [Absorption dynamotors] 578/10; Hookham [Motor meters] 3,174/10; Compagnie pour la Fabrication des Compteurs, etc. [Moving-coil recording instruments] 6,782/10.

Storage Batteries: Estelle [Manufacture of plates] 9,964/10.

Switchgear, Fuses, and Fittings: Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Motor controllers] 4,814/10, and [A.C. motor controllers] 11,904/10; Fortington-Neave [Motor controllers] 6,825/10; Wilkinson [Conduit and wiring fittings] 8,444/10; Gunner [Wiring conduit fittings] 12,903/10.

Telephony and Telegraphy: Fessenden [Utilisation of radiant energy] 28,577/09; Nash and Western Electric Co. [Covers for relays] 9,071/10; Schwarzhaupt [Telephone receiver] 12,739/10.

Traction: Stockdale [Signalling] 5,364/10; Moyes and Stevenson [Signalling] 5,615/10; Todd [Magnetic brakes] 7,048/10.

Miscellaneous: Long [Temperature indicator] 27,678/09; Scherl [Gyroscope stability mechanism] 27,688/09, 27,838/09, and 27,839/09; Oglesby and Ayton [Packing of incandescent lamps] 28,133/09; Ruthenberg [Distillation of coal] 29,328/09; Alliott, Hailwood and Dean [Miners' safety lamps] 29,818/09; Fabris [Signs] 30,469/09; Boult (*International Telechronometer Co.*) [Apparatus for supplying intermittent D.C. current] 849/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.:—Girardelli [Motors with rotating fields for transmitting angular movements to a distance] 22,714/10; Breslauer [Generators] 26,187/10.

Electric Ignition: R. Bosch, 22,580/10; Pieper, 27,230/10.

Electrochemistry: Morrison [Primary cells] 25,515/10.

Switchgear, &c.: Elektromechanische Werke Ges. [Rectifiers] 27,060/10.

Telephony, &c.: Siemens & Halske A.-G. [Automatic telephone circuits] 27,026/10; Girardeau [Wireless apparatus] 27,247/10.

Traction: Alwies [Street indicators] 27,652/10.

Opposition to Grant of Patents

15,151/09. **Controllers.** R. C. Lyness. The grant of this patent has been allowed in spite of opposition. It covers a contact finger for controllers, which is sprung into a bracket on the contact base, and is provided with a renewable tip sprung on to the finger.

10,802/10. **Prepayment Meter.** W. V. Palmer. This patent has been granted in spite of opposition. It covers a device for use in prepayment meters to prevent the insertion of too many coins at one time and jamming the mechanism.

Applications for Amendment

13,276/04. **Protective Devices for Transformers.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). The British Thomson-Houston Co. desire to amend this specification, which covers a method of connecting tripping coils in shunt to the secondaries of series transformers in the primary and secondary circuits of the transformer to be protected, and arranging them in such a manner that the tripping coils are operated on a change of the normal ratio of current in-put to out-put. It is proposed to delete certain parts of the specification and one figure, and to insert a specific reference to British Patents Nos. 3,896/04 and 11,364/04.

18,909/05. **Electric Welding of Sheet Metal.** A. F. Rietzel. The Pontelec Welding Patents, Ltd., of London, desire to amend this specification, which covers a process of electric spot welding, consisting in providing a number of contact spots over the surface of the sheets and then applying current and mechanical pressure until the sheets soften and weld at the contact points. It is proposed to insert a reference to British Patent No. 11,921/03 by Mr. Ferranti, and to disclaim the melting of the metal at the points of contact.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: F. M. Ekert [Insulating material] 17,396/05.

Dynamos, &c.: J. W. Macfarlane [Hydro-extractors and vertical motors for same] 19,060/02; H. Leitner and R. N. Lucas [Train-lighting system with differentially wound generator] 18,581/03.

Electrometallurgy, &c.: H. M. Chance [Electrolytic purification of metals] 17,449/05.

Instruments, &c.: W. Stanley [Integrating watt-meter] 18,858/02.

Switchgear, &c.: British Thomson-Houston Co. (*E. M. Hewlett*) [Circuit-breaker with magnetic blow-out without special coil] 17,193/01; T. Zweigbergk [Traction controller] 19,032/02; W. Fairweather (*Diehl Manufacturing Co., U.S.A.*) [Controllers for sewing machines] 18,907/03; W. and J. Y. Middleton [Cable couplings and terminals] 18,919/04.

Telephony, &c.: O. Imray (*Soc. des Telegraphes Multiplex, System E. Mercadier*) [Multiplex telegraph with alternating currents] 18,867/03; C. M. Jacobs and A. H. Nicholson [Automatic telephone exchange] 17,380/05.

Traction: J. Gresham [Pipe couplings for railway carriages] 17,423/01; T. Zweigbergk [Multiple-unit control system] 19,032/02; J. Carter, G. Hall, and A. Parsons [Automatic circuit-breakers or hanger cut-outs for trolley wires] 4,918/04.

Miscellaneous: H. E. Parsons [Smoke consuming furnace] 17,163/01; G. L. Scott [Oven with air circulation] 17,510/02; R. P. Lloyd and P. Noel [Advertising device] 17,786/05.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

CALENDARS, &c.—A very serviceable desk calendar and blotting pad has been sent us by Bruce Peebles and Co., Ltd. (Edinburgh). A feature of this is the large note-book attached to the left-hand side consisting chiefly of squared paper, and with the first few pages devoted to abridged specifications and approximate price lists of the firm's standard manufactures.

Siemens Brothers' Dynamo Works, Ltd., conjointly with Siemens Brothers & Co., Ltd., have been kind enough to send to our editor and assistant editor copies of the 1911 issue of their well-known pocket diary in morocco leather binding. This, as usual, contains in a compact form much useful information and a new set of illustrations which give a good idea of the wide range of the activities of the two firms.

The convenient pocket diary of Simplex Conduits, Ltd., makes its appearance in an even more attractive form than usual this season. Full particulars of standard conduits are included, with many useful tables of wires, &c., and quite a compendium of electric engineering information, the lighting data being particularly well selected. The Company request us to state their stock of these diaries is already exhausted.

The Union Electric Co. have adopted an effective coloured design showing a large Excello lamp hanging over London for their wall calendar for 1911. The same design is also being used as a show-card, and can be supplied to contractors with their own names and addresses printed on.

FITTINGS.—A handsome illustrated catalogue of artistic electric light fittings and sundries is being issued by A. Emanuel and Sons, Ltd. (13 George Street, Manchester Square, W.). This deals with a great variety of brackets, ceiling fittings, pendants, lanterns, electroliers, standards, hand-lamps, etc., for interior lighting, as well as water, light, and other fittings for exterior lighting, reflectors and signs, ornamental metal plates and accessories. The interest is enhanced by the fact that a large proportion of these fittings are manufactured at the company's own works.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ARC LAMPS.—A new list of enclosed arc lamps is being issued by Crompton and Co., Ltd. (Salisbury House, London Wall, E.C.). Full descriptions of a variety of patterns are included, both for continuous and alternating currents. Among them are single carbon and twin carbon lamps for use under various conditions, single and double enclosed, with several different styles of lantern and globe. Full lists of accessories and spare parts are included.

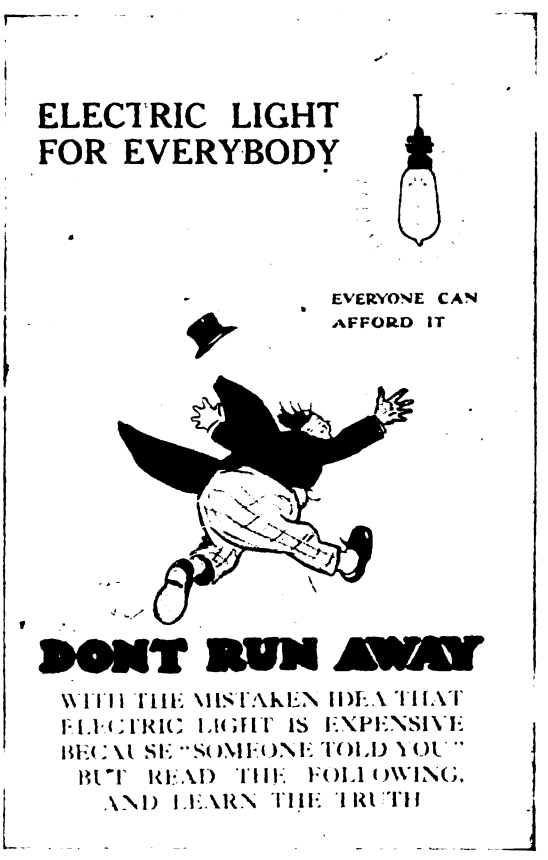
INSULATING VARNISH, &c.—A well got up catalogue of special varnishes and other preparations for the insulation of electrical machinery is being issued by Messrs. Pinchin, Johnson and Co., Ltd. (26 and 27 Bevis Marks, E.C.). A great deal of useful information is given regarding each class of materials listed, facilitating their selection and application. The booklet is also made attractive by photographs of machines in the construction of which those compounds are used. The range of varnishes is too long to repeat here, but the thoroughness with which the company has gone into the requirements of manufacturers of electrical machinery is shown by the fact that no less than nineteen varieties, each suited to particular electrical purposes, have been standardised. Among these we have special armature varnishes for stoving, elastic and quick-drying varnishes, special varnishes for traction motors, black and golden finishing varnishes, core plate and acid resisting varnishes, and a special material for making up micanite. Joint box compounds and similar materials are also made in considerable variety.

TELEPHONES, &c.—We have received from the Western Electric Co., Ltd. (Norfolk House, Victoria Embankment) a copy of a new list of telephone switchboards and instruments, including apparatus for central battery, magneto, and local battery systems. A great variety of private exchange boards are dealt with, as well as instruments of the wall and table patterns, both for exchange and private lines. Another section contains particulars of intercommunication sets on several different systems. Street, portable, and military telephone sets are also included. A smaller list deals with domestic telephones and intercommunication sets, and separate pamphlets are also being issued regarding cable terminals for outdoor and indoor line construction, condensers for telephone and telegraph service, lightning protectors, and aerial cable and line construction specialities.

MOTOR-CAR ACCESSORIES, &c.—A list from Messrs. S. Smith & Sons (9 Strand, W.C.) contains particulars of a number of patterns of speed indicators, lamps, horns, &c., including complete dynamo outfits for electric motor-car lighting, with cut-out arrangements depending both on speed and voltage. Electric horns are also dealt with. Separate lists deal with watches, clocks, &c., for all requirements.

TELEPHONES.—The Peel-Conner Telephone Works, Ltd. (Peel Works, Adelphi, Salford, Lancs.), have issued the first of a series of bulletins dealing with their products. This number is devoted to Magneto Call Telephones, and is far more than a price-list. It contains descriptions of a complete and technical character of every pattern of this class of apparatus, which the company makes, and is illustrated with finely-finished photographic blocks of the various instruments and parts, and also drawings of connections, etc. So complete is the bulletin that if the intention of the company to produce successive ones in the same style as carried out, they will, when completed, form a veritable treatise on the whole subject of telephony. We have also received from the same firm a pamphlet in an artistic folder, giving an account of the proceedings at the official inspection of the new Central Telephone Exchange at Glasgow, which was equipped by the Peel-Conner Telephone Works, Limited. The publication includes a brief but well-illustrated description of the Exchange, mentioning particularly the important features, and it also quotes press notices from some of the leading daily papers. It is evident that the Peel-Conner Telephone Works intend to keep the telephone exchange managers and officials well supplied with exceedingly attractive literature on the subjects which interest them.

SUPPLY ADVERTISING.—A striking new leaflet, the front page of which is reproduced here, is being issued by the Electric Publicity Committee. The sketch of the man running away is by Mr. Charles Crombie. The savings effected by electrical



methods are tersely and forcibly put in the interior pages. The circular is intended to arrest the attention of non-consumers, and to dispel antiquated ideas of the expense of electric lighting. The committee are also issuing a booklet for shopkeepers, illustrated with specimens of up-to-date lighting.

ARC LAMPS.—The Globe Electric Co., Ltd. (11 Farringdon Avenue are issuing a new pamphlet on their "Multax" long burning flame arc lamp, of which considerable quantities have been sold since their introduction early in the year. A full description of this lamp with its "bridge core" carbon was given in ELECTRICAL ENGINEERING, March 10th, page 163. It is important to notice that the prices of the special double carbons used have been reduced so that they are now even cheaper for given burning hours than the single carbons used in some competing lamps.

Crystal Palace School of Engineering.—The award of certificates took place at the school yesterday morning. Mr. Alexander Siemens was in the chair.

OSRAM LAMPS

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THE WIRELESS TELEGRAPH PATENT CASE

A REPORT of the first two days' proceedings in the action between Marconi's Wireless Telegraph Co. and the British Radio Telegraph and Telephone Co. was given in our last issue. On Monday of last week, the first day, Mr. Astbury, K.C., for the Marconi Co., opened that part of the case in respect of Patent No. 7,777 of 1900, covering the use of a closed oscillating circuit inductively coupled to the aerial circuit by means of a transformer, the periods of oscillation of these circuits being the same. Mr. Justice Parker will probably deliver judgment with regard to this patent before the other two for the magnetic receiver and the toothed-wheel discharger respectively are dealt with. Mr. Swinburne was in the witness box on Tuesday, Wednesday, and Thursday, and Mr. Dugald Clerk on Friday. The hearing was resumed on Tuesday, when Mr. J. Pletts (of the Marconi Co.) gave evidence, and Mr. Walter addressed the Judge on behalf of the Marconi Co. Yesterday Mr. Terrell gave his opening address for the defendants, and the case was then adjourned until after the Christmas vacation, when it will be taken on three days in each week until completion.

It will be remembered that Mr. Astbury described the particular advantages of the arrangements in Marconi's patent, and pointed out that the defendant company had exactly similar apparatus except that an auto-transformer was employed in place of a double-winding transformer. Mr. Swinburne, examined by Mr. Walter, said that the feature of the patent was that all the circuits were tuned right through. He had tested oscillating circuits arranged according to the diagram published by the defendants, and had proved that it made no difference whether a double-winding transformer or an auto-transformer were employed.

Mr. Terrell then cross-examined Mr. Swinburne with regard to several patents put forward by the defendants as anticipating Mr. Marconi's patent. The first of these, No. 8,575 of 1891, by Nikola Tesla, describes apparatus for producing high potentials at high frequency by discharging an oscillating circuit into the primary of a transformer; the second, No. 20,981 of 1896, also by Tesla, covers an arrangement in which a condenser is intermittently charged and discharged into the primary of a transformer by means of a high-speed rotary commutator. Mr. Terrell read out a passage in this last specification stating that the charging and discharging circuits should have equal periods of electrical vibration. Mr. Swinburne held, however, that there was no real resonance in the arrangement, nor did he think that a passage in a Paper read by Tesla before the National Electric Light Association at St. Louis in 1893, which Mr. Terrell read out, indicated real tuning. Further, in Tesla's arrangements, the secondary was a closed circuit, and there was no suggestion of using it as a radiator.

Questioned on Lodge's patent, No. 11,575 of 1897, Mr. Swinburne admitted that Lodge appreciated the importance of tuning the receiving to the transmitting station, so as to build up oscillations in the receiving circuit and to admit of selective signalling. Lodge did not, however, divide his transmitting circuit. One figure showed a coherer and a battery in a secondary circuit of a transformer, the primary of which was in series with the aerial, but this coherer circuit could not be tuned to the aerial circuit. Two other Lodge patents, Nos. 18,644 and 29,505 of 1897, were also referred to by Mr. Terrell. The first related to receiving circuits for Hertzian wave telegraphy, and the second to tuning for selective working in magnetic induction telegraphy. A patent by Dr. S. P. Thompson, No. 525 of 1898, also relating to tuning in telegraphy by magnetic induction, was also discussed, but Mr. Swinburne pointed out that in both these last cases the circuits were tuned to the frequency of the impressed impulses.

A patent by Braun, No. 1,862 of 1899, was then put forward by Mr. Terrell as anticipating Marconi. This claimed the use of long waves obtained by inserting inductance in the oscillatory circuit, and incidentally described the use of a transformer between the closed oscillatory and aerial circuits. Mr. Swinburne admitted that this arrangement was the same as Marconi's with the exception that nothing was said about tuning the secondary to the primary circuit. Another Braun patent, No. 1,863 of 1899, referred to the vibrations being superposed on the secondary circuit, but Mr. Swinburne held that in this also there was no intention of tuning.

On Thursday, in the course of Mr. Swinburne's cross-examination, experiments were made by Mr. Duddell with an oscillograph projecting on to a small screen, to demonstrate the effect of altering the electrical constants of an oscillating circuit, and the coupling between two oscillating circuits. The difficulty of producing resonance with a very tight coupling, and the lengthening of the period of highly damped waves by the insertion of resistance, were also shown. Finally, an experiment was made on a model of the defendants' apparatus. The inductance *M* (called by the plaintiffs an auto-transformer) in the diagram of the defendants' apparatus was divided into two parts, which were put at right-angles

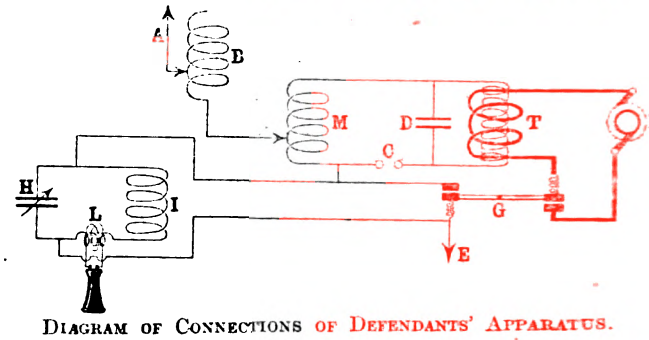


DIAGRAM OF CONNECTIONS OF DEFENDANTS' APPARATUS.

so as to have no inductive effect on each other, and it was admitted by Mr. Swinburne that the effect was practically the same as when the two parts were side by side (as they are in the actual apparatus), *i.e.*, that there was practically no mutual induction between them. From this, Mr. Terrell inferred that there was no transformer action in the defendants' arrangement.

Mr. Swinburne, examined on the Marconi patent in question, said that tuning was the main point of the claims. No particular kind of transformer was claimed. He did not know why Marconi had not claimed tuning the receiving circuits also. Mr. Terrell suggested that the reason was that it was well known at the time. According to Mr. Swinburne, an auto-transformer with the whole winding common to both circuits was still an auto-transformer, but Mr. Terrell asserted that the winding was then merely an inductive shunt to the circuit, *i.e.*, that it was only a transformer so long as there was a step-up or step-down effect, and consequently that the defendants' arrangement of coils could not be called a transformer.

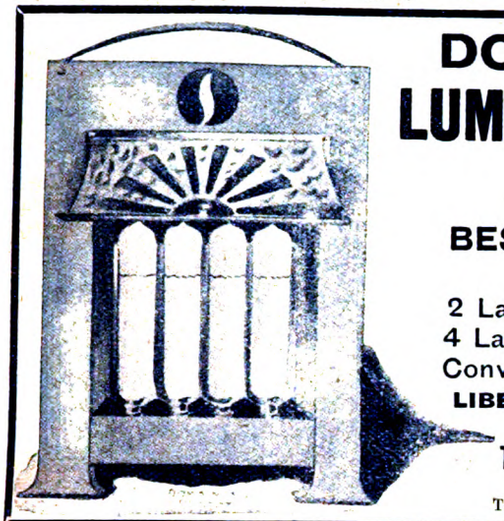
On Friday, Mr. Dugald Clerk was examined on the same points as Mr. Swinburne. He confirmed the evidence as to the novelty of the arrangement described in Marconi's patent, and the identity of the defendants' arrangement with an auto-transformer.

Mr. J. Pletts, of the Marconi Co., giving evidence on Tuesday, stated that he had erected the early Marconi stations in the Sandwich Islands prior to 1900. They had then only succeeded in communicating over 70 miles, but after applying the system described in the patent, they reached to 150 miles, or over double. He also gave evidence with regard to the action of the defendants' apparatus.

Mr. Walter then summed up the case for the Marconi Co. He dealt chiefly with the question of infringement, insisting that the defendants' inductance coil acted as an auto-transformer, and therefore came within the claims of the Marconi patent.

Mr. Terrell then proceeded to state the case for the British Radio Telegraph & Telephone Co. He said that he would show that there was no subject-matter for Marconi's patent, as it was merely a combination of Braun's transformer with what was common knowledge in 1900 as regards tuning. As Marconi did not claim the use of an auto-transformer, he did not think the defendants infringed if their device acted as such, but he hoped to prove, with the aid of expert witnesses, that the defendants' device did not even act as an auto-transformer. Referring to the diagram, he held that the few turns of *M* below the point where the aerial connection was made acted merely as an inductive shunt, and explained the action as follows:—The oscillatory circuit consisted of a capacity *D*, the inductance *M*, and a spark-gap *C*. When an oscillatory discharge took place across the gap, a portion of the total current was conducted into the aerial from *M*, the lower turns acting as an impedance to this current and forming no part of the radiating circuit. The aerial circuit could be said to be from *A*, through *B*, the upper portion of *M*, through *D* and across the gap *C* to earth *via* the key contact

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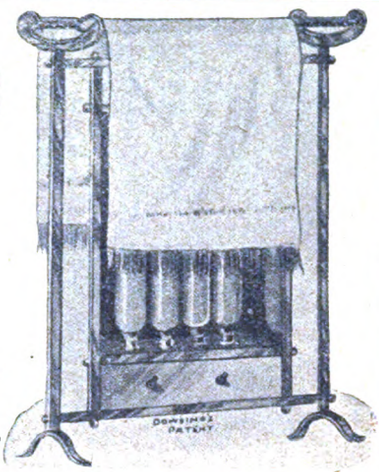
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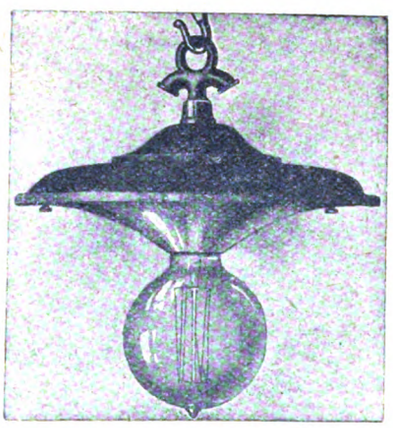
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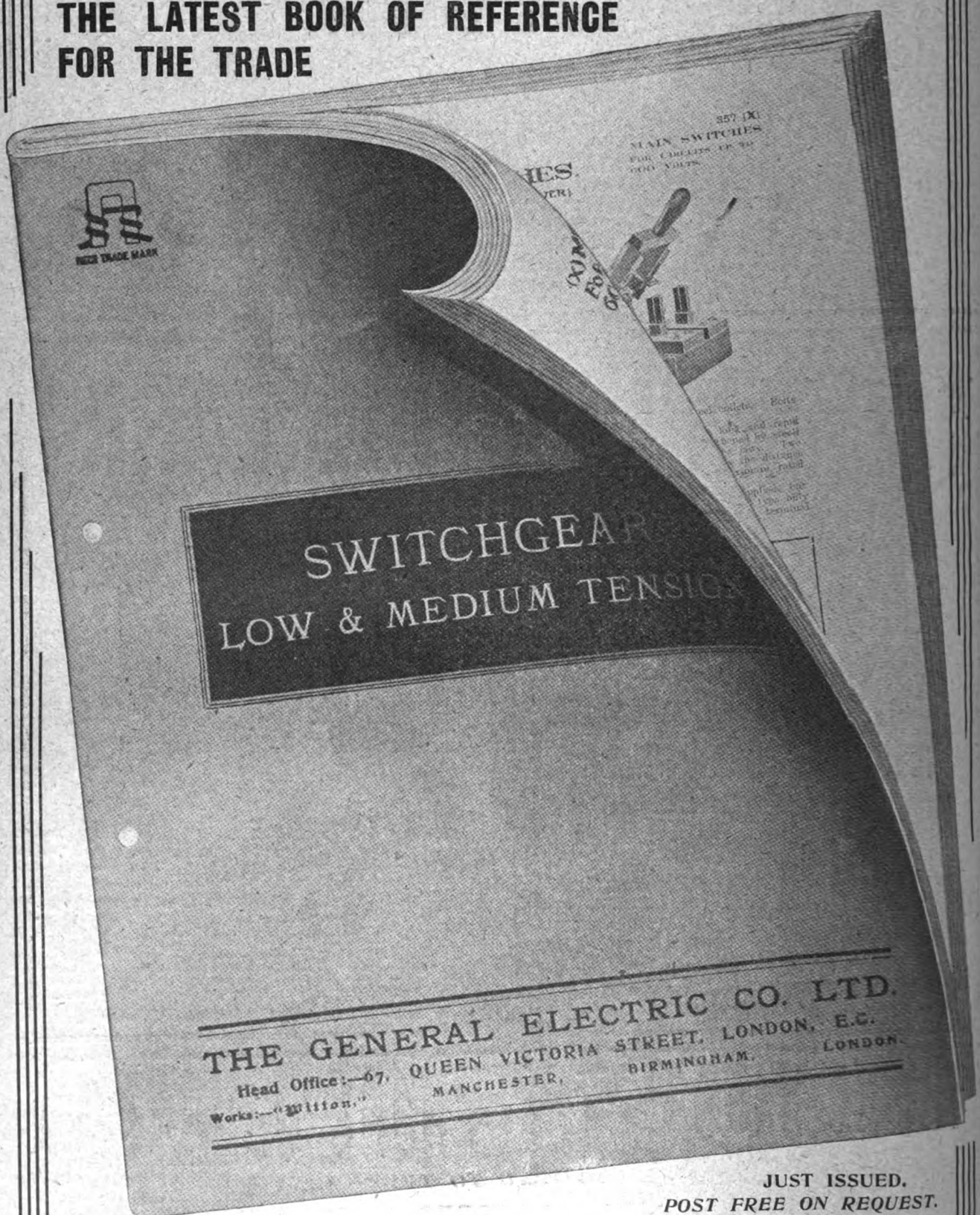
Telephone Men. LV. Charles William Salmon.
Papers: Their Writers and Audiences. By E. Hare (concluded).
The Pupin System applied to Aerial Telephone Lines (concluded).
The Psychology of the Office. By J. F. Scott.
A Year's Growth of the Telephone. By W. H. Gunston.
Automatic versus Manual Switchboards. By John J. Carty (concluded).
Method of Locating and Repairing Faults in Underground Cable. By J. W. Warnock.
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Mr. Swinburne was again called at this point, as it was complained that this point of view had not been put to him. He disagreed with it, and stated that during radiation, the aerial circuit would be from *A*, through the lower turns of *M* to earth, and that consequently these turns could be looked upon as part of a secondary circuit receiving oscillations from the primary oscillatory circuit. Mr. Terrell, continuing his speech yesterday, pointed out that the omission of an iron core in the inductance *M* made the transformer effect negligible.

Some interesting information with regard to the expenses of the case were published in the *Daily Telegraph* last week, prefixed, however, by the words "it is stated." Our contemporary says that each of the leading counsel has his brief marked at 400 guineas, to which a daily fee, known as a "refresher," has to be added. According to the custom of the profession, the juniors receive two-thirds of the "leader's" fee. Hence the retainers will make an aggregate of about £1,740, to which an extra £100 may be added in the case of Mr. Astbury, K.C., in his capacity as a "special."

LOCAL NOTES

Beckenham: *Street Lighting.*—The Electricity Committee recommend that the Shortlands district be lighted by electricity, the price per lamp per annum being £3 7s. 6d. In addition, the Committee are to defray the cost of the services, cables, lamps, and fittings at an estimated cost of £350.

Glasgow: *Smoke Abatement Exhibition.*—There is a surplus of £1,145 from the Smoke Abatement Exhibition, which was recently held. It is recommended that £200 of this surplus be paid to the Electricity Department and a similar sum to the Gas Department. The balance is to be handed to the Sub-Committee of the Health Committee on Air Purification.

Handsworth: *Tramway Electrification.*—The Town Clerk has been instructed to ask the General Manager of the Birmingham Corporation Tramways as to the steps that have been taken under the arrangement made with the Council for converting the cable lines to electric traction. The Tramways Committee have given instructions for the preparation of plans, sections, and specifications, for the track work, and under the agreement with the Corporation the latter are to supply the overhead equipment.

Leicester: *Electricity Undertaking.*—Mr. James Swinburne, who was called in recently to advise the Corporation as to the best method of reorganising the electricity undertaking—there being a separate tramway power station—recommended that the two works should be linked up and worked as one undertaking. He estimates that a saving of £2,000 per annum will be effected by this course.

London: *Lewisham: Street Lighting.*—The County of London Electric Supply Co. and the South Metropolitan Gas Co. have been granted permission to carry out experimental street lighting.

County Council: Assessment of Greenwich Generating Station.—The assessment of the L.C.C. power station at Greenwich was inserted in the quinquennial valuation list at £60,300 gross, and £40,200 rateable. The Local Government Committee of the County Council appealed against this, and the figures were reduced to £60,000 gross, and £38,000 rateable. The Committee are now advised that a fair valuation would be £27,500, and an appeal to Quarter Sessions is recommended.

Marylebone: Electricity Accounts.—The revenue account for the September quarter shows a gross income of £27,756 against £22,826 for the September quarter of last year. The two items primarily responsible for the increase are the larger public lighting income and the substantial turnover of the Sales Department. After reducing the gross income for each quarter by the public lighting special charges, and the prime cost of the various works undertaken by the Sales Department, the comparative figures are: Sept., 1910, £24,681, and Sept., 1909, £22,199, giving an increase of £2,482, against which has to be set the cost of the Sales Department establishment. The working of the Sales Department for the quarter shows a loss of £178, compared with £509 for the June quarter. The average costs per unit sold were 1·25d. per unit, exclusive of capital charges, compared with 1·362d. and 1·767d. for the two preceding September quarters. At the meeting of the Council on Thursday, Councillor Duncan Watson adversely criticised the working of the electricity undertaking, and said he failed to see that there was evidence of anything having been done by the fifteen highly trained business-getting officials in the Department, about whom so much had been heard.

Norwich: *Proposed Purchase of Tramways.*—The Law and Parliamentary Committee recommend that notice of purchase be given to the Norwich Electric Tramways Co. for Aug. 6th, 1911.

Paisley: *Tramway Extension.*—The extension to Rouken Glen from Barrhead will be opened by the Paisley & District Tramways Co. in a few days' time.

Scarborough: *Tramways.*—A conference took place between the Corporation and the Scarborough Tramways Co. last week with regard to the winter service, but although a long discussion ensued, it is stated that no fresh proposals were formulated. The matter was later discussed at a meeting of the Streets and Buildings Committee, who recommend that the company be proceeded against for non-compliance with the order of the Board of Trade. The maximum penalty is £5 per day.

Shipley: *Quick Motor Connection.*—The Electricity Department carried out a prompt piece of work last week. At 10 a.m. on Friday a telephone message was received for an electric motor; at 11 o'clock the application form was filled in and signed, and the deposit paid, and within twenty-four hours the complete installation, including motor, switchgear, &c., had been installed and actually put into operation. Further, the whole of the work was done by the ordinary staff in the ordinary working hours.

Sunderland: *Electric Lighting Charges.*—There was some discussion at the last meeting of the Corporation with regard to the proposed revision of the electric lighting tariffs mentioned in our last issue. On a vote being taken there was a tie, but the Mayor gave his casting vote in favour of the Committee's recommendations.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Brighton.—Additional sub-stations are contemplated.

Edinburgh.—An application for an additional loan of £75,000 for electrical purposes is to be made.

Gateshead.—The Guardians invite tenders for generating machinery, storage battery, switchboard, and wiring installation for about 500 lights. Particulars from the Clerk, Prince Consort Road, and tenders by Jan. 9th.

Harrogate.—An application for a loan of £2,500 for new mains is to be made.

Leyton.—A Local Government Board inquiry was held last week concerning a loan of £7,000 for electrical extensions.

London: *Battersea.*—Additional services at an estimated cost of £54 are to be laid.

County Council.—It has become necessary to instal new high-tension switchgear in place of the existing plant at the Camberwell and New Cross sub-stations, owing to the existing installation being of an old pattern and not complying with the electricity regulations recently issued under the Factory and Workshops Act. Tenders are to be invited for the new work.

Southampton.—The Electrical Engineer proposes to duplicate the main from the Western Shore works to Shirley at an estimated cost of £1,350. He also proposes to duplicate the Portswood main over a portion of its length at an estimated cost of £800.

Yarmouth.—The Local Government Board have sanctioned loans of £3,500 for mains; £750 for a cooling tower; and £1,550 for public lighting.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Conversion of premises at junction of Merton Road and Standen Road, Southfields, to cinematograph hall.

Structural improvements at the Redvers Street School, Hoxton.

PROVINCES.

Barnsley.—Electric theatre in Eastgate.

Birmingham.—New Council School in Cherrywood Road, Bordesley Green.

Bolton.—Presbyterian Church in St. George's Road.

Bradford.—Infirmary in Duckworth Lane. Architect, Mr. K. D. Young.

Cardiff.—Additions to Seamen's Institute, Barry Dock. Architects, Messrs. Tather and Wilson.

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Carlisle.—School in Newtown district.
Gravesend.—Electric theatre, Windmill Street.
Grimsby.—Extensions to Public Library.
Haslingden.—Lighting of new Infirmary.
Lincoln.—Library in Free School Lane.
Manchester.—Alterations and additions to Municipal School, Cavendish Road, Withington.
Margate.—New general hospital. Trustees of Margate Cottage Hospital.
Paisley.—Extensions to Post Office.
Pudsey.—United Methodist Sunday School and Institute. Architect, W. H. Dinsley, Chorley, Lancs. Tenders for building by Jan. 7th.
Redditch.—School in Bridge Street.
St. Helens.—School in Robin's Lane.
Swansea.—Cinematograph hall in High Street.
Weston-super-Mare.—St. Paul's Church. Erection to be commenced shortly.

MISCELLANEOUS

Ayr.—It has been decided to proceed with the Hawkhill tramway extension at an estimated cost of about £13,000.
Dundee.—A report has been prepared by Mr. Peter Fisher, the tramway manager, upon some tramway extensions at an estimated cost of £7,190.
London: *Hackney.*—The Guardians require telephone installations in the "A" and "B" pavilions at the Homerton Infirmary. Particulars from the Clerk, and tenders by Jan. 4th.
County Council.—Tenders are invited for the supply of cable ducts in connection with the reconstruction of the tramways from Baring Street, via Southgate Road and Green Lanes, Finsbury Park.
Salford.—Tenders are invited by Jan. 16th for a steam-driven air-lift pumping plant at the Frederick Road Electricity Works.

TENDERS RECEIVED AND ACCEPTED

Barnsley.—The tender of the Tudor Accumulator Co., Ltd., for replating the traction battery at £555 15s. has been accepted.
Broadstairs.—The tender of the Isle of Thanet Electric Lighting & Tramways Co. to erect five arc lamps in High Street and St. Peter's Road at a cost of £50 per annum has been accepted. The Gas Company offered to do the work for £42 15s., but an amendment to accept this tender was rejected at the last meeting of the Council.
Glasgow.—The British Westinghouse Co. have offered to put down an electric lighting and power plant at the Scottish History Exhibition next year on condition that the Corporation purchase the plant at the close of the exhibition at £4,805, a price which is considerably less than cost. The stipulation is that the plant is to be acquired by the Corporation as their requirements necessitate, the purchase money not being paid until the installation of the plant is complete. The Glasgow Electricity Committee recommend the acceptance of the offer.
London: *Battersea.*—The offer of J. B. Garnham to purchase scrap copper from the Electricity Works at £54 2s. 6d. per ton has been accepted.
County Council.—The tender of the St. Pancras Ironworks Co., Ltd., for a weather shelter at New Cross Gate at £210, is recommended for acceptance.
The following tenders have been received for charging apparatus for the electrically-driven motor escape vans which are to be placed at the new fire stations in Parnell Road and Brunswick Road, Bow:—Electric Construction Co., Ltd., £260; Lancashire Dynamo & Motor Co., Ltd., £280 15s.; General Electric Co., Ltd., £293; Wright & Wood, Ltd., £304. The first-named tender is recommended for acceptance.
Walsall.—The tender of Messrs. Babcock & Wilcox, Ltd., for a water-tube boiler has been accepted at £1,189. The Underfeed Stoker Co. will supply the stoker.

The Diesel Engine Co., Ltd., have just received the following orders:—From the Hoffmann Manufacturing Co., Ltd., of Chelmsford: One 220 kw. generating set, consisting of a three-cylinder Diesel engine, running at 187 r.p.m., direct coupled to a shunt wound multipolar continuous current generator of 110 volts, built by the General Electric Co., Ltd., to run in parallel with the existing Diesel generating set of the same output. From the Daimler Motor Co., Ltd., of Coventry: One 525 b.h.p. three-cylinder Diesel engine, running at 150 r.p.m., direct coupled to a Dick, Kerr two-phase alternator, built to run in parallel with the two existing 218 kw. Diesel engine sets, which have been running since February, 1908.
Messrs. David Bridge & Co., Ltd., Castleton, Manchester, have received an order for a hydraulic vulcanising press, 14 ft. long by 54 in. wide, with 12 rams, for the Premier Reforming Co., Ltd., of Walthamstow, for the manufacture of sheeting and other goods. Messrs. Bridge have also installed three of their special heavy grinders, each electrically driven.

APPOINTMENTS AND PERSONAL NOTES

Mr. Herbert A. Jones, who has made many friends during the past eleven or twelve years he has been with the Phœnix Dynamo Manufacturing Co., Ltd., of Bradford, has resigned his position as managing director, and in the new year is commencing business in London in partnership with Mr. T. K. Irwin (for many years general manager of John Butler & Co., Ltd., Stanningley Ironworks, Leeds) under the style of Irwin & Jones, engineers and agents, 5 London Wall Buildings, London, E.C. When Mr. Jones first assumed control the company only employed a dozen hands or so, whereas now some three hundred are at work.
There were 48 applications for the post of traffic assistant in the L.C.C. Tramways Department at a salary of £600 per annum, and the following three gentlemen formed the final selection:—Mr. R. Fritz Rogers, Traffic Superintendent, London United Tramways; Mr. F. Schofield, Tramways Manager, Leyton District Council Tramways; and Mr. L. Slattery, Manager of the Oldham Corporation Tramways. The Highways Committee recommend the appointment of the last-named.
The Bristol Corporation Electricity Department desires to find appointments for a number of trustworthy and experienced engine-drivers, stokers, and other station hands, whose services are obliged to be dispensed with owing to one of their generating stations being no longer required. (See an advertisement on another page.)
Owing to the death of Mr. M. Sutherland, Burgh Electrical Engineer at Oban, Mr. E. G. Stagyle has been appointed Burgh Electrical Engineer temporarily.
A meter tester is wanted at Barrow-in-Furness, with experience of Chamberlain & Hookham meters.
A junior shift engineer is required at Stepney (see an advertisement on another page).

Obituary.—We regret to announce the death of Mr. J. R. Salter, General Manager of the Lancashire United Tramways Co. Mr. Salter, who was only 35 years of age, spent several years as assistant to the late Dr. John Hopkinson, and later joined the late Sir Clifton Robinson as assistant in connection with the electrical equipment of the London United and Bristol tramway systems. He thus had a great deal to do with the introduction of electric traction in London, and the difficulties which arose in connection with electrolysis, and interference wth the Kew Magnetic Observatory. In 1902 Mr. Salter took up the duties of Engineer-in-Chief to the Lancashire United Tramways Co., and has been responsible for the complete organisation and development of that extensive system.
The New York Explosion.—The serious explosion which occurred in New York on Monday morning, near the Grand Central Terminus of the New York Central Railway, has given rise to somewhat conflicting reports, but appears to have originated on the premises of New York Central Railway in the ignition of lighting gas escaping from a pipe or reservoir broken by a train running into the buffer stops. The gas seems to have pervaded the underground station of the New York subway, and the explosive mixture is reported to have been ignited by an electric spark. This first explosion caused the explosion of a car of dynamite on the adjoining premises of the New York, New Haven, and Hartford Railway, and the complete wreck of a new sub-station of that railway under construction near by. Considerable damage was done to all buildings in the neighbourhood, several persons were killed, and a large number were injured. In Lexington Avenue a tramcar is said to have been lifted bodily off the ground, and to have fallen over on to a passing automobile.
The G.B. System in the Mile End Road.—An application was made on Friday to Mr. Justice Ridley regarding the verdict recently given against Sir John Benn for £12,000 damages in respect of certain statements made by him concerning the G.B. surface-contact system. At the trial a stay of execution was granted provided security was given for £5,000 within ten days. The application now made was to the effect that this security had not been given, and that an affidavit had been filed stating that Sir John Benn had no intention of giving it. In these circumstances, as Messrs. Griffiths and Bedell propose to issue a bankruptcy notice against Sir John Benn, an order of the Court was asked for, saying that the stay of execution was removed. On behalf of Sir John Benn it was asked that the order should not be made in view of the magnitude of the damages, and the fact that the appeal against the verdict was expected to be heard early in January. Mr. Justice Ridley decided that the stay was removed.

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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £59 to £59 10s. per ton (last week, £59 to £59 10s.).

Canadian Agencies.—A Birmingham company manufacturing electrical fittings are anxious to appoint first-class Canadian agents.

A Montreal importer of electrical supplies inquires for the names of United Kingdom manufacturers of ignition magnetos.

Further information at Office of High Commissioner for Canada, 17 Victoria Street, London, S.W.

An agent in Vancouver offers to represent United Kingdom manufacturers of electrical appliances and supplies.

Exhibition Awards.—The India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., Silvertown, London, E., have received the following awards for their display at the Railway & Land Transport Exhibition held at Buenos Ayres:—Three grand prizes for brake hoses, motor tyres, and cycle tyres; gold medal for india rubber tiling; and diploma of honour for telegraphic apparatus.

Agency.—On and after January 1st next, Messrs. Felten & Guilleaume's agency for insulated wires and cables, rail bonds, and rubber manufactures will be conducted by Mr. R. R. Todd at 324 Birkbeck Bank Chambers, W.C. Mr. Todd has for the last eight years managed this agency, first under Messrs. W. F. Dennis & Co., and subsequently under the Lahmeyer Electrical Co., Ltd.

Bankruptcies.—The last day for receiving proofs in the bankruptcy of W. G. Everingham, electrician, 37 Auckland Road, Ilford, is Dec. 28th. The trustee is Mr. J. Mercer, 14 Bedford Row, London.

A first and final dividend of 7d. in the £ will be paid on Dec. 29th in the bankruptcy of A. E. Felgate and W. Storey, electrical engineers, 10 Queen Victoria Street, Reading.

New Zealand Agency.—A Christchurch firm of engineers desires to obtain the agency of British manufacturers of electrical motors, cables, and electrical fittings. Apply 73 Basinghall Street, London.

Change of Address.—The London agency of Dr. Heinr. Traun was removed on Dec. 21st from 8 Redcross Street to 23a Goswell Road.

Christmas Holidays.—Siemens Brothers Dynamo Works, Ltd., inform us that their stores and showrooms at 39 Upper Thames Street, E.C., will be closed on Monday and Tuesday, 26th and 27th inst., and also for stocktaking on Friday and Saturday, the 30th and 31st.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

India Rubber, Gutta Percha & Telegraph Works Co.—At the annual meeting on Tuesday, the abnormally high prices of raw rubber which ruled during the spring and summer this year were referred to. The directors thought that on the whole a difficult position had been reasonably met with regard to stocks. A dividend of 5 per cent. was sanctioned, after an amendment to the effect that a 2½ per cent. dividend should be paid in order to provide for special reserve against stocks, had been ruled out of order.

British Columbia Electric Railway Co.—The annual general meeting was held on Monday, Mr. R. M. Horne-Payne, Chairman of the Company, presiding. The Chairman said that they now seemed to have reached a period of settling down to steady regular conditions of prosperous commercial life in the cities which the Company's system served. The development that was taking place was involving much capital expenditure, and would continue to do so, but this was a necessary and satisfactory feature of any undertaking in a new country. The Company had now about 150 miles of electric railway working, and about 12 to 14 miles in an incomplete state. At the close of the annual meeting a resolution was passed increasing the capital of the Company by 700,000 shares of £1 each.

Birmingham Electric Club.—At the annual meeting of the Birmingham & District Electric Club on Saturday, Mr. F. W. Foster was elected president.

The Society of Engineers.—Among the premiums for papers published during 1910, which were awarded at the annual general meeting of the Society of Engineers on Monday of last week, was one for a paper by Mr. A. H. Allen on "Electricity from the Wind."

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—*Associate Members:* H. H. Brierley, S. E. Day, R. E. Lovelace, H. W. Malcolm, H. F. Nottage. *Students:* L. F. Burgess, C. S. Buyers, B. C. Clayton, A. W. Head, A. D. Peacock, R. W. Riley.

MOTOR-CONVERTERS

(*La Cour Patents*)

The recent order for SIXTEEN MOTOR-CONVERTERS (for one Supply Company) which has just been placed with **Bruce Peebles & Co., Ltd.,** *Edinburgh, makes an aggregate of 36,700 K.W., and comprises 76 machines (of this type) ordered from that firm since 1st January, 1910.*

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TRADES DIRECTORY
OF
ADVERTISERS IN "ELECTRICAL ENGINEERING."

(One Free Entry is given to every Advertiser. Entries under additional headings, 6d. per insertion.)

ACCESSORIES (Electric Light and General Supplies).
Briscoe (W. H.) & Co., 32 & 33, Cox St., Birmingham.
Cable Accessories Co., Ltd., Britannia St. Works, Tividale, Staffs.
Feld Bros. & Co., Ltd., 25, Budge Row, London, E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co., Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
Belliss & Morcom, Ltd., Birmingham.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
British Thomson-Houston Co., Ltd., Rugby.
Electrocarbon, A.-G., Niederglatt, Switzerland.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Jandus Arc Lamp and Electric Co., Ltd., Harthain Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Sloan Electrical Co., Ltd., 12, Golden Lane, E.C.

ARMATURE REPAIRS.
Higginbottom (J.) & Co., Blenheim St., Chelsea, S.W.
Marryat & Place, 28, Hatton Garden E.C.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
Concordia Electric Wire Co., Ltd., Cricklewood Lane, N.W.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CLUTCHES (Friction).
Bridge (David) & Co., Ltd., Castleton, Manchester.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Mirrlees Watson & Co., Ltd., Glasgow.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

FIRE EXTINGUISHERS.
"Kyl Fyre," Ltd., Eastbourne.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
Crossley Bros., Ltd., Openshaw, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.
Mirrlees, Bickerton, & Day, Ltd., Hazel Grove, Nr. Stockport.

HEATING AND COOKING APPARATUS.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dowsing Radiant Heat Co., Ltd., 24, Budge Row, E.C.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.
Bertram Thomas, Worsley St., Hulme, Manchester.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row W.C.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.
Phillips (J. W. & C. J.), 23, College Hill, E.C.
Weston Electrical Instrument Co., Audrey House, Ely Pl., Holborn, E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.
Ruberoid Co., Ltd., 81 & 83, Knightrider St., E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

LAMPS (Incandescent).
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
Sunbeam Lamp Co., Ltd., Park Rd., Gateshead-on-Tyne.
Welsbach Incandescent Gas Light Co., Ltd., 344—354, Gray's Inn Rd., W.C.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), 8kin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

MARBLE AND STONE (Reconstructed).
The British Stone and Marble Co., Ltd., Ponders End, Middlesex.

METERS AND METER PARTS.
Bastian Meter Co., Ltd., Kentish Town, N.W.
Bernhard Thormann, 25-26, Wassmannstr. Berlin.
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

MINE EQUIPMENTS AND APPARATUS.
A. E. G. Electric Co., Ltd., 133-135, Oxford St., W.
British-Thomson Houston Co. Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Phœnix Dynamo Mnfg. Co., Ltd., Thornbury Works, Bradford.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Ingleby & Co., Elland Road, Leeds.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Phœnix Dynamo Manfg. Co., Ltd., Thornbury Works, Bradford.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wilson-Wolf Engineering Co., Ltd., Bradford.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.
Sokal (S.), 55, Chancery Lane, W.C.

PORCELAIN INSULATORS.
Macintyre (Jas.) & Co., Ltd., Burslem, Staffs.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
Willans & Robinson, Ltd., Rugby.

RESISTANCE WIRE.
Drennan, Glover & Cooper, 429-431, Corn Exchange Buildings, Hanging Ditch Manchester.

SIGNS (Electric).
Electrical and Engineering Supplies Co., Ltd., 36 & 37, Upper Thames St. London, E.C.
Krupka & Jacoby, 11, Queen Victoria St., London, E.C.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
A. E. G. Electric Co., Ltd., 121-125, Charing Cross Rd., W.C.
Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby

STREET LANTERNS.
Haydn Harrison, 11, Victoria St., S.W.
Wardle Engineering Co., Ltd., Hargreaves St., Hulme, Manchester.

SWITCHGEAR.
Adams Manufacturing Co., Ltd., Bedford.
Adams Watkin Co., Ltd., 36, Victoria St., S.W.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Apparatus Co., Ltd., Milford Works, Queen's Rd., Battersea, S.W.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne
Spagnoletti, Ltd., Goldhawk Rd., Shepherd's Bush, W.
Union Electric Co., Ltd., Park St., Southwark S.E.

TECHNICAL BOOKS AND JOURNALS.
Archibald Constable & Co., Ltd., 10 Orange St., Haymarket, W.
Colonial Office Journal, Waterlow & Sons, Ltd., Gt. Winchester St., London.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W
Electric Journal, 422, Mansion House Chambers, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.

TELEWRITER.
National Telewriter Co., Ltd., 24, Bucklersbury, E.C.

VENTILATION AND FANS.
Ozonair, Ltd., 96, Victoria St., S.W.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122-124, Golden Lane, E.C.

WATCHES (Non-Magnetic).
Batty (W.), & Sons, Ltd., Market St., Manchester.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

No. 209 [Vol. VI., No. 52] THURSDAY, DECEMBER 29, 1910. [Price One Penny.
All rights reserved. *Registered as a Newspaper.*

"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

SUBSCRIPTION RATES.

United Kingdom. 6s. 6d. per Annum.

Canada. 8s. 8d. per Annum.

Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for Situations Vacant and Wanted, Articles for Sale and Wanted, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

Official Notices and Technical College Announcements are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the Editorial and Publishing Offices: 203-206, Temple Chambers, London, E.C.

Telegrams: "Circling, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to The Kilowatt Publishing Co., Ltd., and to be crossed London County and Westminster Bank (Temple Bar Branch).

A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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BINDING "ELECTRICAL ENGINEERING." — Vol. VI. of "Electrical Engineering" (Jan.—Dec. 1910) closes with our issue of to-day. An index for the volume will be ready on Jan. 5th, and copies may be ordered from any newsagent or bookseller at the price of 1d. each (or post free, 2d.). Binding Cases, including index, price 2s. each, post free 2s. 4d. (Abroad 2s. 6d.) Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to us, carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad.

SUMMARY

The Westminster City Council, after having passed a resolution permitting the St. James's and Pall Mall Electric Light Co., to maintain some flame arc lamps in Piccadilly free of cost, have rescinded it owing to representations by the Gas Co. Complaints are made as to the new gas lighting in Regent Street, compared with the previous electric lighting. (Page 820.)

A description is given of the electrical equipment of the works of Messrs. J. B. Brooks & Co., at Birmingham, where the Brooks' cycle saddle and other leather goods are manufactured. (Page 821.)

Mr. H. W. Clothier read a Paper at the last meeting of the Newcastle Local Section of the Institution of Electrical Engineers on the Merz-Price system of balance protection, describing its various applications and the special form of iron-clad switchgear which his company have developed. An interesting discussion followed. (Page 822.)

Two light railways in Austria-Hungary are being equipped on the single-phase system, and the conversion to electric traction of several main-line sections of the State railways will shortly be commenced. It is probable that these will be equipped uniformly on the single-phase system with a trolley-wire pressure of 10,000 volts at 15 or 16 cycles. (Page 825.)

A new agreement has been made between the Stepney and Poplar Councils for standby supply.—The Islington Council have decided to put its wiring powers into force.—Arrangements for giving complete telephonic intercommunication in Glasgow after the transfer of the company's undertaking to the Post Office next year are in hand.—Scarborough Corporation have been granted a summons against the Tramways Company in respect of the winter service.—The Taunton Council are considering their position in relation to their free wiring agreements. (Page 825.)

Among the specifications published by the Patent Office on Thursday was one by R. A. Fessenden for tanks for evaporating water by the heat of the sun and supplying low-pressure turbine generating plant. The British Thomson-Houston Co. describe a system of electrical propulsion particularly adapted for warships. A method of automatically adjusting the protective devices of D.C. rolling-mill motors according to the speed is covered by Siemens Bros. Dynamo Works. Opposition has been entered to a patent by the Westinghouse Metallfaden-Gluhlampenfabrik-Ges. for a process of decarbonising metal filaments. (Page 826.)

Melbourne City Council require a 4,000-ampere-hour battery; Copenhagen Corporation, a 4,000-kw. turbo-alternator; Sale Council, Diesel oil engines and generators; Taunton Corporation, single pole switches and fuses; Morley Corporation, tramway track; and Warrington Corporation, steel points and crossings. Extensions are contemplated at East Ham (£17,430), Hull (£100,000), Finchley (£15,500), Greenock (£32,000), and Maidstone (£4,000). Extensions are also contemplated at Huddersfield. (Page 827.)

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TRAIN LIGHTING

IT is a regrettable but indisputable fact that the effects of the deplorable accident which occurred on the Midland Railway on Saturday were rendered more serious than need have been the case by the presence of gas lighting on the train. The danger of gas in railway accidents has been pointed out over and over again; it seems extraordinary that some of the railway companies should show so little regard for the safety of their passengers, and we trust that the Board of Trade will now take action in the matter. The danger has been fully recognised in other countries, and already in Austria the total supersession of gas by electric lighting on trains has been decided upon, and the completion of the change is only a matter of time. In Switzerland, too, movement is being made in the same direction. There is no technical difficulty involved; many excellent systems of electric train lighting have been devised, perfected, and proved reliable in practice, and, in fact, both as regards economy and convenience, electric train lighting systems have shown themselves superior to gas. Several railway companies, both in this country and abroad, have voluntarily replaced gas by electric lighting, but the change is taking place too gradually. Even if the cumbrous machinery of a Government Department cannot be invoked, we hope that the shareholders of the railway companies will find a means of rousing the directors to a better sense of their responsibility.

The Fire at Dick, Kerr & Co.'s Works.—We understand from Messrs. Dick, Kerr & Co., Ltd., that the statement as to a fire at their works at Preston last Thursday was much exaggerated. It appears that a tank of varnish caught fire, but that only very slight damage was done.

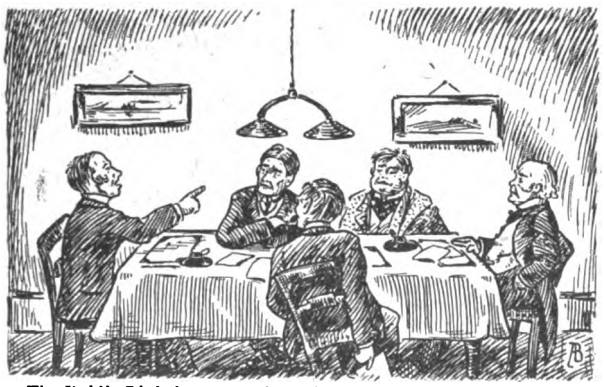
COMPLAINTS OF GAS LIGHTING IN REGENT STREET

AT the Westminster City Council on Thursday it was stated that the leading tradesmen in Regent Street are of the opinion that the new system of gas lighting introduced by the Westminster City Council is not so good as when the thoroughfare was lighted by electricity. The point arose out of a report by the Works Committee to rescind a previous resolution of the Council that an offer by the St. James's & Pall Mall Electric Light Co., Ltd., to provide and maintain for five years at their own expense additional public lighting in Piccadilly Circus by means of electric flame arc lamps be accepted. The St. James's Co. proposed to put up on three columns, 35 ft. high, *i.e.*, 15 ft. higher than the gas lamps, flame arc lamps to give an aggregate lighting power of 36,000 c.p. in three clusters, each giving 12,000 c.p.

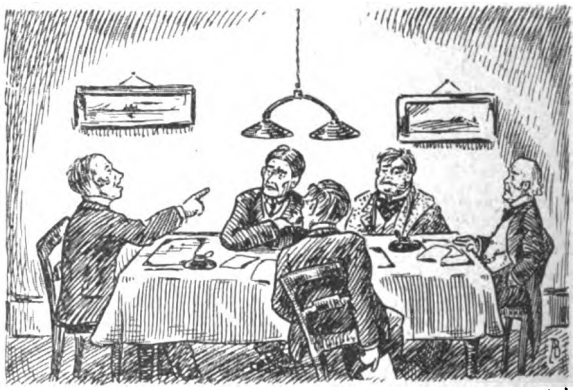
To this proposal the Gas Light & Coke Co. object, as violating their contract with the City Council, Clause 10 of which states that any additional lighting, if found necessary, is to be provided by the contractors, *i.e.*, the Gas Co., as the Council retain the power "to increase the number of lamps as and when they may deem desirable, such additional lamps being provided and maintained at the prices in the accepted tender." The St. James's & Pall Mall Co. communicated with the Council to the effect that, should the decision to allow them to erect these lamps be rescinded, their only alternative would be to retire altogether from a competition in which, apparently, they cannot expect to receive fair play.

In recommending the Council to rescind the original resolution giving consent to this electric lighting, the Works Committee state that they are now of the opinion that such an enormous concentration of light (whether electric or gas) would depreciate the effect of the new gas lighting, and would, from the point of view of public lighting, be superfluous. The recommendation not to allow the St. James's Co. to carry out the experiment was passed by the Council.

At Leith, the Electricity Committee have reduced their price both for power and lighting; the Tramways Committee claim that the reduction should apply also to Tramways; but the Electricity Committee contend that the reduction refers only to consumers amongst the general public. According to the *Edinburgh Evening Dispatch*, both Committees are composed of the same members. The following is what may be expected to occur on similar lines in the Urban District of Muddlett:—



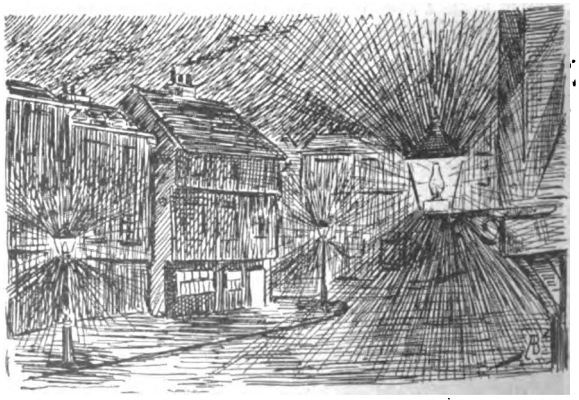
The Public Lighting Committee decide to invite tenders from both the Gas and Electricity Committees for the lighting of the streets of Muddlett. The Chairman explains that in the case of Westminster (London) such competition resulted in obtaining an exceedingly advantageous contract.



The Gas Committee, who have been informed of recent events in Westminster (London), decide that, in view of the increasing headway made by the rival method of illumination and the consequent loss of business to the gas undertaking, they will tender below cost price.



The Electricity Committee decide that, profiting by the experience gained in Westminster (London), it will be necessary to quote considerably under cost price to secure the contract.



The Local Government Board refuse to sanction the loan.

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ELECTRICAL EQUIPMENT OF THE WORKS OF MESSRS. J. B. BROOKS & CO.

THE electrical equipment of the above works is of interest as illustrating how under efficient and progressive management it becomes a practical necessity to adopt electric driving. Until a few years ago the works were dependent on gas engines for their supply of power, but it was

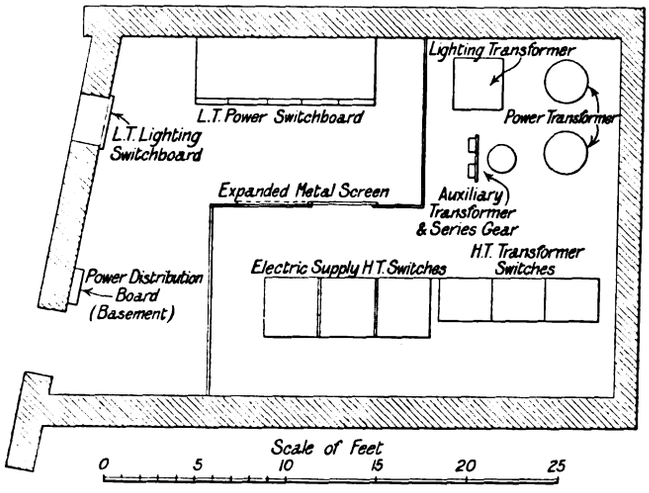


FIG. 1.—PLAN OF SUB-STATION.

then decided to install a few electric motors as an experiment. These motors gave so much satisfaction that the firm determined to adopt electric driving throughout, and at the present time there is not a single gas engine remaining.

The works buildings, although compact as regards ground plan, consist in most parts of four floors, so it will be readily understood that there were considerable losses in belting and shafting with the old method of driving by engines placed in the basement. For example, if it was desired to use power in the top floor only, it was nevertheless necessary to drive all the intermediate belts, pulleys, and shafting.

Messrs. Brooks & Co. take their supply of power from the electric supply department of the Birmingham City Council, this supply being given in the form of three-phase current at a pressure of 5,000 volts, and a periodicity of 25 cycles. The high-pressure mains are brought into a sub-station which is situated in the centre of the Livery Street portion

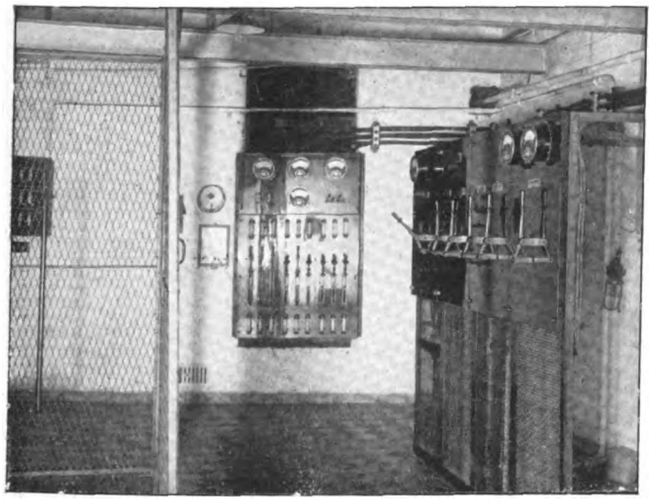


FIG. 2.—SUB-STATION, SHOWING POWER AND LIGHTING SWITCHBOARD.

of the works, and of which a plan is given in Fig. 1. The H.T. supply is given on the ring-main principle, and the electrical department have installed three switch panels, two of which serve to cut off either side and the third to cut off the supply to the consumer. All these panels are of the standard type used by the department, and consist of oil-break three-pole switch fitted with overload trip, isolating switches, and charge indicators, the whole being enclosed in sheet-iron case. On the consumer's panel, in addition to the above, an integrating wattmeter and an ammeter are fixed. From the oil switch on the consumer's panel the high-tension mains are taken to three H.T. transformer panels, which control the primary circuits of the three-power and lighting transformers. There are two three-phase, 50 k.v.a. power transformers, which reduce the pressure from 5,000 to 440 volts and one three-phase, 100 k.v.a. lighting transformer, the secondary pressure of which is 115 volts. All these transformers were supplied by the British Electric Transformer Co., and are of the oil-immersed type. The secondaries of the power transformers are controlled by two switch panels which form a part of the L.T. power switchboard, and the secondary of the lighting transformer is controlled by the L.T. lighting switchboard. Figs. 2 and 3 show views of the sub-station and its switchgear.

As during a considerable part of the day only a comparatively small number of lights are in use, it was decided recently, on the advice of the consulting engineers, to use a series transformer on the "Berry" system so as to reduce the light load losses of the main lighting transformer. Accordingly, a 10 k.v.a. auxiliary transformer was installed, together with the necessary automatic switchgear for short-

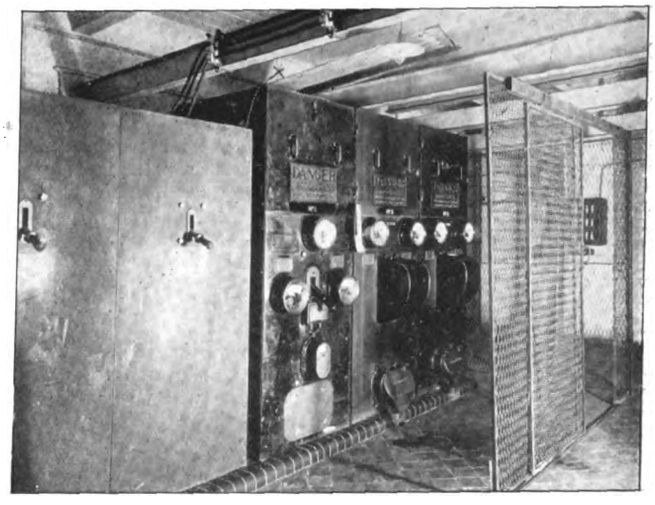


FIG. 3.—SUB-STATION, SHOWING H.T. SWITCHGEAR.

circuiting it when the load is more than it is capable of dealing with, and this arrangement has effected a considerable economy, since the constant iron losses are reduced by approximately 80 per cent.

The system of wiring adopted in the case of the motors is galvanised steel conduit with V.I.R. cables. The sub-mains in the Livery Street portion of the works are controlled by switches and fuses on the L.T. switchboard in the sub-station and terminate in three-pole fuse-boards in cast-iron cases, one of which is situated on each floor to control the motors on that floor. In the case of the Great Charles Street portion of the works, a three-core paper-insulated and lead-covered cable is taken through the tunnel which connects the two parts of the works; this cable is controlled by one switch panel on the L.T. switchboard in the sub-station, and terminates in a four-way distribution board situated in the basement of the Great Charles Street works. From this distribution board sub-mains are carried in galvanised steel conduit to four three-pole fuse-boards situated on the various floors, as in the case of the other portion of the works. The wiring work was carried out by Messrs. Ellis & Ward, of Birmingham.

There are in the various parts of the works twenty-seven motors, varying in size from ½ h.p. up to 20 h.p. These are all of the squirrel-cage type, and are for the most part of the British Westinghouse Co.'s manufacture.

The majority of the starters are of the rheostatic type, made by George Ellison (Birmingham), but a few motors

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are provided with star-delta starters. The former starters are provided with both no-voltage and overload releases, the latter having a time lag attached to prevent their operation when the power required exceeds the normal for only a few seconds. Most of the motors are fixed on brackets attached to the walls and drive shafting by means of belting, but a few are fixed to the floor.

One of the chief products of this firm is, of course, the well-known Brooks cycle saddle. It is probably not so well

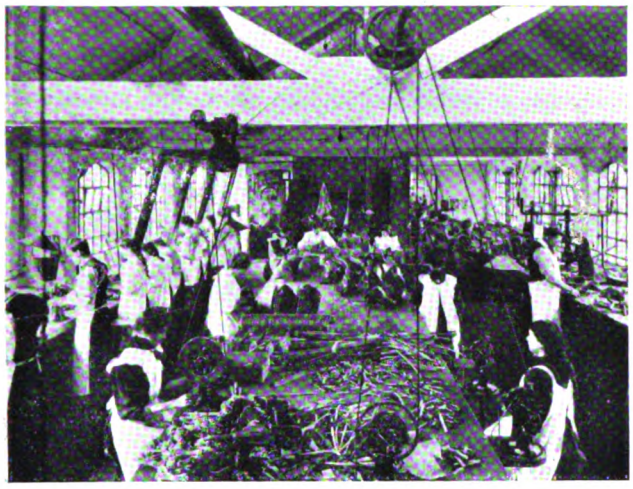


Fig. 4.—Leather-working Shop.

known to the general public that Messrs. Brooks are also manufacturers of a variety of other leather goods, such as dressing-cases, footballs, leggings, purses, &c.

The machines required for the manufacture of a Brooks cycle saddle are varied, and include special machines for straightening and bending wire, mops for polishing, automatic machines for turning out the screws and nuts in large numbers, shaking barrels for cleaning metal parts, presses for cutting out both metal and leather portions of the saddle, sewing machines, and veining machines for straps, &c. A view of the leather-working shop is given in Fig. 4, and a motor generator set consisting of a three-phase motor driving two plating dynamos is shown in Fig. 5.

Three of the motors are used for operating goods lifts in different parts of the works, and as the arrangement adopted is somewhat novel a description of same will be of interest. The motor for each lift, which is of the squirrel-cage type

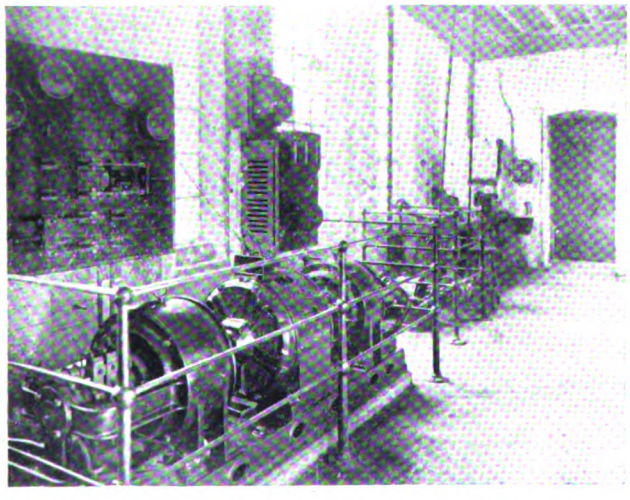


Fig. 5.—Motor Generator Set for Plating.

of 5 b.h.p., is provided with a slipping clutch, made by the Lancashire Dynamo & Motor Co., of Trafford Park, Manchester. This clutch, which acts as a flexible coupling, consists essentially of a boss having two or more radial driving arms secured to the motor shaft; at the extremity of each arm is placed a curved slipper, which is free to move radially outwards on the rotation of the motor shaft; in moving outwards the slippers impinge on the inner circumference of the other half of the clutch, which is keyed to the shaft to be driven, and which, in appearance, resembles a hollow pulley. When current is first switched on to the motor the rotor is free to revolve by itself, and until the speed has reached a considerable value the slippers do not exert sufficient pressure to grip the coupling and drive the worm shaft.

This device allows of the cage being started without shock. With this type of clutch on the motor it is possible to switch the motor direct on to the mains without any form of starting device to give reduced voltage at the motor terminals; in the lifts in use at Messrs. Brooks' works, the controller takes the form of a reversing switch, so that the electrical gear is extremely simple and the waste of energy in resistance is avoided.

The lighting of the works is carried out by means of incandescent lamps, which are for the most part of the carbon filament type. Metal filament lamps of high voltage and low power do not show to their best advantage in a building with several storeys, with much vibration, and with current at less than 1d. per unit, the higher price of lamp renewals may counteract the gain in consumption due to their higher efficiencies, although with the prices of supply for lighting more usually paid the superior economy of the metal filament lamp is unquestionable. The wiring for the lights is carried out with V.I.R. wires in wood casing and capping, and it is arranged to balance as far as possible the total number of lamps between the three phases.

It will be of interest to give some idea of the effect of the introduction of electric driving from the financial point of view. The method adopted by the firm in calculating their power costs is to compare the total expenditure on power and fuel with the total sales, and we give here the comparative figures for the years 1907 to 1910:—1907, 0·83 per cent.; 1908, 0·84 per cent.; 1909, 0·79 per cent.; and 1910, 0·74 per cent.

The first motors were installed in 1908, and the last gas engine was removed in 1910, so that there is a decrease in the comparative cost of power due to electric driving of about 12 per cent., and this notwithstanding the fact that a considerable increase has taken place in the number of machines driven by power.

Our best thanks are due to Mr. Boultbee Brooks, one of the managing directors of the company, for permission to describe the works, and to Messrs. Moffett & Rosher, the consulting engineers, who designed and carried through the electrical conversion, for furnishing the technical particulars given in this article.

THE MERZ-PRICE PROTECTIVE SYSTEM

THE Merz-Price system of protection of electrical circuits formed the subject of a Paper read last week before the Newcastle Local Section of the Institution of Electrical Engineers. One entitled "Switchgear and the Isolation of Faults on Supply Systems," by Mr. H. W. Clothier (Messrs. A. Reyrolle & Co.), on Monday, December 19th.

The Paper commenced with some general remarks on the necessity for instant isolation of faulty parts of a system, and the suitable interconnection of the network. Ring mains were more economical than duplicate cables, and lent themselves more easily to the isolation of portions of the circuit without interruption of supply. The general requirements of switchgear from the protective point of view were summed up, and some of the disadvantages of certain types of high-tension switchgear were pointed out. The desirability of the complete enclosure of live conductors, in preference to bare conductors in cells, was emphasised, however elaborate the interlocking between the doors, isolating switches, &c.

Turning to the actual protective gear, he said that the discriminating devices which had been most generally used were overload devices and reverse-current devices (with or without time-element), but, in his opinion, the system of balance gear which he was about to describe was the most satisfactory and reliable. The use of graded time-limits in series had not been altogether a success, and the arrangement could not be used on a ring main; it was opposed to the principle of instantaneous release, and it was difficult to predetermine the correct setting of the relays. The principal difficulty with reverse-current devices was to make them inoperative when faults occurred on sections other than those which they were intended to protect.

In the system of balance protection the criterion of operation is that, while a section is sound, the current entering it must be identical with that leaving it (excluding a very small amount due to capacity). Current transformers are installed at the entries and exits of each section, and a balance of their electrical properties is obtained. In the

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event of a fault or leakage occurring, the current leaving a section differs from that entering; the balance is hereby disturbed, and by means of relays the circuit-breakers are automatically opened at the ends of the faulty section. Three methods of connecting this system have been adopted—E.M.F. balance, current balance, and neutral wire balance. The connections of the first are as shown on Fig. 1. The balance is obtained by having the E.M.F. at the secondary terminals of the current transformers in opposition, that is to say, under normal conditions no current flows through the pilot wire. The connections for "current balancing"

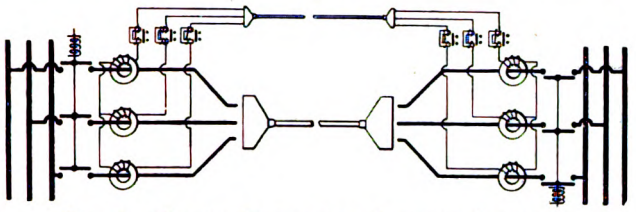


Fig. 1.—Feeder Protection, Current Balance.

are as shown on Figs. 2, 3, and 4. The secondaries of the transformers are connected uni-directionally, *i.e.*, under normal conditions current flows through the pilot system in direct proportion to the main current. There were two systems developed under this category—the first was that shown on Fig. 4, which has been called "magnetic balance," and the other, that on Figs. 2 and 3, the "bridge" method.

In the third system, called "Neutral Wire Balancing," an example of which is shown on Fig. 5, the secondaries of the transformers are connected uni-directionally as for current balance, the neutral wire connects between points of equal

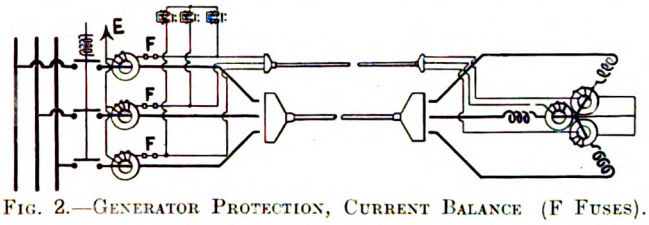


Fig. 2.—Generator Protection, Current Balance (F Fuses).

potential at the two ends of the section, and in this case under normal conditions, no current passes through the pilot system on which the relays are connected.

In some cases it is desirable to supplement the balance gear with devices for protection against sustained overloads. With current balancing this can be obtained by merely inserting fuses in the secondary protective leads, as shown in Figs. 3 and 4. The introduction of a time-limit device applied to feeder protection with E.M.F. balancing has also been suggested.

The above diagrams indicate in each instance the connec-

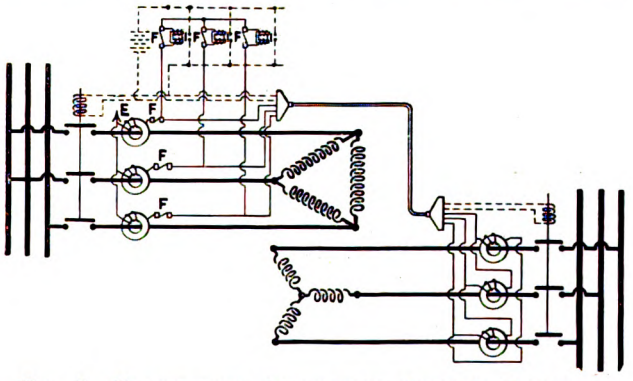


Fig. 3.—Transformer Protection, Current Balance.

tions for three-phase A.C. systems having the neutral point earthed, which, considered from a protection point of view, is the most suitable system in that a fault of sufficient magnitude between either of the three phases and earth would operate the relays. On the other hand, in a system with insulated neutral, a smaller number of transformers, relays, and pilot wires can be used.

A method of balance protection by three-core feeder-cables, known as "core balance," or leakage protection, has also been devised, in which the three cores pass through one current transformer, which only has current induced in its secondary when the algebraic sum of the currents in the three cores is other than zero. In another modification of this system, three transformers are used, one on each phase, and fuses and further relays are introduced to give a time-element overload protection. The use of this system is of course strictly limited as a means of protection against faults on high-tension networks by the fact that it only discriminates between a fault to earth and an overload, that is, it is quite useless in its present form for ring main protection. It may, however, serve some purpose in the protection of tail ends and for mines and places where sustained arcing is a great source of danger.

The Paper then dealt successively with generator, bus-bar feeder, and transformer protection. Generators can, if desired, be protected from failing field by a relay and time-element, which will open the main switch when a drop in

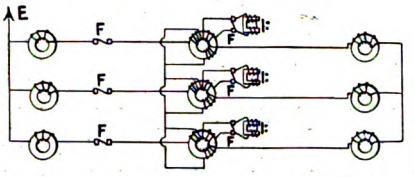


Fig. 4.—Transformer Protection with Relay Balance Transformers, Magnetic Balance (showing Secondary Connections only for simplicity).

excitation voltage occurs, and a reverse power relay may be resorted to, protected against failure of the prime mover, but in many stations this is not considered necessary. Protection against breakdown of the machine itself is best effected by the current balance method shown in Fig. 2. Bus-bars can be protected by placing current transformers on each entry to and exit from the switchboard, or any section of the same. These transformers are so connected that a balance in the secondary circuit is maintained under healthy conditions, but immediately a short or an earth occurs on any conductor on the switchboard all the switches connected to the faulty section would be opened, thus isolating the bus-bars and all the electrical connections attached to them.

For feeder protection, the simplest arrangement is the E.M.F. balance method of Fig. 1. The adoption of the balance protection on a large system carries with it the

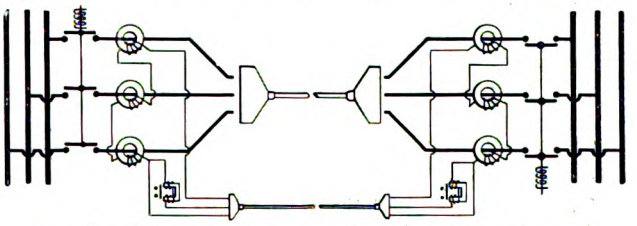


Fig. 5.—Feeder Protection, Neutral Wire Method.

necessity for sectionalising the various ring mains and interconnected network by means of overload cut-outs at certain points: for instance, in the absence of some form of protection to isolate a sub-station switchgear automatically in the event of a short circuit occurring on its bus-bars, a heavy current would be fed into the fault. In order to guard against the possibility of a shut-down under such fault conditions the network is divided into areas which are interconnected by cables equipped with an instantaneous overload release, and time-element overload devices are installed at the generating station end or at other sources of supply to the several areas. For transformer protection, the current balance method already described is most suitable.

The Paper concludes with a description of the now well-known system of ironclad switchgear developed by Messrs. Reyrolle & Co., which, in conjunction with the Merz-Price system of protection, has given excellent results on the power distribution systems in Northumberland and Durham.

Discussion.

Mr. E. B. Wedmore (British Thomson-Houston Co.), who opened the discussion, thought that a difference should be made between generating station and sub-station switchboards. The latter were to some extent protected by the power-house board, which should clear a fault in the section in which the sub-station was. For sub-station boards, however, a more compact design was justified than for a generating station. Referring to the type of iron-clad switchgear described, he criticised the filling in of

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the space around the bars by compound, and considered that, even for enclosed conductors, an air space was preferable. He also considered that the close sealing up of the apparatus would increase the explosive effect in the event of trouble.

With regard to protective gear he agreed with the principle underlying the same, the difficulty having always been the standard by which it should be determined whether current had reversed or not. In the old days the standard of reference was always the potential of the supply, and he believed that he was the first to construct a relay in which current was compared with current and not potential. At the same time Messrs. Merz and Price developed the apparatus described to-night, also employing a comparison of current against current. There was no other system so reliable for single interconnectors and single ring mains, and cases where the cost of pilot wires was not of importance. There were, however, other systems which could meet the conditions without pilots in many cases, and he described a simpler arrangement adapted to duplicate mains carrying the same current.

Mr. WOOD then asked a few questions.

Mr. HUNTER expressed the opinion that the iron-clad gear removed dangers which had been experienced, due to the effect on neighbouring conductors, of smoke and flame ejected from oil switches on bad short circuits. With regard to the balanced protective gear, it was admittedly faulty, but one could not get a better. It saved 30 to 40 per cent. of capital expenditure on mains compared with other systems.

Mr. W. C. MOUNTAIN (Messrs. Ernest Scott & Mountain) thought that the Merz-Price system had the objection in colliery work that it had a fourth wire, and if the system that Mr. Wedmore had hinted at could be used with the same simplicity, he would rather favour it. Protective systems were very useful if not overdone; but one did not want the whole apparatus to be safeguarded to such an extent that if one touched anything the whole system went down. For example, in the case of a pump in-bye, it was sometimes necessary to keep it running even if faulty, provided it was watched carefully.

Dr. W. M. THORNTON (Armstrong College, Newcastle) made some remarks on the nature of the break in oil switches and the quality of oil most suitable.

Mr. C. S. VESEY BROWN expressed admiration for the enclosed gear in preference to open bus-bars.

Mr. ANDERSON spoke from experience of the reliability of iron-clad gear. On large systems, when a short-circuit occurred near a power station, the effect was like an explosion. Once when an open isolating switch blew out, the explosion moved concrete blocks three feet square and 3 in. thick, and blew out windows in the power-house. He thought that a strong iron-clad board would localise damage, as the arc would go to earth through a smaller space. He asked what were the limits to which one could go to a short circuit before the transformers went out of balance.

Mr. F. O. HUNT drew attention to the similarity between the system described by Mr. Clothier as "core balancing," and that which had been developed and worked by Mr. M. B. Field. In this a balance was obtained of the magnetic effect of the three cores of a three-phase cable, and therefore the same sort of protection. With regard to oil switches, it was important to remember that an automatic switch took appreciable time to operate, however complete the short-circuit might be, apart from the speed of the relay. In a mine such delay might be sufficient to start a fire.

Mr. VERNIER spoke of the application of protective gear to overhead transmission lines. With the Merz-Price gear the falling of a wire causes instant isolation if it strikes an earthed bracket or guard wire. It would be an advantage if operation could be ensured directly a wire broke. This could be done by a coil on a pilot wire connecting the neutral points of the transformers in star at each end. With Merz-Price gear one knew where to look for the fault, and the faulty feeder did not interfere with the supply to consumers.

Mr. PORTER pointed out that any capacity current in the cable passed through the relay, and might be sufficient to trip it. The difference between the minimum fault current and the maximum capacity current was the margin on which the relay had to work. It was difficult to get gear working on the required margin with capacity on a long pilot. The current transformers are often so designed that the characteristic fell away considerably, and induction coils should shunt the pilot in order to balance its capacity. For section faults and bus-bar faults, such as switches sticking, with extensive sections there was not a time-limit overload relay in existence to meet the conditions. For generator protection, as the ordinary winding of a generator is such that the fault is nearly always a fault to earth, a useful arrangement would be to arrange a current transformer on each phase of the generator and one on the earthed neutral connection in conjunction with a relay, so that out-of-balance due to an earth fault would trip out the generator.

Mr. CLOTHIER, in his reply, said that he would rather stand near a conductor in compound than one in an iron chamber when trouble was in progress, as the sudden expansion of air might easily shatter a cast-iron case. The chief difficulty relating to a conductor in compound was to get it out again. The cell type gear was in use in the majority of big generating stations, but he thought that the day when it would not be was not very far distant. The day would also come when big generators with all their conductors would be completely enclosed in metal casing and run in solid with compound. Some rough experiments had been taken, from which it was estimated that the time taken to clear a fault was $\frac{1}{20}$ to $\frac{1}{10}$ second. This was not so quick as one would like, but proposals had been made by Mr. Taylor, of Birmingham, by which he estimated a switch could be opened in $\frac{1}{100}$th second. If such were possible it would save the hammering action which occurred at each period on the winding of a machine with a fault in it. The effect of capacity current that Mr. Porter had mentioned was not so serious as one would at first think.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ELECTRICAL PLANT, INSTRUMENTS, &c.—We have received from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), copies of the first four of a series of Bulletins which the company are issuing as supplements to their ordinary catalogues. These contain more technical particulars and explanatory matter than can be included conveniently in the catalogues themselves. The first is entitled "Important Plant," and contains many excellent illustrations of large and small machines which the company have made at their Witton Works, including numerous large turbo-generators as well as slow-speed generators. A detailed list of large installations carried out by the company is also given. While this is mainly devoted to generating plant, No. 2 of the series, entitled "Electrical Plant for Shipyards and Engineering Works," treats of electric motors and their applications. Useful information is set forth regarding systems of drive, and particulars with approximate price of the motor involved are given in the case of the numerous examples illustrated. The third Bulletin is devoted to descriptions of Dr. W. E. Sumpner's iron-cored moving-coil wattmeters and other instruments, and their applications, and the last is the Bulletin on "Country House Lighting," which has already been reviewed in these columns.

MEASURING INSTRUMENTS.—A handsome new list from the Electrical Co., Ltd. (122–124 Charing Cross Road, W.C.) illustrates and describes a complete range of switchboard, portable and testing ammeters, voltmeters, and wattmeters, including numerous patterns of the electromagnetic, moving coil, induction, hot wire, and dynamometer types. Particulars of current and potential transformers are also included, but no prices are given.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

HEATING APPARATUS.—We have received from the Bastian Electric Heating Syndicate, Ltd. (91 to 93 Palmerston House, E.C.), a new catalogue of their well-known "Quartzlite" heating and cooking apparatus, in which the metal heating units are enclosed in quartz tubes and the whole allowed to glow at a dull red heat. The articles to which this system is applied include radiators, ovens, hot-plates, toasters, coffee percolators, kettles, boilers, etc., with complete removable heating elements applicable to various different utensils, water boilers and irons.

TELEPHONES.—A new list from the Sterling Telephone and Electric Co., Ltd. (200 Upper Thames Street, E.C.), describes the Sterling "Primax" system of automatic central battery intercommunication telephones, in which special means are adopted to avoid induced cross-talk between the lines. Several patterns of instrument are made, and the list contains particulars of special batteries and multiple cables recommended for use with the system.

CALENDARS, &c.—This season's wall calendar from the D.P. Battery Co., Ltd., Bakewell, Derbyshire, well keeps up the reputation of its artistic predecessors, and bears a coloured view of Lathkill Vale, near the company's works.

A small monthly tear-off calendar from the Electric Supply Publicity Committee is embellished with one of their well-known advertisement designs.

A waistcoat pocket diary of very convenient size and shape is being issued to their friends by the Brush Electrical Engineering Co., Ltd.

Institution of Post Office Engineers.—A meeting of this Institution will be held at the Institution of Electrical Engineers on Monday, January 16th, at 6 p.m., and members of the latter Institution are invited to attend.

Electric Traction in Germany.—It is reported that Herr von Dernburg, the ex-Colonial Secretary of the German Government, has accepted a seat on the board of the Allgemeine Elektricitats-Ges., and may later become president on the retirement of Dr. Emil Rathenau. Herr Dernburg will then, it is said, make renewed efforts in connection with the substitution of electric for steam traction on all the State railways.

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ELECTRIC TRACTION IN AUSTRIA-HUNGARY

AMONG the Papers presented before the International Railway Congress in Bern this year was one on the subject of electric traction in Austria-Hungary, by Dr. A. Hruschka, head of the department of the Austrian State Railways, which is preparing plans for the conversion of the Austrian railways to electric traction.

At present there are only seventeen light railways operated electrically, excluding tramways, and of these only two are on the single-phase system with pressures of 2,500 volts and 550 volts respectively, the other fifteen being continuous-current railways. Two other light railways, aggregating about 100 miles of line, are under construction by the Austrian and Hungarian houses of Siemens-Schuckert-Werke respectively. The first of these is the line connecting St. Pölten, Mariazell, and Gusswerk, which is the first narrow-gauge line to be equipped on the single-phase system. The total length of the line is about 57 miles. A trolley-wire pressure of 6,000 volts and a frequency of 25 cycles are to be employed. The trains are to be hauled by locomotives, fourteen of which of the design illustrated and described in ELECTRICAL ENGINEERING, Sept. 29, 1910, p. 625, have been ordered. Power will be supplied from two water-power stations and a Diesel gas-engine reserve station at St. Pölten, the current from which will be transmitted at 25,000 volts to sub-stations along the line. The other line is that connecting Budapest, Vacz, and Gödöllo. This is a single-phase line operating with a trolley-wire pressure of 10,000 volts and a frequency of 15 cycles. The rolling stock will consist of four locomotives and eleven motor coaches. Power will be supplied from a steam generating station in the neighbourhood of Budapest.

Many new lines are proposed, and it has already been decided to convert certain main line sections of the State railways. One of the first sections to be converted will be the 10-mile length of main line between Trieste and Opcina, which has many badly ventilated tunnels. The traffic is very dense, and electric working is to be substituted for steam in order to increase the capacity of the line. Single-phase locomotives are to be employed, and designs have already been prepared. Other sections requiring conversion to increase their capacity are three very short lines connecting the chief station of Prague with the outlying districts. From economical reasons the early conversion of the Innsbruck-Lindau section of the Arlberg railway may be expected; the water power of the rivers Petz and Inn will be utilised for this purpose. In all, the conversion of some 612 miles of railway is under consideration (see also ELECTRICAL ENGINEERING, Vol. V., p. 724). In Hungary, the authorities have decided to equip the Fiume-Kameral-Moravieza section of the Budapest-Fiume line for electric traction, and power will be taken from a large water-power company. Further, a light railway is being constructed by Messrs. Ganz & Co. between Pressburg and the Austrian frontier. In concluding his Paper, Dr. Hruschka mentions that in all probability the main line sections will be equipped uniformly on the single-phase system, with a trolley-wire pressure of 10,000 volts and a frequency of 15 or 16 cycles.

LOCAL NOTES

Barnard Castle: *Electric Lighting Order Revoked.*—The Board of Trade have revoked the Electric Lighting Provisional Order granted to the Council in 1900.

Bingley (Yorks): *Electricity Supply.*—The Council's application to the Board of Trade to cancel the powers of the Yorkshire Electric Power Co. in this district has been refused.

Bognor: *Electric Lighting.*—Both the Council and the Chichester Electric Light Company have given notices of application for electric lighting orders for Bognor. There was a possibility of the Council agreeing to the company's application, withdrawing their own, but after a discussion in the Council it has been decided to oppose the company.

Carlisle: *Electric Supply.*—The Corporation is to apply for an Electric Lighting Provisional Order to supply electrical energy in the rural district within a radius of two miles from the Cathedral.

Dorchester: *Electric Lighting.*—Messrs. J. & W. Purves, of Exeter, propose to prepare an electric lighting scheme. A few years ago there was a Dorchester Electric Light & Power Company, but the provisional order which they possessed was never put into force.

Eastwood (Notts): *Electric Lighting.*—The local Council have on several occasions approached the Nottingham Corporation to give a supply of electricity in the district, but this has not been done, and the Council now propose to apply for an electric lighting provisional order.

Frome: *Electric Lighting Undertaking.*—The Board of Trade have raised certain objections to the proposed transfer of the Council's electric lighting undertaking to Messrs. Edmundson's Electricity Corporation.

Glasgow: *Telephone Arrangements.*—The transfer of the National Telephone Co.'s system to the Post Office at the end of next year will involve the closing down of a number of National exchanges where these exist almost side by side with Post Office exchanges. The work of preparing the arrangements for transferring the circuits from one exchange to the other has been going on for some time, and, of course, it will necessitate the alteration of some telephone numbers. An important effect of the transfer in Glasgow will be that there will be complete intercommunication between all subscribers.

Launceston: *Electric Lighting.*—The Council are recommended to enter into an agreement with the New Development Co. with regard to electric lighting.

Leith: *Charge for Tramway Energy.*—If the facts given by the *Edinburgh Evening Despatch* are correct, a somewhat amusing position has arisen at Leith with regard to the supply of electrical energy for tramway purposes. According to our contemporary, there are separate Electricity and Tramways Committees composed of the same members. Recently the Electricity Committee decided to reduce the charge for power and lighting, and the Tramways Committee considered that tramway supply came under the head of power supply, and asked for the same reduction. To this the Electricity Committee object, and the position is that the Electricity Committee are objecting to a proposal made by themselves sitting as the Tramways Committee.

London: *Stepney: Electric Supply Agreement.*—A fresh agreement has been entered into between the Stepney and Poplar Borough Councils with regard to standby supply, the agreement being terminable at any time on twelve months' notice from either party. The Board of Trade and the London County Council have to sanction the agreement.

County Council Coal Contracts.—The recommendation of the Highways Committee that the Council should deal direct with colliery owners in ordering their supplies of coal has been referred back to the committee.

Islington: Hiring of Electrical Apparatus.—The Electricity Committee have prepared a scheme for the electric lighting of private premises on the contract system, and also for the hiring out of motors, radiators, irons, fans, &c. It will be remembered that all the London Borough Councils have authority to do this work under the L.C.C. General Powers Act of 1906.

Longwood (Yorks): *Electric Lighting.*—Public meetings are being held in favour of public lighting. Mr. A. B. Mountain, Electrical Engineer to the Huddersfield Corporation, has given some information showing that domestic lighting installations can be fitted for 8s. per house, including a slot meter. Experiments in a small property in Huddersfield have shown the cost of lighting to be 18s. a year, including meter rent.

Malden and Coombe: *Electric Lighting Order Revoked.*—The Malden and Coombe Electric Lighting Order, granted in 1907, has been revoked by the Board of Trade.

Mansfield: *Tramway Extension.*—The Mansfield & District Tramways Co. have notified the Corporation that the construction of the tramway to Crown Farm Colliery will be commenced in January.

Norwich: *Tramway Purchase.*—At the last meeting of the Council the Law and Parliamentary Committee drew attention to the fact that the undertaking of the Norwich Electric Tramways Co. may be purchased as from August 6th, 1911, but made no recommendation as to any action. After some discussion the report was entered upon the minutes as "received."

Nottingham: *New Tramways.*—The Carlton Road tramways, in the East Nottingham district, have been opened for traffic. An agitation for tramways in this part of Nottingham has been carried on for many years, but it was necessary to make a new main road before constructing the lines.

Potteries: *Tramways.*—The Board of Trade have granted a further extension of time for the construction of the light electric railway from Cradley Heath to Brierley Hill. Messrs. Hawtayne & Zeden are connected with the matter.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published December 22nd, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

28,577/09. **Utilising Radiant Heat from the Sun.** R. A. Fessenden (Brant Rock, U.S.A.). This patent relates to the scheme described in Mr. Fessenden's Paper before the British Association last September (see Electrical Engineering, Sept. 22nd, 1910, p. 606), and describes an evaporating tank containing water or other liquid in which is dissolved iron salts to cause it to absorb the sun's rays. A cover of glass containing an iron salt is used in order that the heat of the liquid shall not be radiated off. The steam or vapour generated is supplied to a low-pressure turbine. A combination of two tanks at different levels with pumps and turbines is also described. One figure.

29,250/09. **Propulsion of Ships.** British Thomson-Houston Co., Ltd. (*General Electric Co., U.S.A.*). A system particularly adapted to warships is described. Two propellor shafts are employed, one on either side of a central water-tight bulkhead, the engine space being likewise divided. Control of the machinery can be effected from either engine room. Each of the two turbines drives an alternator which supplies two induction motors on the propellor shaft, one of which is provided with pole-changing arrangements to give a low speed. Rotor resistance control is provided for one of each pair of motors. Two figures.

536/10. **Lead Joints.** Metal Jointing Co., Ltd., and T. Harden. This patent covers the use of a combined flux and jointing material in the form of a strip or ribbon which is wrapped round the inner pipe or cable sheath, so that the application of heat to the outer pipe or sheath will fuse the ribbon and complete the joint. (See Electrical Engineering, Feb. 24th, 1910, p. 140.) Four figures.

1,716/10. **Driving of Rolling Mills.** Siemens Bros. Dynamo Works, Ltd. (*Siemens-Schuckertwerke Ges.*). A D.C. rolling-mill motor, the protective gear of which is adjusted for the high rolling speeds of the later stages, cannot take as much current as it might do without sparking at the lower speeds of the earlier stages. The gear described in this specification automatically adjusts the protective devices so that the permissible current varies inversely as the speed, and thus allows heavy currents to be taken at low speeds while limiting the current at high speeds. Ten figures.

4,814/10. **Motor Starter.** Adams Manufacturing Co., Ltd. (*Cutler Hammer Manufacturing Co., U.S.A.*). A combined starter and controller has two switch arms for the armature and shunt field contact-stops respectively. An auxiliary switch, normally short-circuiting the field resistance, is opened by the movement of the armature resistance arm on to the last stop, and the field regulating arm can then be moved back, independently of the armature arm, to insert resistance in the field. Three figures.

5,660/10. **Arc Lamp.** H. Malachowski (Berlin). An arc lamp without any mechanism, with the carbons side by side as in the Jablochkoff candle, has an insulating layer of gypsum, graphite, or carbon, and a metal powder. The carbon prevents the oxidation of the metal and ensures a metallic bridge for re-ignition. Nineteen figures.

7,048/10. **Magnetic Track Brake.** J. P. Todd (Stretford). In magnetic brakes comprising a pair of side plates with wound cores between them, each exciting coil is enclosed in a spun metal case, and the connecting wires are led through stuffing boxes and glands in a second metal casing brazed or riveted to the coil casings. Three figures.

12,903/10. **Wiring Conduit Fittings.** C. E. Gunner (Anerley). To avoid the loss of the screws of the lids of conduit fittings, the screws are threaded for a short portion at the bottom only, the rest up to the head being plain and of the inside diameter of the thread. The hole in the lid is threaded, and so the screws, though loose in the lid, can only be screwed out. Seven figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Lake (*Clark*), 10,943/10 and 10,955/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Metal Jointing Co. & Harden [Lead joints] 534/10.

Dynamos, Motors, and Transformers: Felten & Guilleaume-Lahmeyerwerke A.-G. [Prevention of induced currents in shafts and bearings] 7,463/10; Biber [Repulsion motors] 15,014/10.

Electric Ignition: Brazier and Watson [Control of gas lamps] 30,383/09; R. Bosch [Construction of coils] 25,008/10.

Electrometallurgy and Electrochemistry: Henri, Helbronner and Von Recklinghausen [Sterilisation of liquids by ultra-violet rays] 28,067/09; Köhler [Electrodes for electrolytic refining of metals] 2,364/10; Werth [Tube galvanising apparatus] 9,522/10.

Heating and Cooking: Van Loon [Liquid heaters] 28,634/09.

Incandescent Lamps: Bergmann Elektricitäts-Werke A.-G. [Manufacture of metal filament lamps] 21,326/10.

Instruments and Meters: Chevretot [Temperature indicator] 15,747/10; Chamberlain & Hookham, Ltd., and Sprague [Prepayment meters] 17,415/10.

Switchgear, Fuses, and Fittings: Winn [Leakage indicators] 28,430/09; Clarke, Chapman & Co. and Harris [Control gear] 29,004/09; Schultz [Automatic circuit-breakers] 30,185/09; Lind [Electrical bulkhead fittings] 1,076/10; Boult (*Crowdus*) [Electro-magnetic devices] 13,662/10.

Telephony and Telegraphy: Elphinstone [Signalling mechanism] 1,484/10; Arnold [Signalling apparatus] 23,044/10.

Traction: Hansen [Block-signalling system] 25,129/09; Colman [Railway signalling] 3,629/10; Altoun [Ventilator for railway and tramway vehicles] 18,981/10.

Miscellaneous: Parsons [Turbines] 29,119/09; Loebl and British Ever Ready Electrical Co. [Warming of internal combustion engines] 29,238/09; Gates [Electrically illuminated signs] 29,437/09; Scott [Illuminated signs] 535/10; Le Fevre [Door alarms] 2,963/10; Keller-Dorian [Composite magnets] 16,367/10; Rice [Illuminated signs] 17,335/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: Hartmann & Braun A.-G. [Mounting electrodes in vapour lamps] 26,747/10; Ges. für Maschinen- und Metall-Industrie, 27,942/10.

Distribution Systems, &c.: Speakman [Insulators for use in mines] 27,804/10.

Dynamos, &c.: Allgemeine Elektricitäts Ges., 27,993/10.

Electric Ignition: Ginestes [Sparking-plugs] 27,991/10.

Incandescent Lamps: Siemens & Halske A.-G. [Manufacture of filaments] 22,365/10; Lichtwerke Ges. [Filament supports] 27,710/10.

The following amended Specifications can now be obtained.

Johnston [Ceiling roses] 11,773/09; Schlick [Dynamo for bicycle lamp] 5,043/10.

Opposition to Grant of Patent

2,983/10. **Tungsten Filaments.** Westinghouse Metallfaden-Gluhlampenfabrik Ges. (Vienna). Opposition has been entered to the grant of this patent. The specification, abstracted in Electrical Engineering, November 3rd, 1910, p. 700, describes a process of decarbonising tungsten filaments in a vacuum furnace.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

30,144 of Dec. 31st, 1896. **Storage Battery Plates.** A. F. Cothias (Ivry, France). Lead plates for storage batteries and electrolytic apparatus are rendered porous by evaporating oil in the mould during casting.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: British Thomson-Houston Co. (*W. le P. Emmet, U.S.A.*) [Commutator bars] 16,049/00; H. Chitty [Ventilation armatures and commutators] 19,522/03.

Electrometallurgy, &c.: J. Harris [Ozonised-air ventilating system] 17,805/01.

Instruments, &c.: J. C. Fell (*W. Stanley, U.S.A.*) [Motor meters] 15,888/00; C. E. Hibberd [Prepayment meters] 17,877/05.

Switchgear, &c.: A. P. and G. C. Lundberg [Wall sockets] 19,076/98; P. H. Thomas [Connections of vapour rectifiers] 18,987/04, and [Vapour rectifier and starting switch for D.C. motor driven off A.C. supply] 18,991/04.

Traction: J. F. Mason and H. Kremnitz [Tramcar obstruction-remover] 19,431/02; R. Ames [Rail drainage inspection box] 19,806/02; J. & T. O. Dixon [Railless traction system] 19,540/04 and [Electric canal haulage] 19,541/04.

Miscellaneous: H. H. Lake (*Soc. L. Gaumont et Cie.*) [Synchronous driving of phonographs and cinematographs] 18,015/[illegible]

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Scarborough: *Tramways Service.*—The Corporation have been granted a summons against the Tramways Co. for failing to provide a winter service.

Southampton: *New Tramways.*—The new tramways to Northam were opened last week.

Taunton: *Free Wiring Agreements.*—In view of the recent decision with regard to the free wiring agreements in Canterbury, the Town Clerk has been instructed to prepare a report as to the Corporation's position in relation to similar agreements entered into in Taunton a few years ago.

Walton: *Electric Supply.*—The Council have agreed to the Woking Electricity Supply Co. supplying certain premises in the Walton area.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—The Melbourne City Council recommend extensions of the generating plant at an estimated cost of £29,540. The new plant includes a 4,000 ampere-hour battery.

Brazil.—According to the *Board of Trade Journal* a concession has been granted to Gabriel da Silveira Basconcellos to erect a telephone line connecting a large number of municipal districts with the town of Campinas.

Copenhagen.—A 4,000 kw. turbo alternator with condensing plant is required by the Municipality. Particulars from the Elektrisk Station, Gothersgade No. 30, Copenhagen, and tenders by January 16th.

East Ham.—An inquiry was held last week concerning a loan of £17,430 for electrical extensions.

Finchley.—A loan of £15,500 is to be taken up for electrical extensions.

Greenock.—Extensions at an estimated cost of £22,000 are contemplated. Of this sum £18,000 are required for extensions to buildings, cables, coal-handling plant, &c.

Huddersfield.—A sub-committee has been appointed to investigate as to the prospective requirements of the electricity undertaking.

Hull.—A scheme of electrical extensions, at an estimated cost of about £100,000, is recommended by the Electricity Committee. The extensions will consist of 16 additional boilers and 8 turbo alternators with the necessary coal storage, etc. It is recommended, however, that only two boilers and two 4,000 kw. generating sets be installed at the present moment. This plant will be housed in a separate building on land adjoining the present power house in Sculcoates Lane.

Maidstone.—A Local Government Board inquiry was held last week concerning a loan of £4,000 for electrical extensions. The Maidstone Gas Co. and a number of other large ratepayers opposed. The inquiry was concluded.

Sale.—The Council invite tenders for Diesel oil engines and generators. Consulting Engineer, Mr. C. Hopkinson, 20 Princess Street, Manchester.

West Africa.—According to the *Board of Trade Journal*, tenders will be received at the Town Hall, San Thomé (Portuguese West Africa), by March 25th, 1911, for the installation of an electric supply works.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

PROVINCES.

Bolton.—New training college. Town Council.

Bo'ness (N.B.).—Nurses' Home at Cadzow Crest.

Chester.—Tenders are invited for a new Sorting Office. H.M. Office of Works, Storey's Gate, London.

Additions to Upton Pauper Lunatic Asylum.

Colne.—New church.

Cork.—New technical school buildings.

Dunfermline.—Riding school for Forfar Yeomanry.

Gravesend.—Additions to Milton Road School.

Grimsby.—School in Victoria Street.

Ilford.—Wesleyan Methodist Institution at Seven Kings.

King's Norton.—School at Woodgate. Architect, E. Harper.

Mirfield.—Elementary school. West Riding Education Committee.

Preston.—Grammar school in Moor Park Avenue. Builders, T. Croft and Sons, Ltd.

Rawtenstall.—Electric lighting of the Workhouse and new Infirmary at Higher Pike Law for Haslingden Guardians. Consulting Engineer, C. D. Copland, 16 John Dalton Street, Manchester.

Rochdale.—Nurses' home. Board of Guardians.

Southampton.—Adaptation of Hollybrook House as boys' home.

Stafford.—New school at Baddeley Green.

Stoke-on-Trent.—Proposed technical college.

Swansea.—Girls' intermediate school.

Todmorden.—Wiring and fitting of the Town Hall. Also conversion of the gas chandeliers to electric lighting in the Public Hall. Particulars from the Borough Electrical Engineer.

Torquay.—Secondary school on site of Elms.

Wakefield.—School in Lawefield Lane.

MISCELLANEOUS

Morley.—The Corporation invite tenders for the construction of 1 mile 7 furlongs of single line tramway with loops, together with the necessary overhead material. Particulars from the Town Clerk, and tenders by January 16th.

Taunton.—A supply of single pole switches and fuses for the 2,500 volt system is required. Particulars from the Borough Electrical Engineer.

Upholland (Lancs.).—The Bispham Hall Colliery Co. have asked the Council if they will take a supply of electrical energy for public and general lighting. The matter is receiving consideration.

Warrington.—The Tramways Committee require a supply of steel points and crossings. Tenders by January 10th.

TENDERS RECEIVED AND ACCEPTED

Carlisle.—The tender of the British Insulated and Helsby Cables, Ltd., has been accepted at £545 for the supply of cable to Messrs. Cowans, Sheldon and Co.'s works.

London: *Westminster.*—The tender of Messrs. Drake & Gorham, Ltd., has been accepted for substituting metal filament lamps for the present carbon filament lamps in Caxton Hall.

Mexborough.—The tenders of Messrs. Callender's Cable & Construction Co., Ltd., for cable at £105 10s., and that of the Royal Potteries Co. for cable troughs at £16 1s. for one-way, £19 8s. for two-way, and £21 14s. for three-way per thousand lengths of two feet each, have been accepted.

The following tenders have been accepted by the L.C.C. for 1911:—Carbons: The Brush Electrical Engineering Co., Ltd., Wm. Geipel & Co., Ship Carbons, Ltd. Electric fittings: The Atlas & Carbon Battery Co., Ltd., Baxter & Caunter, the British Ever-Ready Electrical Co., Ltd., British Insulated & Helsby Cables, Ltd., Dorman & Smith, Edison & Swan United Electric Light Co., Ltd., Elliott Bros., General Electric Co., Ltd., A. P. Lundberg & Sons, Wm. McGeoch & Co., Plutte, Scheele & Co., Ltd., Siemens Bros. Dynamo Works, Ltd., Sunbeam Lamp Co., Ltd., Veritys, Ltd., Wm. White & Co. Electric cables and wires: British Insulated & Helsby Cables, Ltd., Hooper's Telegraph & India Rubber Works, Ltd. Electric lamps: British Tungsten Lamp Co., Ltd., Cryselco, Ltd., Edison & Swan United Electric Light Co., Ltd., Pope's Electric Lamp Co., Ltd., Siemens Bros. Dynamo Works, Ltd.

Metropolitan Association of Tramway Managers.—Mr. A. H. Stanley, managing director of the London United Tramways, has been appointed chairman of the Metropolitan Association of Tramway Managers, and Mr. H. E. Blain, general manager of the West Ham Corporation Tramways, vice-chairman. Mr. T. B. Goodyer, general manager of the Croydon tramways, has been re-elected honorary secretary.

Railway Signals and Tramways.—In July the London, Brighton and South Coast Railway Co. complained that their signalling apparatus at Tulse Hill and other stations in the district had been affected by the working of the L.C.C. overhead trolley tramways between Loughborough Junction and Norwood. The Highways Committee did not agree with this view, and it was decided to ask Dr. Gisbert Kapp, as President of the Institution of Electrical Engineers, to arbitrate. This arbitration was held on November 10th and 24th, and the award is to the effect that the expense incurred by the company in carrying out certain protective works rendered necessary owing to the working of the tramways, and amounting to £309, should be borne by the Council. Each party bears its own costs, but the Council has to pay the costs of the award, making a total of £566.

OSRAM·LAMPS

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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. Bolling & Lowe's *Review of the Metal Trades for* 1910 states that the outstanding feature has been the remarkable persistence in the demand for copper from all classes of consumers, a demand which has not only taken up all the metal coming into sight, but has actually made inroads upon the visible stocks, both in America and Europe. The establishment of a copper market in Hamburg where 10-ton contracts form the basis of dealing, is an event which may ultimately affect the volume of business transacted in London, and, in any case, it will have the result of necessitating the warehousing there of a considerable amount of metal, notably American electrolytic and Chili bars. Next year will see Russia, for the first time, an exporter of electrolytic copper, the development of properties and plant in that country having now reached a point at which an exportable surplus is available.

Messrs. George Smith and Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Friday night, was £59 to £59 5s. per ton (last week, £59 to £59 10s.).

Dissolutions of Partnerships.—F. Fozard and F. T. Hewitt, electrical agents and engineers, Chapel Street, Bradford, have dissolved partnership.

E. Strutt and S. A. Gardner, electrical and general engineers, St. Michael's Road, West Croydon, have dissolved partnership. Debts by E. Strutt.

J. A. Robinson and S. Bowman, dealers in electrical fittings, &c., 17 Houghton Road, Liverpool, have dissolved partnership.

Bankruptcies.—A second dividend of 1s. 4d. in the £ will be paid on and after to-day (December 29th) at Messrs. J. Miles & Co., 28 King Street, Cheapside, London, in the bankruptcy of J. Cunnington and H. Allinson, trading as Laing, Wharton & Cunnington, Electrical Contractors, 7 Great Newport Street, London.

Change of Address.—Messrs. Mirrlees, Bickerton & Day and the Mirrlees Watson Co., Ltd., give notice of the removal of their London office from Gresham House, Old Broad Street, to 122 Cannon Street, London, E.C.

Liquidations.—A meeting of Telegraph & Telephone Instruments, Ltd., will be held at 25 Victoria Street, London on January 25th, to hear the liquidator's account of the winding-up.

APPOINTMENTS AND PERSONAL NOTES

A meter-tester is required by a large electricity supply undertaking. (See an advertisement on another page.)

The Melbourne City Council have decided to send their electrical engineer, Mr. H. R. Harper, to Europe and America to investigate the latest developments in electrical engineering. Mr. Harper will leave about the middle of February, and will be absent for seven months, £500 having been granted him for expenses.

Damages for Injury caused by Feeder Pillar Explosion.—On December 15th, in the King's Bench Division of the High Court, the case came before Mr. Justice Grantham and a special jury, in which Mrs. L. E. Elliott claimed damages from the Battersea Borough Council in respect of an accident which took place on October 29th, 1909. The lady was standing by a feeder pillar and had her hand on it when an explosion occurred in it, knocking her down, and, it is alleged, causing permanent internal injury. It appears that a fault occurred on a bitumen cable, and that the gas given off collected in the feeder pillar and was ignited by the blowing of a fuse. The fault was attributed to the piercing of a tile covering the cable, in the course of the construction of a trench for the L.C.C. trams. The Judge, in his summing up, stated that there was no negligence on the part of the Battersea Corporation Electricity Department, but that the Council was, nevertheless, liable. The jury returned a verdict for the plaintiff for £525 damages.

Telephone Wayleaves.—The following letter has been received by the Birmingham Chamber of Commerce on the question of wayleaves when the Post Office takes over the National Telephone Co.'s system :—"I am directed by the Postmaster-General to inform you that, speaking generally, any private person or subscriber on whose private property poles or other fixtures for the construction of telegraphic lines have been erected by the National Telephone Company, will be entitled, after the telephone system has been taken over by the Government, to withdraw the facilities which he has granted in accordance with any agreement he may have previously made with the company. As regards poles in hedges and banks on the road-side, the Postmaster-General has certain powers under the Telegraphic Act of 1908 which are not enjoyed by the Telephone Company, and his position with reference to the use of roads and the flying of wires over property differs from that of the company."

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

United Electric Tramways of Montevideo.—Interim dividend of 6 per cent. per annum for the half-year.

Winnipeg Electric Railway Co.—Quarterly dividend of 2½ per cent.

Canadian General Electric Co.—Quarterly dividend of 1¾ per cent.

Melbourne Electric Supply Co.—After meeting debenture interest there is a net profit of £17,369 for the year to August 31st. Interest on preference shares absorbed £3,500; depreciation and general reserve £5,000; and suspense account £1,526, carrying forward £3,352. A scheme has been prepared for dealing with the arrears of dividend on the 150,000 six per cent. cumulative preference stock. An agreement has been entered into for a tramway scheme at Geelong. Mr. J. B. Brantwaite presided at the annual meeting last week. The units sold have increased by 25 per cent., and 32½ miles of additional streets have been served with mains. There have also been important additions to the power connections, and these facts taken in conjunction with authority to supply in several flourishing suburban districts, indicate that the position of the company is extremely satisfactory. The present rate of progress in the connection of consumers is three times that of last year.

Western Telegraph Co.—Interim dividend at the rate of 6 per cent. per annum.

United River Plate Telephone Co.—Interim dividend of 3 per cent. on the ordinary shares.

Hong Kong Tramway Co.—The scheme for writing off 15s. from each £1 share was sanctioned in the Chancery Division this week.

Manilla Electric Railway & Lighting Co.—Dividend of 1 per cent. for the quarter ending December 31st.

Direct West India Cable Co.—Interim dividend at the rate of 6 per cent. per annum, free of tax, for the half-year.

Halifax & Bermudas Cable.—Interim dividend at the rate of 5 per cent. per annum for the half-year.

J. G. White & Co.—Interim dividend at the rate of 10 per cent. per annum for the half-year.

New Gutta Percha Co.—A petition for reducing the capital from £200,000 to £125,000 will be heard before Mr. Justice Swinfen Eady in the Chancery Division on January 14th.

Burma Electric Tramways & Lighting Co.—There is a profit of £4,057 for the year to July 31st. The sum of £2,500 is placed to depreciation and the balance carried forward.

Costa Rica Electric Light & Traction Co.—The net revenue for the year to June 30th amounted to £14,529, against £15,[illegible] in the previous year. The work on the new power station at El Brasil is still continuing. 600 kw. of plant is in position, the pipe line and aqueduct is nearly finished, and the transmission line with transformers, poles, and fittings has been delivered.

Liverpool Electric Cable Co.—A final dividend of 15 per cent., making 20 per cent. for the year, has been declared.

Association of Mining Electrical Engineers.—A meeting of the Cardiff Branch will be held on Saturday at the Hotel Metropole, Swansea. Mr. R. R. Smith's Paper on the repair and inspection of electrical plant underground will be further discussed, and a Paper by Mr. E. Kilburn Scott on "Electricity in New South Wales Collieries" will also be read. A meeting of the Warwickshire and South Staffordshire Branch will be held on the 31st inst. at the Imperial Hotel, Birmingham, at 5.30 p.m. A Paper by Mr. E. K. Scott on "Electricity in New South Wales Collieries" will be read and discussed.

Sub-station Fatality.—An inquest was held at Ossett on Tuesday of last week on S. Henshall, who was killed by electric shock at the Ossett sub-station of the Yorkshire Electric Power Co. on the previous Sunday. Henshall, who was employed at the sub-station, was engaged in cleaning a section of the high-tension gear which had been isolated, and, having finished it, went to a live section with a metal bar in his hand, which was used to place across the 'bus-bars to cause a short, and thus prevent accidents in the event of the bars being made live during the cleaning. It appears that he touched a live part with the bar, and received a shock at 7,000 volts, which caused instant death. Evidence was given that the deceased had been properly warned of the danger. The jury returned a verdict of accidental death, and recommended that the company should provide an instrument with an insulated handle for short-circuiting the bars during cleaning.



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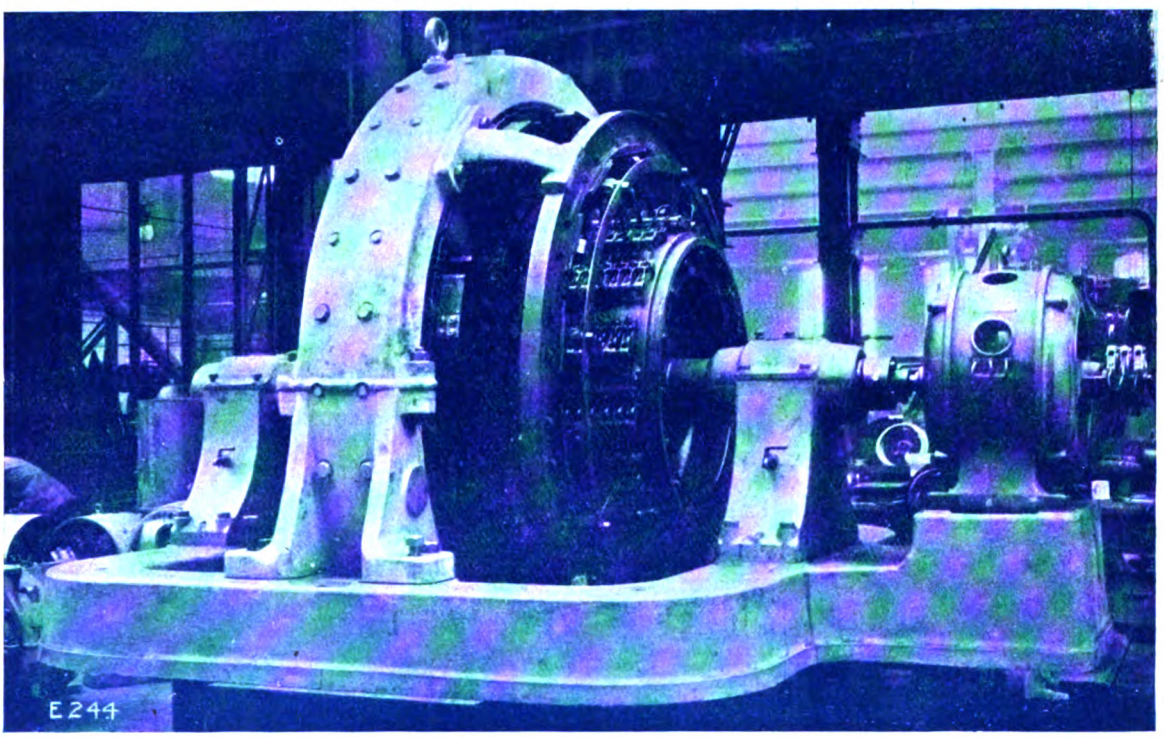
ELECTRICAL ENGINEERING

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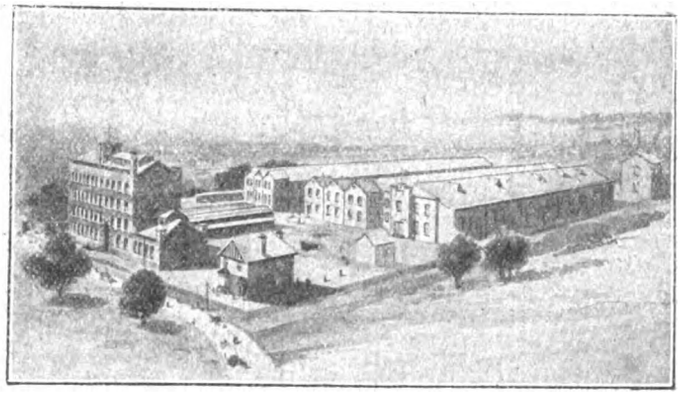
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Rawlings Bros., Ltd., 82, Gloucester Road, Kensington, W.
Rowland & Hulton, Ltd., 62, King William Street, E.C.
Speedy, Eynon & Co., 6, Duke Street, Adelphi, W.C.
F. Troy & Co., 194-196, Finchley Road, N.W. (opposite L. & N.W. Railway Station).
Watson & Co., 10, Glasshouse Street, Piccadilly Circus, W.

ABERDEEN.
Aberdeen Electrical Engineering Co., 17, Belmont Street.
Claud Hamilton (Aberdeen), Ltd., 254, Union Street.

BURNLEY.—Simpson Brothers, Curzon Street.

CARDIFF.—R. Nance, 2, Dock Chambers.

EDINBURGH.—Cole & Co., 42, Frederick Street.

GLASGOW & DISTRICT.
J. A. Allan, 241, Main Street, Bellshill.
Grindlay, Ross & Co., 47, Waterloo Street.
R. D. Livingston & Co., 3 & 5, Buchanan Court.
Wm. McWhirter & Son, 212, 214, & 216, Holm Street.

HULL.—Alexander Shaw, 18, Story Street.

LEAMINGTON SPA.—Parry Mell, A.M.I.E.E. 34, The.

MANCHESTER.—The Harland Engineering Co. (Wiring Dept.), 196, Deansgate, also Glasgow

NEWCASTLE-ON-TYNE.—Falconar, Cross & Co., 7 & 9, Ridley Place.

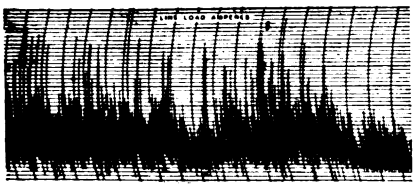
WINDSOR & SLOUGH.—The Windsor & District Electrical Co., 53, Thames Street, Windsor.

WOLVERHAMPTON.—Wolverhampton Electric Fittings & Installation Co., 28, Darlington Street.

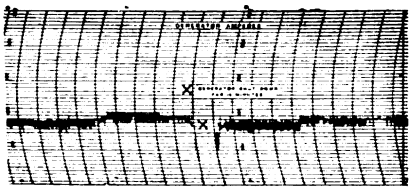
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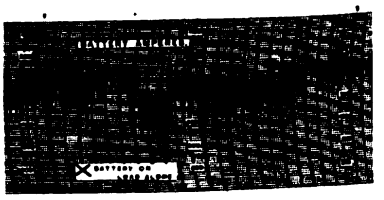
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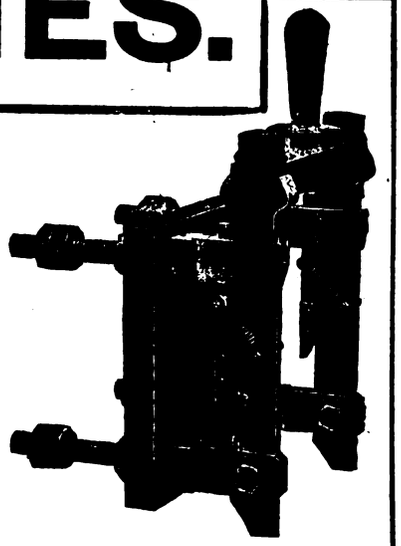
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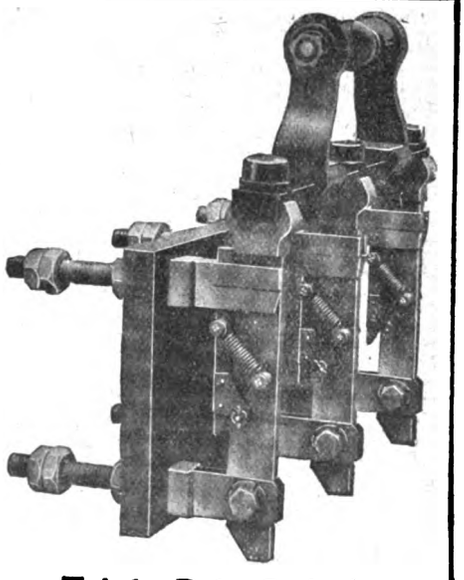
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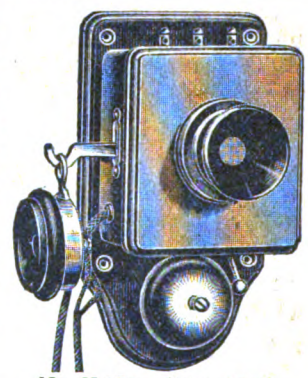
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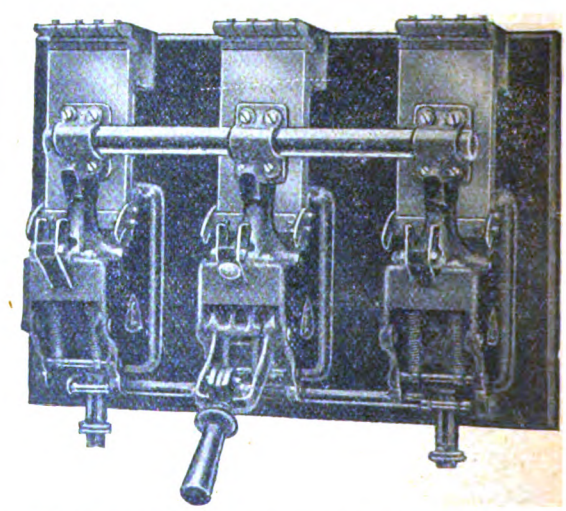
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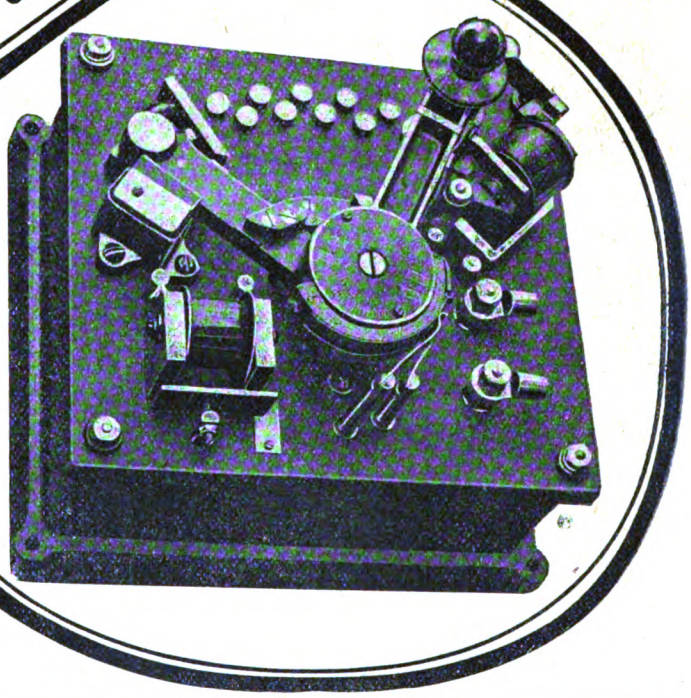
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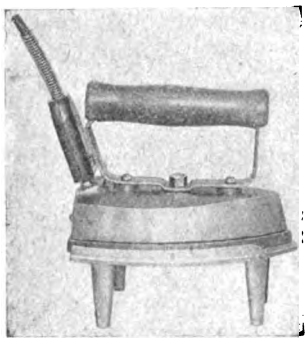
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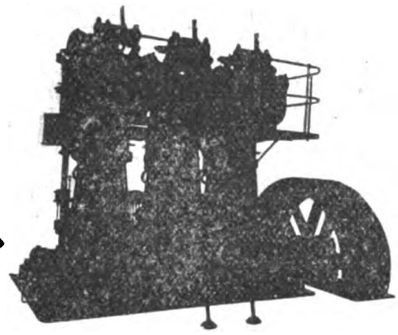
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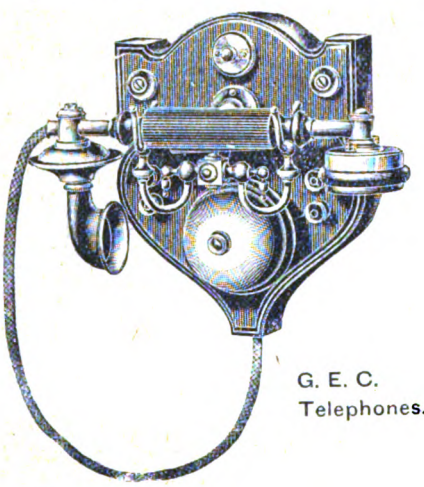
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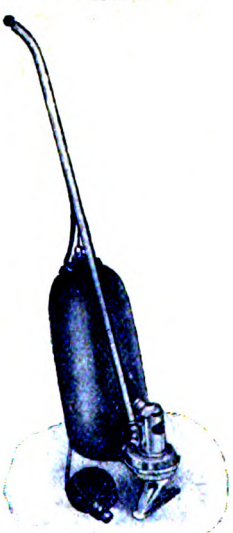
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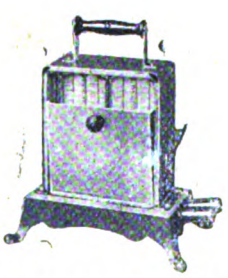
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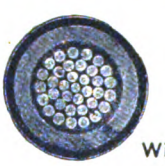


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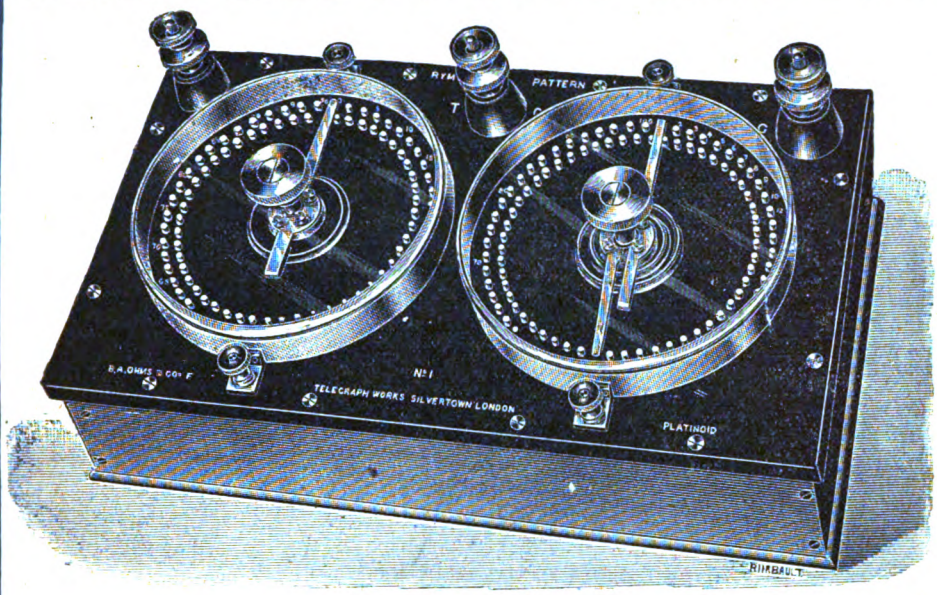
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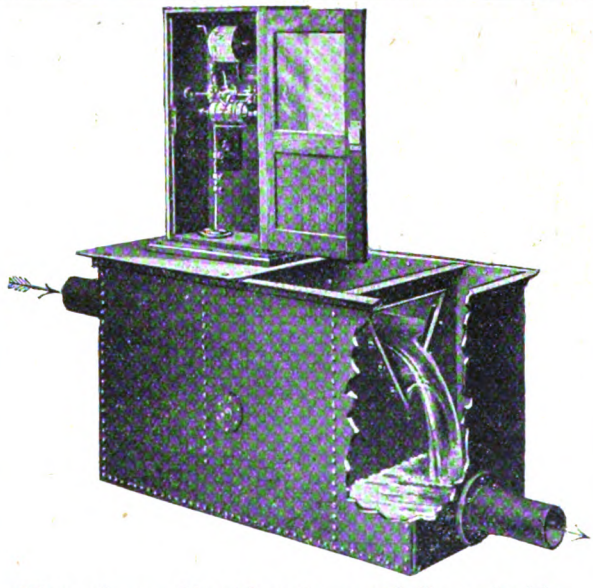
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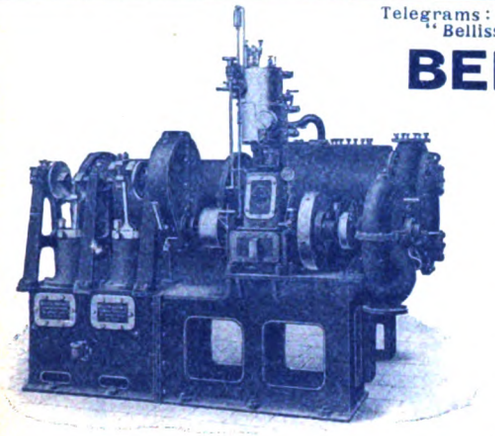
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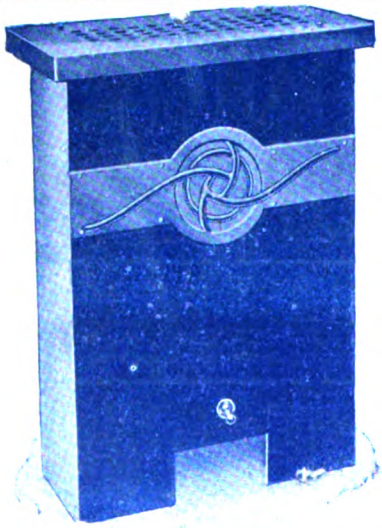
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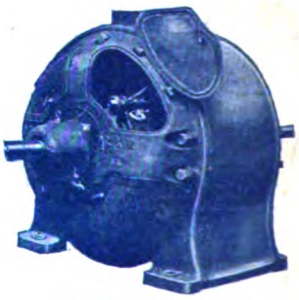
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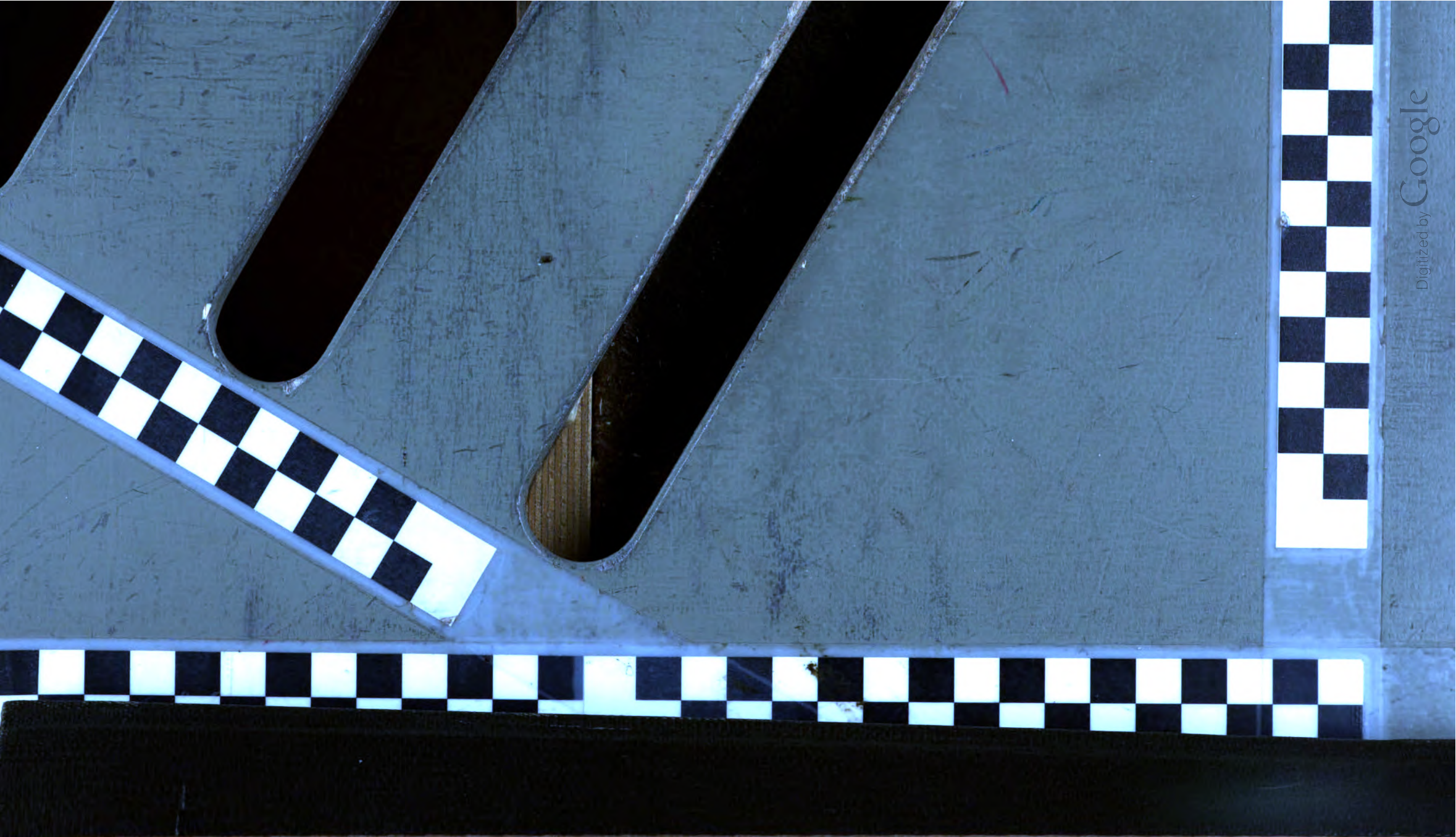
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